Stockland Bristol, St Mary Magdalene - MEP Employers Requirements Specification and Preliminaries

ISSUE HISTORY

Issue	Date	Description
P01	13/02/24	S4 – Issued for Stage 3 Costing

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Engineer	Role
SR	Project Leader
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BA	Engineers

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INTRODUCTION

Project Overview, Design Philosophy, Key Aspects of the Brief

The purpose of this project is to provide facilities for a multi-purpose community space for the village of Stockland Bristol in the North Aisle of St. Mary Magdalene church, for the use of village residents, booking groups and casual visitors. In conjunction with this, the existing services to the main church are to be upgraded and made ready for further future upgrades.

The North Aisle space is to host a range of task-based activities and is therefore to be provided with plentiful socket outlets and high-quality lighting. A new kitchenette space and Accessible WC will serve the North Aisle, with associated cold water and drainage provision and point-of-use hot water provision. Heating is to be provided to the space on a 'pay-as-you-use' basis to avoid incurring administrative or financial costs to the church. Provision is to be made for future heating upgrades.

The Main church space will not have an upgrade to the existing under-pew heating system at present, but electrical provision is to be made for future upgrades. Remnants of the legacy cast iron heating system are to be removed where feasible. New power outlets are to be provided throughout the main church and tower and an entirely new lighting system is to be installed throughout.

Key MEP Design Strategies

There is no existing gas or oil connection to the church for heating, and no new connection is to be made, in accordance with CofE policy.

The prospective peak electrical demand of the building will increase due to these works. All new and future heating systems will be electrically based and increased peak socket usage is expected. The current electrical supply is to be upgraded to a three-phase 69kVA supply to ensure capacity for new and future peak demand.

A full rewire of the church is to be undertaken. The incoming supply will serve a main panelboard in the porch. This is to serve:

- New porch consumer unit for small power and lighting for the main church
- Existing porch consumer unit for main church underpew heating
- New consumer unit in North Aisle for North Aisle small power/lighting/water heaters
- New separate distribution board in North Aisle for North Aisle heating (via contactless payment meter).
- Spare ways for other and future installations: Fire alarm panel/future main church heating/future air source heat pumps/photovoltaics.

A large amount of new socket outlets are to be provided in the North Aisle. These are mostly to be provided through floorboxes via underfloor ducting. New wall-mounted socket outlets are also to be provided throughout the main church and tower.

New lighting is to be provided throughout the North Aisle and the Main church, predominantly via track-mounted spotlights and ceiling-washers mounted at high level on the wall plate. Lighting to the North Aisle is to be dimmable with high lux levels and colour rendering to facilitate a range of tasks, predominantly controlled via a dimmer switch panel in the kitchenette area. Lighting to the Main church is to be non-dimmable, predominantly controlled via a simple on/off switch panel at the entrance. New lighting is also to be provided in the tower spaces. Emergency lighting is required throughout.

The church has no existing mains water connection, so a new connection is to be made to the water main in the road outside the gate, via trenching through the churchyard and through the West church wall to a stopcock in the kitchenette. An outdoor tap is to be provided, and pipework is to be laid beneath the new North Aisle floor to serve the new Accessible WC.

Heating to the North Aisle is to be provided by high level Infra-red radiant HALO heaters to provide quick response comfort to occupants. The accessible WC is to be provided with a low surface temperature radiator. These heat emitters are to be connected to a single separate distribution board. This is to be wired via a contactless payment timer meter which enables occupants to switch on the emitters for a given time period with a bank card.

Underfloor heating pipework is to be laid as part of the new North Aisle floor, with provision for a future manifold in the kitchenette area and future connection to a prospective air source heat pump system in the event that the future occupancy profile makes this viable.

No upgrade to the current under-pew heating system in the main part of the church is planned as part of these works, but spare electrical ways and capacity are to be provided for the future installation of infra-red radiant heating in the main church. Existing legacy cast iron radiators are to be removed where feasible and existing under-pew heaters removed only where pews are removed as part of the architectural works.

Hot water production for the kitchenette sink and Accessible WC basins is to be provided via point-of-use instantaneous water heaters in each case.

Mechanical extract ventilation is to be provided to the Accessible WC via a ceiling fan ducted to the vestry roof.

Foul and rainwater drainage from the kitchenette and Accessible WC is to be via gravity. An AAV is to be provided for the kitchenette. Drainage from the WC and basins is to vent to air and connect to the Below Ground drainage system via an offset in the basement below the AWC.

This specification is to be read in conjunction with the architect's specification. Refer to this for further details.

Provisional sums to be allowed for:

- An upgraded electrical supply to the church, based on an updated quotation from SSEN following contractor's own load calculations.
- New water connection to the church, based on Wessex Water quotation.
- A fire alarm system is anticipated to be required in the church, although a fire engineer has not yet been consulted. Include a provisional sum for a fire alarm system based on fire engineer's specification.

MEP Documentation

This document forms the MEP Specification and Preliminaries as part of a Tender Stage information issue. It provides an overview of the project-specific MEP services installations and forms part of the design information. No further MEP design information will be provided. This document should be read in conjunction with the Main Contract Preliminaries and all associated documents.

- Appendix A - Drawings and Schedules
- Appendix B - Design, Commissioning & Handover Information Responsibilities
- Appendix C – Reference Specification
- Appendix D – Electrical Connection Budget Quotation (National Grid)

Basis of Tender and Contractor Design Responsibilities

The Tender Stage documents for the MEP engineering services include MEP design developed to RIBA Stage 3.

The MEP systems are to be fully designed, installed and completed by the Contractor under a Design and Build contract.

Allow for the cost of all scheduled equipment, alternatives selections will only be considered if there are tangible benefits such as cost, efficiency, operability or size associated with these alternative selections.

Technical submittals will be required for all plant selections prior to order.

Drawings show design intent for the main mechanical services, all sizing and final routing is to be by the contractor and installation drawing will be required for all mechanical and public health services, for review. Note that radiator selection and other visible items are described in the architects and interior designers package.

Allow for all necessary interfaces between all systems to allow for a fully functional system meeting the requirements of this and other packages to be handed over at the end of the project.

Install all services in a workmanlike manner in accordance with best practice. Do not install any services to routes other than those shown on the agreed installation drawings without prior agreement of the CA. Any services installed unacceptably or without prior agreement shall be modified until acceptable to the CA without additional cost to the contract.

PM_40_40_10 BUILDER'S WORK FOR SERVICES

Performance Objectives
Design, supply, install, and test builder's work for services that provide adequate fire-stopping, acoustic-stopping, water-tightness and air-tightness.

Industry Standards
- The Building Regulations
- The Building Regulations Approved Document E – Resistance to the Passage of Sound

Manufacturer's Recommendations and Instructions
- Incoming services gasket system
- Fire-stopping manufacturer

System Description
The Contractor is to carry out the design, supply and/or construction & installation of all necessary builder's work for the distribution of mechanical, electrical and public health systems without compromising the structural, aesthetic or acoustic value of any hidden or exposed structural and architectural elements.

Holes, recesses and chases to be in locations which will least affect the strength, stability and sound resistance of the construction, and to be of the smallest practicable size.

The contractor will make good all holes, chases etc. and the level of making good shall:

- meet the acoustic performance that would otherwise be given by properly constructed wall or floor as appropriate, and in accordance with Approved Document E;
- maintain the fire rating of the wall/floor, if any, as described by the architect's fire strategy drawings or other relevant drawings produced by a fire specialist;
- be installed to the approval of the CA;
- ensure that all building fabric penetrations are watertight, maintain the building waterproof line, are suitable for the location, building material, site conditions and type of service.

Appropriate allowance shall be made for movements of mechanical services.

Where services pass through external walls or the floor slab, all penetrations and holes must be sealed completely water-tight. Provide puddle flanges/gasket systems cast into the concrete where single service pipes pass through the basement floor slab or bunded wall construction. This must include but is not limited to all:

- SVP penetrations through the ground floor slab
- Incoming and outgoing LV ducts
- Incoming and outgoing water pipes
- Ventilation ductwork through the roof

For all builderswork establish with MECHANICAL AND ELECTRICAL subcontractors the locations and dimensions of all holes and chases required for services.

Do not cut concrete or drill holes in concrete (agree with structural engineer) without permission.

Do not cut or drill any structural steelwork without permission.

Do not cut chases in walls of hollow or cellular blocks without approval.

In walls of other materials:

- Vertical chases must be not deeper than one third of the single leaf thickness.
- Horizontal or raking chases must be not be longer than 1m and not deeper than one sixth of the single leaf thickness.

Do not set chases or recesses back to back; offset by a clear distance not less than the wall thickness. Where sockets, etc. are shown on drawings as nominally back to back, obtain instructions.

Any chases or recesses to be agreed with architect on site prior to undertaking work.

Submit proposals to Structural Engineer for bridging over holes for ducts, pipes, etc, which exceed 300mm in width.

Sleeves to extend through full thickness of wall/floor and be accurately positioned to give a minimum clearance around service of 20 mm or diameter of service, whichever is the least. Sleeves, whether built in or installed in preformed holes, to be bedded solid. Seal annular space between service and sleeve with mortar.

Where exposed to view, finish bedding and sealing neatly to architect s approval.B certified and CE marked.

AC_10_10_25_00 IDENTIFICATION, DECOMMISSIONING AND STRIP OUT OF EXISTING SERVICES

Performance Objectives
The role of the strip out works is to identify, make safe, isolate, strip out and dispose of the existing electrical services installations which are deemed to be inadequate or unsafe for re-use.

Ensure safe occupation of the building for all building users, contractors and subcontractors during the period of the Works.

The contract sum is to include for the complete strip out of the redundant services as identified in the tender documents and for the reporting of any additional redundant or unsafe existing installations.

At the beginning of the contract, carry out a full visual survey of the existing services running through the site and provide a report stating which additional (not already identified) services are deemed redundant or unsafe.

Provide a list of additional existing services which are deemed redundant or unsafe to the CA for instruction on whether these additional services are to be removed.

Where redundant services can be traced beyond the areas covered by the Works, and reasonable access can be obtained to the redundant services (e.g. without disrupting fixed ceilings/floors/walls, or disrupting other live services), then strip put these services in their entirety.

System Description
This section outlines the requirements for stripping out of the existing services installation generally.

- The contractor is required to survey, isolate, strip out and dispose of all of the identified redundant existing services in a safe manner.
- At the start of the contract the contractor shall survey, trace and identify all the existing services, and report any live services which may link to any adjacent buildings or areas outwith the contractor's immediate site compound.
- Agree with the main contractor the sequence for the isolation and strip out of the existing redundant and unsafe services and issue method statements.
- Contractor to ensure that all safety measures are taken into account when handling existing installations, in particular when there is asbestos present.
- See copy of the asbestos survey in the Main Contract for more details.
- On completion of the project there should be no redundant or unsafe services present.
- Cap off and make safe any existing incoming supplies to the buildings that are not being re-used.
- See the structural engineer's drawings and specifications for any strip-out works required for the existing below ground drainage.

- Asbestos removal:
    - Seek full asbestos report from the main contractor and ensure safe working practices when stripping out services.
    - Comply with:
        - The Control of Asbestos at Work Regulations.
        - The Asbestos (Licensing) Regulations 1983.
        - The Asbestos (Licensing) (Amendment) Regulations 1998.
        - Health and Safety at Work Act.
        - HSE L28 Work with Asbestos Insulation, Asbestos Coating and Asbestos Insulating Board.

SS_50_30_04_00 FOUL DRAINAGE ABOVE GROUND

Performance Objectives
Design, supply, install, test, commission and set to work a complete foul and waste water disposal system from all sanitary and kitchen fittings (refer to architects drawings) as required to below ground drainage system with minimum risk of blockage and nuisance through noise or smells.

Provide sufficient access into pipework systems to permit clearance of blockages and maintenance.

Provide adequate ventilation to all soil stacks and branch discharge pipework.

Issue installation and as-built drawings, manuals, testing and commissioning certificates. Demonstrate system to the satisfaction of the CA. Provide 12-months defects period.

Include for all materials, fixings, fittings etc to form a complete installation. Include for all minor BWIC required, including acoustic and fire-stopping.

Industry Standards
- The Building Regulations
- The Building Regulations Approved Document H – Drainage and Waste Disposal
- CIBSE Guide G: Public Health and Plumbing Engineering :2014
- The Water Regulations Guide (WRAS)
- WRAS Information and Guidance Notes
- 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 12056-5:2000 - Gravity drainage systems inside buildings. Installation and testing, instructions for operation, maintenance and use
- BS 8000-13:2014 - Workmanship on building sites. Code of practice for above ground drainage and sanitary appliances
- BS 5422:2009 - Method for specifying thermal insulation.
- BS EN 12380:2002 - Air admittance valves for drainage systems - Requirements, test methods and evaluation of conformity

Project Specific Requirements
- Requirements of Below Ground Foul Water Treatment
- BS EN 12056-1 System Type III

Manufacturer's Recommendations and Instructions
- Specified above ground pipework manufacturer
  - Geberit
  - Marley
  - Polypipe
- Air admittance valve manufacturer
- Specified insulation manufacturer
- Specified sanitaryware manufacturers (refer to Architect's information)

System Description
To be a gravity foul water drainage via a combination of stub stacks and soil vent pipes to below ground drainage (by Architect)

Pipework to be fusion welded HDPE where new and concealed. Provide thermal and acoustic insulation to prevent condensation and noise breakout.

Provide a complete above ground drainage installation including:

- Traps, wastes, and connectors on all sanitary and kitchen appliances.
- Branch drainage and ventilation pipework
- Internal drainage stacks

Where SVPs are the head of a below ground drainage run, they are to terminate to atmosphere external to the building. SVPs which are run to atmosphere shall be insulated along their length with 50mm mineral wool to minimise heat loss.

Where SVPs are not the head of a below ground drainage run, they are to terminate via an Air Admittance Valves (AAV), located within boxing out at a height above the overflow of the highest connected appliance. Access to all AAVs to be provided.

All air admittance valves shall have been independently tested by an independent party and quality certified as being compliant with BS EN 12380:2002 and designated as Class A1.

This means that all AAVs shall:

- Be able to be installed above the flood level of connected appliances (for best practice it should be installed above the floor level.
- Have an operating temperature range of -20ºC to + 60ºC
- Be tested at -250 Pa for their air flow capacity and the flow rate stated alongside each valve listed

The application and installation of all AAVs shall be in strict accordance with the manufacturer's installation details.

Where automatic air admittance valves (AAVs) are provided in a concealed location, the contractor shall ensure sufficient free area ventilation and access is provided to adequately maintain the operation of the devices.

Provide readily accessible stack access fittings into all stacks at lowest floor level served for the purposes of rodding and cleaning. Connect into the below ground drainage using connectors between dissimilar pipework materials as recommended by the pipework manufacturer. Ensure that there is a change of gradient at stack connections. Ensure all rodding points are accessible.

Use swept branches on small diameter pipe work. Use swept or 45-degree branch connections for pipe diameters of 60mm or over.

Drainage pipework to be run concealed within ceiling voids, floor voids, wall voids, risers and cabinetry. It may run exposed in plant rooms.

Ensure cut ends of pipes to be clean and square with burrs removed. Allow for thermal and building movement when jointing and fixing.

Form junctions using fittings intended for the purpose, ensuring that jointing material does not project into bore of pipes, fittings and appliances.

Avoid contact between dissimilar metals and other materials which would result in electrolytic corrosion.

Prevent entry of foreign matter into any part of system by sealing openings during construction.

Fit all access covers and cleaning eyes as work proceeds.

Connect plastics pipework to pipework of other materials using approved connectors and methods in accordance with plastics pipework manufacturer's recommendations, to form a watertight joint.

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

SS_55_70_38_00 HOT AND COLD WATER

Performance Objectives
Design, supply, install, test, commission and set to work a complete hot and cold potable water system to all hot and cold water outlets and appliances.

Provide hot and cold water at an acceptable flow rate and temperature. Safely limit the temperature of hot water supplies to sanitaryware in order to reduce risk of scalding. Limit legionella risk. Make efficient use of water.

Prevent cross contamination and comply with statutory requirements.

Issue installation and as-built drawings, manuals, testing and commissioning certificates. Demonstrate system to the satisfaction of the CA. Provide 12-months defects period.

Include for all materials, fixings, fittings etc to form a complete installation. Include for all minor BWIC required, including acoustic and fire-stopping.

Industry Standards
- The Building Regulations
- The Building Regulations Approved Document G – Sanitation, Hot Water Safety and Water Efficiency
- The Building Regulations Approved Document H – Drainage and Waste Disposal
- The Building Regulations Approved Document L1 – Conservation of fuel and power in dwellings
- The Water Efficiency Calculator for new dwellings
- Domestic Building Services Compliance Guide
- Pressure Equipment Directive (PED) 97/23/EC, implemented in the UK throughthe Pressure Equipment Regulations 1999
- The Water Supply (Water Fittings) Regulations 1999
- The Water Regulations Guide (WRAS)
- WRAS Information and Guidance Notes
- CIBSE Guide G: Public Health and Plumbing Engineering :2014
- CIBSE Commissioning Code W: Water Distribution Systems
- CIBSE TM 13: Minimising the Risk of Legionnaires' Disease
- CIPHE Plumbing Engineering Services Design Guide
- BSRIA Commissioning Water Systems BG 2/2010
- BS EN 806 (all parts) - Specifications for installations inside buildings conveying water for human consumption - All relevant parts
- BS 8558:2015 - Guide to the design, installation, testing and maintenance of services supplying water for domestic use within buildings and their curtilages. Complementary guidance to BS EN 806
- BS 5422:2009 - Method for specifying thermal insulation

Project Specific Requirements
- Requirements of Wessex Water
- Requirements of the local Fire Authority
- See architect's information for the specification of Brassware, sanitaryware and white goods appliances (where provided).
- Required minimum pressure at all hot and cold outlets: 1.5 bar (or greater to meet requirements of individual appliances and outlets)
- Required maximum differential pressure between adjacent hot and cold water outlets: 0.2 bar
- Maximum temperature for stored cold water and water held within the distribution system: 20ºC
- DHW Storage Temperature: 55ºC (user adjustable)
- DHW Flow Temperature: 55ºC (user adjustable)
- DHW Return Temperature: 50ºC (user adjustable)
- Pipework Velocity: 1-1.5 m/s
- Pipework pressure loss: Select pipe sizes to ensure maximum velocities are not exceeded, to avoid water hammer, and to ensure adequate pressures are available at outlets.

Manufacturer's Recommendations and Instructions
- Booster set installation
- Water softener installation
- Hot water storage tank
- Specified sanitaryware manufacturers (refer to Architect's information)

System Description
A new mains water supply is to be provided from the main road. The Client has requested a new supply from Wessex Water - Ref. NC0031645. Utility meter to provided by Wessex Water at the site boundary within underground chamber.

The contractor is to make an allowance in their tender return for final co-ordination with Wessex Water for the new connection.

The contractor is to excavate and lay a new supply pipe from the site boundary (by the Southwest gate) to the new community space kitchenette. Depth of new service pipe to be confirmed with Wessex Water. A limited depth trench is preferred by the Client. The Contractor is to make an allowance for insulating the full length of the new service pipe.

The contractor is to consult architect's and archaeological information to determine exact route of new external water supply pipework from connection point to internal stopcock through the churchyard to avoid disturbance of any archaeological matter.

Provide marker tape to below ground pipework. To read 'mains water' or 'cold water' as applicable. Free issue to main contractor for installation in services trench.

New customer stopcock and isolation point to be concealed within kitchenette cabinetry.

No central storage or boosting required.

The mains supply is to be tested for pressure and flowrate and the reports distributed at the earliest opportunity to allow a decision on water storage requirements to be taken. Test pressure and flowrate for a minimum 1min periods at 3 separate times of the day - morning peak – 8am, 12 noon and evening peak 6pm.

Incoming water supplies to be routed through appropriately sized proprietary pipe gasket system through the external walls and slab, such as Doyma. Consideration to be given to using a multiservice gasket which can accept other services (heat pump header pipework, incoming electrical cables etc).

New cold water supply to kitchenette sink , AWC sink, AWC wash hand basin and AWC WC.

External tap required behind kitchenette.

Hot water to be generated by new point of use electric hot water heaters at kitchenette sink, AWC sink and AWC wash hand basin:

- Community space kitchenette: Provide instantaneous electric water heater. Contractor to assess the viability of semi-instantaneous with storage.

- Individual AWC: Provide point of use instantaneous electric water heaters to sink and wash hand basin.

The scheduled instantaneous hot water heaters have been tested to TMV3 standards. Hot water supply to AWC sink and AWC wash hand basin to be tested to be tested to the same level or provided with Thermostatic Mixing Valves.

All new hot water pipework to be copper and insulated throughout.

Hot water distribution pipework to be designed to enable hot water taps to reach 50°C within 10 seconds of turning on the tap. Deadlegs in all hot and cold water pipework are to be minimised.

All new hot and cold water pipework to be copper and to generally be run concealed within ceiling voids, floor voids, wall voids, risers and cabinetry. Any exposed pipework to be agreed in advance with client, CA and architect. Final connections to appliances are to be via braided flexible hoses.
All hot and cold water pipework to be insulated to prevent heat gain and condensation as per schedules. Petrochemical-based insulation materials to be avoided.

Servicing (isolation) valves should be fitted to inlets of all float operated valves, cisterns, washing machines, dishwashers, water heaters, water softeners and other appliances to facilitate maintenance.

Sufficient drain cocks should be provided to facilitate the draining down of all supply and distribution pipework. Air Valves to be provided at system high points.

Ensure all valves are positioned where they can be accessed through doors to risers, cupboards etc as shown on Architect's drawings. Do not install valves in locations which would necessitate additional access hatches, without prior agreement of the CA.

Pressure test all concealed pipework before and after backfilling / covering / closing. Report results to Services Engineer.

All equipment and assemblies which fall within the scope of the Pressure Equipment Directive (PED) 97/23/EC, implemented in the UK through The Pressure Equipment Regulations 1999, must be tested by the manufacturers, and be certified as compliant with the Directive. Such compliance shall be evidenced by displaying the appropriate CE/UKCA Mark on the equipment and assemblies. Only relevant equipment and assemblies certified as compliant will

be permitted under this specification, and any substitution put forward must also be compliant with the Directive.

Provide temperature and pressure relief devices as required.

SS_60_40_00_00 HEATING

Performance Objectives
Design, supply, install, test, commission and set to work an occupant focused heating system within the church.

Issue installation and as-built drawings, manuals, testing and commissioning certificates. Demonstrate system to the satisfaction of the CA. Provide 12-months defects period.

Include for all materials, fixings, fittings etc to form a complete installation. Include for all minor BWIC required, including acoustic and fire-stopping.

Industry Standards
- The Building Regulations
- The Building Regulations Approved Document L1 – Conservation of fuel and power in dwellings
- Pressure Equipment Directive (PED) 97/23/EC, implemented in the UK throughthe Pressure Equipment Regulations 1999
- Domestic Building Services Compliance Guide
- CIBSE Commissioning Code W: Water Distribution Systems
- CIBSE Guide B1: Heating
- CIBSE KS14 Energy Efficient Heating
- BSRIA Commissioning Water Systems BG 2/201
- BSRIA Energy Efficient Pumping Systems (BG12/2011)
- BSRIA Pre-Commission Cleaning of Pipework Systems (BG 29/2012)
- BSRIA Water Treatment, Closed Heating & Cooling Systems (BG 50/2013)
- BSRIA Selection Control Valves in Variable Flow Systems (BG 51/2014)
- BSRIA Commissioning HVAC Systems: Guidance on the division of responsibilities (TM 1/88.1)
- BSRIA Commissioning Management (AG 5/2002)
- All relevant MCS Codes and Standards
- BS 5422:2009 - Method for specifying thermal insulation
- BS EN 12828:2012 - Heating systems in buildings. Design for water-based heating systems

Manufacturer's Recommendations and Instructions
- Herschel infra-red *Halo* heaters
- Flooring manufacturer (refer to Architect's information)

System Description
Provide all-electric space heating, comprising:

- New Herschel infra-red *Halo* heaters within the community space. 2No. 4.8kW units.
- Existing pew heaters to be retained (remove 2No.)
- New low surface temperature (LST) radiator within the AWC.

Underfloor heating pipework to be installed within new community space floor buildup to facilitate a future underfloor heating system. Underfloor heating pipework to continue into WC.

Underfloor heating pipework to be cross-linked high density polyethylene (XLHDPE) multi-layered flexible pipe with oxygen diffusion barrier, suitable for UFH applications and laid at 150mm centres.

Pressure test underfloor heating pipework on completion of laying new floor and securely cap (at manifold location) for future use.

Future underfloor heating manifold to be concealed within kitchenette cabinet, refer to architects information for location.

All new heat emitters to be manually controlled on/off at Contactless Payment Meter within kitchenette area. Provide electric radiator with wireless thermostat. Herschel APX controller to be provided with each *Halo* heater and to be installed in kitchenette area to allow control of output level.

Contractor to coordinate with Herschel to establish optimum exact height and positioning of *Halo* heaters to ensure comfort to the occupied zone of the North Aisle. Contractor to provide a heating system for the North Aisle space which provides sufficient comfort to all areas. Provision should be made for the addition of localised heating to the kitchenette area/speaker area of North Aisle if the two *Halo* units cannot guarantee a comfortable temperature (as defined to the approval of the CA) in these spaces.

Contractor to provide ceiling suspension kit for *Halo* heaters. Ceiling suspension kit to be submitted for approval of architect and CA during design stage.

Contractor to establish roof loading of *Halo* heaters prior to installation and ensure that the roof structure and suspension kit is capable of handling 4x the unit weight.

Replace existing pew heater time clock controllers with new.

All equipment and assemblies which fall within the scope of the Pressure Equipment Directive (PED) 97/23/EC, implemented in the UK through The Pressure Equipment Regulations 1999, must be tested by the manufacturers, and be certified as compliant with the Directive. Such compliance shall be evidenced by displaying the appropriate CE/UKCA Mark on the equipment and assemblies. Only relevant equipment and assemblies certified as compliant will be permitted under this specification, and any substitution put forward must also be compliant with the Directive.

Provide full operating instructions to enable the client to operate the system. Allow for demonstrating the operation of the system and explaining all the functions of the system to the CA and to the client on 2 separate occasions, each for half a day.

Existing LTHW pipework distribution and cast iron heat emitters to be removed where accessible, to be agreed with Architect and CA in advance.

SS_65_40_33_00 GENERAL VENTILATION

Performance Objectives
Design, supply, install, test and commission a mechanical extract ventilation system to the new AWC area to extract stale air.

Issue installation and as-built drawings, manuals, testing and commissioning certificates. Demonstrate system to the satisfaction of the CA. Provide 12-months defects period.

Include for all materials, fixings, fittings etc to form a complete installation. Include for all minor BWIC required, including acoustic and fire-stopping.

Industry Standards
- The Building Regulations
- The Building Regulations Approved Document L1 – Conservation of fuel and power in dwellings
- The Building Regulations Approved Document F – Ventilation
- CIBSE Guide B2: Ventilation and Ductwork
- CIBSE Commissioning Code A 2004
- BSRIA Commissioning HVAC Systems: Guidance on the division of responsibilities (TM 1/88.1)
- BSRIA Commissioning Management (AG 5/2002)
- BSRIA Domestic Ventilation Systems (A Guide to Measuring Airflow Rates) BG46/2013
- BSRIA Commissioning Air Systems (BG 49/2015)
- BESA DW143 Guide to Good Practice – Ductwork Air Leakage Testing
- BESA DW154 Specification for Plastics Ductwork
- BESA TR19 Guide to Good Practice - Internal Cleanliness of Ventilation Systems
- BS 5422:2009 - Method for specifying thermal insulation

Manufacturer's Recommendations and Instructions
- AWC extract fan.

System Description
To provide mechanical extract only ventilation to the AWC. Extract fan to be concealed within ceiling. Makeup air via door undercut.

Insulate all ductwork.

WC extract to be in the concealed valley area.

Internal extract grille to be ceiling mounted in plasterboard. Ductwork to rise internally (exposed) above the WC enclosure and out through the roof.

No additional ventilation proposed to within the main church body or new community space i.e. ventilation to be provided naturally by general infiltration of air and the large volumes of the spaces. Openable window elements to be co-ordinated with the architect. Allowance to be made for humidity & CO2 controlled extract fan from North Aisle space to main church.

All internal and external air terminals/grilles/diffusers are to be agreed with the client, CA and architect. Scheduled equipment is for cost allowances only.

Air terminals to be connected to rigid ductwork using flexible connections of maximum length 0.6m. No bends of less than 120 degrees will be accepted. Replace all filters with new unused filters immediately (less than one working day) prior to Practical Completion.

Extract ventilation triggered on light switch activation, with run-on. Run-on time to be set at commissioning. Provide with humid-stat override.

Provide full operating instructions to enable the client to operate the system.

SS_70_30_45_00 LV SUPPLY / DISTRIBUTION

Performance Objectives
Design, supply, install, test and commission a low voltage electrical distribution system which is safe and reliable in operations and satisfies all regulatory and statutory requirements and is rewirable without significantly damaging the building structure.

Include all containment required throughout the building for power, data, control, fire alarms, ancillary electrical services, etc.

Ensure that the disconnection of fault currents does not damage any of the circuit protective devices.

Allow for any power supplies that may be required for specialist installations provided under other work sections of this specification ad other packages (Architects, interior designers etc) which are in addition to those shown on the system drawings. Any such power supply requirements shall not result in an additional cost to the project.

Design for electromagnetic compatibility and power quality to ensure that there is no disruption to data, fire alarm systems. Minimise system harmonics and leakage currents in phases, neutral and earth conductors.

Issue installation and as-built drawings, manuals, testing and commissioning certificates. Demonstrate system to the satisfaction of the CA. Provide 12-months defects period.

Include for all materials, fixings, fittings etc to form a complete installation. Include for all minor BWIC required, including acoustic and fire-stopping.

Industry Standards
- BS 7671:2018 + AMD2:2022 + Corrigendum 1:2023 – IET Wiring Regulations 18th Addition incorporating Amendment 2 and Corrigendum 1
- The Building Regulations Approved Document L1 – Conservation of fuel and power in dwellings
- Part B Fire safety
- Part P Electrical safety
- Domestic Building Services Compliance Guide
- CIBSE F guide
- CIBSE K guide
- BSRIA Power quality guide (AG 2/2000)
- BSRIA Design Checks for Electrical Services - A quality control framework for electrical engineers (BG 3/2006)
- NICEIC Technical Guidance
- BS 7430 2011 Code of practice for protective earthing of electrical installations
- BS EN 60947-6 2005 Low-voltage switchgear and controlgear. Multiple function equipment. Transfer switching equipment
- BS EN 50085-1 2005 Cable trunking systems and cable ducting systems for electrical installations. General requirements +A1:2013
- BS EN 50085-2-1 2006 Cable trunking systems and cable ducting systems for electrical installations. Cable trunking systems and cable ducting systems intended for mounting on walls and ceilings+A1:2011
- BS EN 50085-2-2 2008 Cable trunking systems and cable ducting systems for electrical installations. Particular requirements for cable trunking systems and cable ducting systems intended for mounting underfloor, flushfloor, or onfloor
- BS EN 60947-6 2005 Low-voltage switchgear and controlgear. Multiple function equipment. Transfer switching equipment

Project Specific Requirements
- National Grid utility requirements
- Shippers metering requirements
- Earthing: TN-C-S assumed – TBC by contractor
- Distribution Equipment Manufacturer
    - Schneider

Manufacturer's Recommendations and Instructions
- Distribution Equipment
- Protective Devices
- Submains Cabling
- Metering
- Surge Protection
- Arc Fault Detection Devices

System Description
The contractor shall liaise with the utility to provide a new 69kVa (3 phase) connection. An application for a new electricity supply has been submitted to National Grid and a budget estimate received, reference 1944144.

The proposed increased electrical supply is to be checked against the design as it develops and, once electrical load requirements are confirmed, a Connection Offer should be obtained from National Grid. The subsequent quote and proposals should be included with the tender package for review and action.

As part of the new electrical supply a new TPN cut-out will be provided in the enclosed entrance porch.

Provide space for a future import/export meter for a Photovoltaic (PV) array within the enclosed entrance porch adjacent the incoming electrical gear.

The new LV supply shall be a direct replacement to the existing overhead supply.

New LV supply is to terminate in new fused cutout with direct metering. Cutout to be provided by utility, meter to be provided by the client's preferred meter shipper.

Contractor to confirm external Earth Fault Loop Impedances, Prospective Short Circuit Current and Earthing Arrangement with utility prior to undertaking their electrical design.

The new main panelboard shall be sized accordingly with spare circuits for:

- Future Air Source Heat Pump installation (3 phase);
- Future Herschel infra-red *Halo* heaters within the Nave: 2No. 7.8 kW units and 1No. 4.8kW unit;
- Future photovoltaic array;
- Additional 10% spare circuits.

Type 1 surge protection device to be installed on the main panelboard in conjunction with Lightning Protection System to protect against transient voltage.

From the meter to the main panelboard and from the panelboard to distribution boards all cables are to be XLPE insulated multicore steel-wire armour to BS 6724. Final circuit cables to be FP200 Gold Prysmian. Cables installed externally within ground to be XLPE insulated multicore steel-wire armour to BS 6724 within ducts.

Provide sub-metering to suit Building Regulations.

All circuit protective devices on the project are to be from the same manufacturer. Schneider Electric is to be used as the basis of costing.

Final circuits to be protected by Miniature Circuit Breakers (MCB), Residual Current Breakers with Overcurrent protection (RCBO) and Arc Fault Detection Devices (AFDD) as required and recommended by the Wiring Regulations.

Contractor to size distribution boards to allow at least 10% spare ways at completion. (Spare ways to be calculated as a percentage of total number of ways on board). Refer to the electrical schedules for additional requirements. MCCB, Consumer Units, DB, MCB, RCD, RCBO and AFDD to be selected from a single manufacturer (Schneider or Wylex).

As per the architect's specification, the electrical contractor is to visit site and satisfy themselves as to the relevant local conditions in regards to protracted routes to minimise holes and visual impact. Refer and conform to all other conditions of section V90 of architect's specification.

All cables and containment to be run concealed where possible. Where exposed cables are generally to be clipped direct. All routes and fixings to be confirmed with the Architect and CA. All concealed cables to be run within zones permitted by the Wiring Regulations.

High level cable on roof structure to be black cable or painted black. Provide and install cables for future Herschel infra-red *Halo* heaters within the Nave.

Ensure draw wires are left within empty conduits for later use of specialist installers. Use draw wires comprising nylon tapes with fitted eyelets. For concealed conduit ensure system is installed to enable re-wiring to be carried out from boxes for fittings or accessories only. Draw-in boxes will only be permitted with prior permission in writing from the CA. Do not use tallow or any other substances to facilitate drawing-in of cables.

Support conduit in accordance with Appendix I of Guidance Note I Selection and Erection published by the IET. Ensure conduit is not under mechanical stress. Fix conduit boxes independently of conduit. Make allowance for any additional mechanical loading supported by conduit boxes. Where protection is specified as IP44 or greater ensure fixings of conduit boxes are suitable to maintain degree of protection.

The electrical contractor shall retain overall responsibility for full coordination of all specialist electrical sub-contractors installations.

The electrical contractor shall be responsible for the supply and installation of containment to all specialist installations.

The specialist sub-contractors shall undertake all works, supply and install all equipment, components, cabling and the like necessary to form a complete system.

Provide full circuit charts and schedules at all distribution equipment.

Existing electrical distribution (cables, containment, sockets etc) to be stripped out as part of the works.

Provide contactless *pay as you use* timer meter to the community space and AWC heating circuit(s).

Contractor to confirm with CA and meter manufacturer that the meter will have sufficient 4G signal to operate. Contractor to liaise with manufacturer to confirm compatibility of controlling all new heating equipment via single meter.

SS_70_30_80_00 SMALL POWER SYSTEMS

Performance Objectives
Design, supply, install, test and commission a complete electrical distribution system including final accessories which is safe and reliable in operations and satisfies all regulatory and statutory requirements.

Provide final circuit distribution and interfaces for loose electrical appliances, loose electrical equipment and fixed equipment within the building.

Provide power supplies to all electrically operated mechanical plant and architectural equipment, in accordance with manufacturer's requirements.

Provide sufficient numbers of power outlets as indicated on the tender layouts and allow for final setting out and coordination by the Architect.

Achieve high standards of electromagnetic compatibility and power quality to ensure that there is no disruption to data and fire alarm systems.

Minimise system harmonics and leakage currents in phases, neutral and earth conductors.

Issue installation and as-built drawings, manuals, testing and commissioning certificates. Demonstrate system to the satisfaction of the Architect and CA. Provide 12-months defects period.

Include for all materials, fixings, fittings etc to form a complete installation. Include for all minor BWIC required, including acoustic and fire-stopping.

Industry Standards
- BS 7671:2018 + AMD2:2022 + Corrigendum 1:2023 – IET Wiring Regulations 18th Addition incorporating Amendment 2 and Corrigendum 1
- Part P Electrical safety
- Part M 2015 (Access to and use of buildings: Volume 1 Dwellings)
- Domestic Building Services Compliance Guide
- CIBSE K guide
- CIBSE TM39: Building Energy Metering
- BSRIA Power quality guide (AG 2/2000)
- BSRIA Design Checks for Electrical Services - A quality control framework for electrical engineers (BG 3/2006)
- NICEIC Technical Guidance
- BS 7430 2011 Code of practice for protective earthing of electrical installations
- BS EN 60947-6 2005 Low-voltage switchgear and controlgear. Multiple function equipment. Transfer switching equipment

As per SS_70_30_45_00 LV SUPPLY / DISTRIBUTION

Manufacturer's Recommendations and Instructions
- Small Power Accessories
- Isolators
- Metering
- Domestic Hot Water Heaters
- Fire Alarm

System Description
Provide a complete electrical system as described here and on the architects drawings. Provide final circuit power distribution to power all electrical appliances, sockets and specialised electrical equipment, including but not limited to those shown on the drawings.

All electrical accessories to be selected from ranges as specified by the Architect:

- Electrical accessories to be Wandsworth Electrical. Allow for bronze *style* for the North aisle and white for the Nave, to be confirmed with architect and CA.
- Concealed electrical accessories to be MK Metalclad.

Agree setting out of all electrical accessories with architect and CA prior to installation.

Power supplies include:
- 13A socket outlets as indicated on the combined electrical layout.
- Floor boxes as indicated on the combined electrical layout.
- USB socket outlets to be provided as indicated on the combined electrical layout, to include 1no. USB-A outlet and 1no. USB-C outlet.
- 13A switched fused spurs to single-phase fixed equipment.
- Unswitched socket outlets at low level wired to above counter switches within the kitchenette for the fridge.
- Switches to be ganged together on multigang gridplates and engraved with the equipment served.
- Retain existing external power outlet.

SS_70_80_33_00 GENERAL LIGHTING

Performance Objectives
Design, supply, install, test and commission a complete lighting system including fittings, switches and controls, cabling and containment, which is safe and reliable in operations and satisfies all regulatory and statutory requirements.

Provide a low energy consumption general lighting installation for the building for functional and decorative purposes. Achieve adequate artificial lighting levels in all areas. Be flexible, expandable, safe, reliable and efficient. Provide logical and easily-understood controls.

Issue installation and as-built drawings, manuals, testing and commissioning certificates. Demonstrate system to the satisfaction of the CA. Provide 12-months defects period.

Include for all materials, fixings, fittings etc to form a complete installation. Include for all minor BWIC required, including acoustic and fire-stopping.

Industry Standards
- BS 7671:2018 + AMD2:2022 + Corrigendum 1:2023 – IET Wiring Regulations 18th Addition incorporating Amendment 2 and Corrigendum 1
- The Building Regulations Approved Document L1 – Conservation of fuel and power in dwellings
- Part P Electrical safety
- Part M 2015 (Access to and use of buildings: Volume 1 Dwellings)
- Domestic Building Services Compliance Guide
- CIBSE Guide F: Energy Efficiency in Buildings
- CIBSE Guide K: Electricity in Buildings
- CIBSE Commissioning Code L: Lighting
- SLL Lighting Guides
- SLL Code for Lighting 2012
- TM39 Building Energy Metering 2009
- BSRIA Power quality guide (AG 2/2000)
- BSRIA Design Checks for Electrical Services - A quality control framework for electrical engineers (BG 3/2006)
- NICEIC Technical Guidance

Project Specific Requirements
- Refer to Schedule of Lighting Fittings.
- Refer to Schedule of Lighting Controls.

Manufacturer's Recommendations and Instructions
- Light fittings and drivers.

System Description
Provide a complete electrical lighting system as described here and on the MF drawings and schedules to replace the existing general lighting system.

New light fittings proposed throughout the church to include the ringing chamber, bell chamber, staircase and basement plantroom/store.

All new fittings to be low energy LED.

Fix all luminaires in accordance with manufacturer's recommendations.

Agree setting out of all luminaires and switches with Architect and CA prior to installation.

Lighting circuits to be individually metered at the main distribution board.

Light switches to be Wandsworth Electrical. Bronze for the North Aisle and white for the Nave. *Style* tbc with Architect and CA.

Emergency Lighting

Provide emergency lighting and emergency escape signage to BS 5266.

Stand-alone self-contained fittings with concealed remote batteries.

External Lighting
Provide external lighting to the main porch and Vestry entrances. External fittings to be IP rated and suitable for marine environment.

All new external light fittings to be low energy LED.

Provide and install electrical supply cables to each main gate (2No.) for future external lighting.

SS_75_50_11_25 ACCESSIBLE WC ALARM

Performance Objectives
Provide a reliable means of alerting staff and building users to people in difficulty in the accessible WC.

To be designed in accordance with the design parameters.

Industry Standards

- The Electricity at Work Regulations 1989
- Equality Act 2010
- The Building Regulations Approved Documents
    - Part M 2015 Access to and use of buildings
    - Part L: 2023 (Conservation of fuel and power) - Volume 2: Buildings other than dwellings
- Chartered Institute of Building Services Engineers (CIBSE)
- CIBSE D Guide
- BS 5839-9: 2011 – Fire detection and fire alarm systems for buildings. Code of practice for the design, installation, commissioning and maintenance of emergency voice communication systems.
- BS 8300: 2009 - Design of buildings and their approaches to meet the needs of disabled people. Code of practice.
- BS 9999: 2017 - Fire safety in the design, management and use of buildings. Code of practice.
- BS EN 62820-1-1: 2016 - Building intercom systems. System requirements. General

System Description
Provide an Accessible WC Alarm system in accordance with the design parameters and this specification, to include specific power supplies and network infrastructure connections prior to their 1st fix installation.

Provide samples for approval by the Client Representative and architect of each visible item associated with this work section.

Provide a complete disabled WC alarm system to the accessible WC's including:

- Pull cord in all accessible WCs and Changing Places room.
- Re-assurance lamp and re-set button in all accessible WCs and Changing Places room.
- Indicator light with audible indication outside all accessible WCs and Changing Places room.

Include for all materials, fixings, fittings etc to form a complete installation. Include for all minor BWIC the disabled WC alarm installation.

All faceplates shall be flush-mounted. All wall-mounted faceplates shall match the finish of other electrical accessories in the area. All equipment shall be suitably IP-rated rated for the environment in which it is to be installed.

Control Requirements
When the pull cord is activated in the accessible WC the reassurance lamp, local indicator lamp/audible signal and remote indicator lamp/audible signal are to activate. Alarm can only be re-set by the re-set panel in the WC.

SS_75_50_28_29 FIRE DETECTION AND ALARM

Performance Objectives
Design, supply, install, test and commission a complete fire detection and alarm system. Provide automatic fire detection for the protection of life and property, to the statutory requirements for holiday let dwellings.

Provide at least three options for the Architect and Client to choose from. Provide 2 options from ADT and Verisure (to integrate with the security system) and one from the contractors choice.

Integrate fire detection and alarm system sympathetically with the architecture. System to be reliable and inexpensive to maintain. Avoid nuisance alarms.

Issue installation and as-built drawings, manuals, testing and commissioning certificates. Demonstrate system to the satisfaction of the CA. Provide 12-months defects period.

Include for all materials, fixings, fittings etc to form a complete installation. Include for all minor BWIC required, including acoustic and fire-stopping.

Install all services in a workmanlike manner in accordance with best practice. Route in accordance with system drawings. Do not install any services to routes other than those shown on the drawings without prior agreement of the CA. Any services installed unacceptably or without prior agreement shall be modified until acceptable to the CA without additional cost to the contract.

DESIGN PARAMETERS - Industry Standards

- BS 7671:2018 + AMD2:2022 + Corrigendum 1:2023 – IET Wiring Regulations 18th Addition incorporating Amendment 2 and Corrigendum 1
- The Regulatory Reform (Fire Safety) Order 2005
- Part B 2013 Fire Safety
- Part M 2015 Access to and use of buildings
- Part P 2013 Electrical safety - Dwellings
- Domestic Building Services Compliance Guide
- CIBSE E Guide
- CIBSE K Guide
- BSRIA Design Checks for Electrical Services (BG 3/2006)
- NICEIC Technical Guidance
- BS 5839 Fire detection and fire alarm systems for buildings – all parts
- BS EN 14604 2005 Smoke Alarm Devices
- BS EN 50849 2017 Sound systems for emergency purposes.
- BS 5446-2 2003 Fire detection and fire alarm devices for dwellings. Specification for heat alarms
- BS EN 54 Fire detection and fire alarm systems – all parts
- BS 9991 2015 Fire safety in the design, management and use of residential buildings. Code of practice
- BS 9999 2017 Fire safety in the design, management and use of buildings. Code of practice

Project Specific Requirements

- System Category: LD1
- System Grade: D1

Manufacturer's Recommendations and Instructions
Fire Alarm System
Fire Alarm cabling.

System Description
Engage a recognised specialist in the field of fire alarms systems to design, supply, install, set to work, test, commission, set to work and demonstrate a complete and fully functioning fire alarm system as described here.

Carry out a Fire Risk Assessment (FRA).

Provide a fire detection system covering all areas of the property as required by BS 5839-6 for a Grade D1, Category LD1 fire alarm system as required for Holiday Lets.

Provide heat detectors to kitchenette and smoke detectors to all other areas.

All fire alarm devices to be interlinked such that fire detection in any area of each property will result in all sounders activating.

Provide standalone sounders if required to provide audible alerts upon detection of fire to the audibility requirements of BS 5839-6. Agree locations of all sounders with client, CA and architect prior to installation.

All fire alarm devices are to be sourced from a single supplier.

All fire alarm devices to be mains-powered and wired in FP 200 Gold cabling with battery back up within detectors and any control panels.

Allow for remote external monitoring from the fire alarm panel.

Record all commissioning tests and provide the certification required by BS 5839-6. Provide manufacturer's certificates of equipment design to an approved quality management system and CIE component selection.

Provide full operating instructions to enable the client to operate the system and for a maintenance company other than the installer to maintain the system. Allow for demonstrating the operation of the system and explaining all the functions of the system to the CA and to the client on 2 separate occasions, each for half a day.

The contractor is to provide one year's maintenance contractor following hand-over of the building. If at the end of the first year the Employer wants to change the maintenance contract , there shall be no charge for this change.

SS_75_50_45_00 EARTHING, BONDING, & SURGE PROTECTION.

Performance Objectives
Design, supply, install, test and commission a complete earthing, bonding, and surge protection system.

The form of earthing has yet to be confirmed by the Utility but is assumed to be TN-C-S. The supply is 400/230V. The contractor shall confirm all details of the supply and earthing arrangement with the contractor prior to undertaking their electrical design.

Issue installation and as-built drawings, manuals, testing and commissioning certificates. Demonstrate system to the satisfaction of the CA. Provide 12-months defects period.

Include for all materials, fixings, fittings etc to form a complete installation. Include for all minor BWIC required, including acoustic and fire-stopping.

Install all services in a workmanlike manner in accordance with best practice. Route in accordance with system drawings. Do not install any services to routes other than those shown on the drawings without prior agreement of the CA. Any services installed unacceptably or without prior agreement shall be modified until acceptable to the CA without additional cost to the contract.

DESIGN PARAMETERS - Industry Standards
- BS 7671:2018 + AMD2:2022 + Corrigendum 1:2023 – IET Wiring Regulations 18th Addition incorporating Amendment 2 and Corrigendum 1
- Part P 2013 (Electrical safety - Dwellings)
- Domestic Building Services Compliance Guide
- CIBSE K guide
- BSRIA Design Checks for Electrical Services (BG 3/2006)
- BSRIA Power quality guide (AG 2/2000)
- NICEIC Technical Guidance
- BS 7430 2011 Code of practice for protective earthing of electrical installations
- BS IEC 61643-32 2017 Low-voltage surge protective devices. Surge protective devices connected to the d.c. side of photovoltaic installations.
- BS EN 50539-11 2013 + A1: 2014 Low-voltage surge protective devices. Surge protective devices for specific application including d.c.. Requirements and tests for SPDs in photovoltaic applications

Manufacturer's Recommendations and Instructions
- Distribution Equipment
  - Schneider
- Surge Protective Devices
  - Schneider

System Description
- Provide combined Type 1 and 2 Surge protection devices at the main panelboard and distribution boards.

- Provide surge protection to all metallic cables (LV, ELV, telecoms etc) which pass through the building structure from external to internal (or vice versa).

- Upon completion, it is recommended the existing installation is tested to ensure no damage during construction.
- Main equipotential bonding conductors shall be supplied and installed by the ELECTRICAL CONTRACTOR to connect various items of exposed metalwork within the building to the main earth bar to include (but not limited to) the following:
  - Incoming metallic pipes.
  - Earthing and bonding as required by the electricity utility.
  - Main earthing terminals adjacent to the main panelboard.
  - Bonding to all steel structure, plant, pipework, ductwork, electrical containment etc to IET requirements
  - Equipotential bonding of all extraneous metal parts to IET requirements
  - Supplementary equipotential bonding to all 'wet' areas (AWCs, kitchenette etc)
  - Other additional earth terminals as required by specialist sub-contractors appointed by the main contractor
  - Circuit protective conductors to be installed on all circuits. Use CPC or Armour (i.e. not containment, although containment is to be bonded).
  - High integrity earthing to all socket outlets
  - Lightning protection system.

100.000 PROJECT PARTICULARS

100.010 CONTRACTOR
Where the term Contractor is used within this specification it refers to the contractor undertaking the Works defined by this specification and associated drawings.

100.020 MAIN CONTRACT PRELIMINARIES
These Preliminaries are in addition to, and are to be read in conjunction with, the Main Contract Preliminaries & General Conditions.
It is the Contractor's responsibility to obtain a copy of the Main Contract Preliminaries. Claims due to want of knowledge of the Main Contract Preliminaries will not be entertained.

100.040 CONTRACT ADMINISTRATOR:
The term Contract Administrator (CA) is used throughout this specification and his duties will be carried out by

- the person named in the Main Contract Preliminaries & General Conditions

100.050 THE CONTRACT WORK:
The engineering services included in the Works and covered by this specification comprise the following installations for the building(s) and site described within the Main Contract Preliminaries:

Mechanical services.
Public health services.
Electrical services.
Security services.

The Contractor is to carry out the work of installation, including the supply, delivery to site, unloading, hoisting, distribution, positioning and fixing of plant & materials.

Include for the design (where required under section 100.060 of these preliminaries), drawing production, manufacture, pre-installation testing, supply, installation, site testing, setting to work, commissioning, system proving, making good of defects that may arise during the defects liability period, provision of Health & safety File(s), and all the labour & materials required to form a complete installation.

Take the phrase "complete installation" to mean not only the major items of plant, equipment & materials described explicitly within this specification and drawings, but also those incidental sundry components that are implicitly required for the proper and safe working of the systems as a whole.

Allow for commissioning and testing as required by the tender documents and as may otherwise be required to give an effective and safe working installation, all to the satisfaction of the CA. Provide programming information and method statements as required.

Carry out and complete the work of design and installation in accordance with the true intent and meaning of this specification and drawings to the entire satisfaction of the CA.

Allow for the coordination and cooperation with others when designing and installing the Works.)

A high level of care and workmanship is therefore required when undertaking any work in or around the existing ruins. The contractor shall obtain approval from the EA before carrying out any work that affects the integrity or appearance of the afore mentioned elements.

Work to be carried out in accordance with the following:
- COSHH and HSE requirements
- IEE Wiring Regulations 18th Edition, (BS 7671)
- Local Authority and other statutory requirements
- Construction Regulations
- The Control of Pollution Act
- Control of Substances Hazardous to Health(COSHH) Regulations 1988
- Other relevant Safety Regulations
- All regulations covering the specific work sections.

All materials, articles and workmanship shall be of the best quality and execution as detailed in the specification and drawings.
All equipment and materials to be installed shall be new unless otherwise indicated.
All equipment shall be installed in accordance with the manufacturer's written instructions and recommendations.
All materials considered by the CA to be unsound or not in accordance with the specification shall immediately be removed and properly replaced to the satisfaction of the CA at no additional cost. All work carried out imperfectly or with faulty materials must be immediately removed and properly replaced to the satisfaction of the CA at no additional cost.
The manufactured articles specified shall serve as a quality standard.
Where manufactured items are not specified by name submit with the tender all necessary details of proposed articles. The CA shall approve these articles before their use is permitted.

100.055 SPECIAL REQUIREMENTS
All services are to be concealed, unless instructed otherwise. Exposed services shall be installed to the highest standards of workmanship, with all visible service routes having been agreed with the CA in advance of installation. Any services installed unacceptably or without prior agreement shall be modified until acceptable to the CA without additional cost to the contract.

The Contractor shall:

(i) liaise with all other subcontractors to establish the requirements for containment routes, pipework routes and equipment/terminal positions etc.

(ii) Review the Max Fordham Layout drawings to identify acceptable distribution routes for all services.

(iii) Fully coordinate ALL services.

(iv) Provide information as required by this Preliminaries Work Section

(v) Obtain approval from the CA for all installation drawings and submittals.

All services shall be installed to the highest standards of workmanship, with all visible services routes agreed with the CA in advance of installation.
A "right first time" approach is imperative.
Services installed unacceptably or without prior agreement or any avoidable damage to building finishes, shall be made good, at no additional cost to the client, to the satisfaction of the CA.

HEALTH AND SAFETY
Hazards and risks have been minimised as far as possible during the design of the installations.
The following specific risks remain:
- Working at height
- Working in confined spaces
- Working around live electrical and mechanical services
- Working on existing structures
- Work at roof level

Undertake all work in accordance with the relevant Health and Safety legislation and guidance.
Provide detailed method statements for each activity. Implement safe and good working practices.

100.060 DESIGN RESPONIBILITIES OF THE CONTRACTOR:
The design responsibilities of the Contractor are as detailed in the following clauses:

100.060B TYPE B: THE CONTRACTOR DEVELOPS & COMPLETES THE DESIGN:
The design has been progressed to approx. RIBA Stage 3 level of detail (developed design) as part of a tender for which the entire MEP services provision forms a Contractor Design Portion. The Contractor is to DEVELOP & COMPLETE the design of all services listed in this specification.

All design responsibility for the correct operation and compliance with the Performance Objectives and Design Parameters within this specification rest with the Contractor. The contractor's design shall meet the Employer's Requirements for the MEP Engineering Services in full, including concepts, performance requirements, details, materials and equipment specifications. Any information relating to the size and duty of equipment that has been included within the tender information, has been included to indicate the assumptions used to establish the space requirements and distribution routes, and should not be relied upon for the purposes of the Contractor's design. The tender price must include for the cost of a complete working installation within the scope of the design described by the Employers requirements, whether explicitly indicated on the drawings or not.

The contractor must not rely on further design detail from the client/employer to complete their design. Max Fordham LLP will be retained by the client/employer to review Contractor's design proposals for compliance with the Employer's Requirements, attend site to inspect services installations and check commissioning of M&E systems prior to Practical Completion.

As part of the tender process, the contractor shall review the MEP designs, performance requirements, details, materials and equipment specifications and

report any concerns with completing, and taking full ownership of the design and installation on this basis.

The contractor may offer alternative design proposals as part of his subsequent design development but these must be presented as optional, including details of the benefits to the client (such as capital, maintenance or running cost savings).

The Contractor will offer themself as an expert in the field of building services and/or relevant specialist field, and will design and install an installation that is in accordance with the tender documentation, is constructed in accordance with the agreed programme and within the tender price.

The Contractor is to employ experienced design engineers who have available to them all published knowledge relevant to buildings, building services and relevant specialist fields.

The Contractor is to allow sufficient time within the programme for carrying out and completing the design, detailed information and installation drawings, review by the CA, incorporation of any comments or necessary amendment(s), subsequent resubmission(s) and review(s).

The Contractor is responsible for the suitability, compatibility and correct installation of all components whether specified within the tender documentation or chosen by the Contractor to meet the specified performance of the installation(s).

300.000 TENDERING INSTRUCTIONS

300.040 PRIVACY OF INFORMATION:
The information contained in the tender documentation shall be treated as private and confidential.

300.050 CHECKING DOCUMENTS:
Check the tender documentation for obvious errors and omissions. Should any such errors or omissions be discovered inform the office issuing the documents immediately in writing in order that a correction may be issued before the date for submission of the tender.

300.150 ALTERATIONS TO TENDER DOCUMENTS:
No alterations or erasures to the text of any part of the tender documentation shall be permitted.

Any tender containing such alterations or erasures may be rejected.

300.170 SELECTION OF PLANT & EQUIPMENT:
Where manufacturers, supplier or installers of products are NOT identified by name select products that comply in all respects with the specification and demonstrate such compliance.
Where manufacturers, supplier or installers of products are identified by name, or names, but NO reference is made to "Or CA Approved Equivalent" use these exclusively unless agreed otherwise within the main contract prelims or if the performance of such equipment will not meet the Employers Requirements.

Where manufacturers, supplier or installers of products are identified by name, or names, but reference is made to "Or CA Approved Equivalent" the submitted tender must include the named or one of the named suppliers. Alternatives may be selected and shall be submitted separately at the time of tender to the CA with an associated revised cost.

Where the Contractor wishes to propose an alternative the Contractor must demonstrate that it complies with the original design intent and fully re-evaluate all parts of the services and building design that may be affected by the acceptance of the alternative. If indicated by the CA that the alternative selection is accepted then the Contractor shall amend the design and drawings to incorporate the alternative item.

300.195 INTERPRETATION OF THE TENDER DOCUMENTATION:
- Should there be any doubt about the precise meaning of any item for any reason whatsoever, the tenderer must inform the office of issue of the tender documents in writing in order that the correct meaning may be given.
- Any clarification of the meaning or intent shall be issued in writing only and no other means of communication shall be valid. All Tenderers will be notified of any such explanation.
- No liability will be admitted, nor claim allowed, in respect of errors in a tender due to mistakes that should have been rectified in the manner described above.

300.200 PROCUREMENT OF MATERIALS:
Allow for the procurement of materials and equipment from suppliers at such a time, and in such a manner as may be necessary to allow for the completion of the Works in accordance with the contract programme.

Clearly state in the tender submission any foreseen difficulties with delivery periods for selected equipment or proposed alternatives. No additional costs resulting from non-compliance will be accepted.

300.210 SUBLETTING:
- Where it is proposed to sublet any portion(s) of the Works a schedule must be submitted with the tender.
- The schedule should define such portion(s) and give for each the details of the proposed company.

310.000 TENDER SUBMISSION

310.032 PROGRAMME:
Submit with the tender a programme indicating the sequence and timing of the principal parts of the works including periods for planning, design, procurement, installation and commissioning.

310.040 MAINTENANCE CONTRACT:
Maintain the works covered by this specification for twelve months, or for the period of the Defects Liability Period if longer, from the date of Practical Completion. Itemise the cost of this maintenance contract separately within the tender return and tender summary provided.

The maintenance requirements are as detailed in clause 910 at the end of these preliminaries.

320.000 PRICING AND COSTS

320.030 TENDER PRICING DOCUMENT:
Alterations and qualifications to the specification must not be made without the written consent of the CA. Tenders containing such alterations or qualifications may be rejected.

Costs relating to items in the specification that are not priced will be deemed to have been included elsewhere in the tender.

The Tenderer shall complete all sections of the tender pricing document in full.

Items described in the pricing document are abbreviated for the purpose of the schedule. The Tenderer is to make full allowance for all works associated with the installation of a particular element.

Items entered in the pricing document shall be deemed to include all costs involved in carrying out the Works.

- Where required the Tenderer must identify separately the cost of all items specifically described under preliminaries.
- Provisional items will be adjusted at the final agreed rates when information is issued in respect of these items.

320.040 SCHEDULE OF RATES:
A schedule of rates must be submitted

- Within one week of request.
- The schedule of rates must include rates for all significant items of work.
- Rates to include Contractor's cash discount.

A quantified schedule of rates accepted by the CA shall only constitute part of the contract in the following respects:

- The descriptions of the works and the rates and prices contained therein shall be used for the purpose of adjusting variations
- The quantities contained therein shall be used to facilitate the preparation and the checking of interim applications for payment
- The provisional and prime cost sums contained therein shall be subject to adjustment in accordance with the rules and procedures contained in the contract conditions.
- The Schedule must be quantified and total the contract sum.

410.000 PARTICULAR CONDITIONS

410.020 INFORMATION PROVIDED BY OTHERS:
Instructions, drawings, or other information required to be provided by the CA will be provided in due time upon written request provided always that such information is not requested unreasonably distant from nor unreasonably close to the date upon which it is necessary. Provide written request to the CA in good time for any information required.

410.030 PROVIDE EVERYTHING NECESSARY:
Provide everything necessary for the proper execution and completion of the contract works to the true intent and meaning of the contract documents.

Details of construction or materials which have not been referred to in the contract documents but the necessity for which may reasonably be implied or inferred from the said documents or which are usually or essential to the completion of the Works, shall be installed with no additional cost.

410.040 SUPPLY OF INFORMATION:
The CA will provide supplementary information from time to time as may be necessary to enable the completion of the Works in accordance with the contract conditions. Allow for such progressive release of further information by the CA during the course of executing the Works.

In order to facilitate the orderly and timely production of all further information that shall be considered necessary, submit to the CA for approval a programme indicating the progressive release of such information to enable the completion of the Works in accordance with the contract conditions.

410.041 CO-ORDINATION OF TRADES:
Allow for co-ordinating the contract works with the works of other trades and installations which may be on site during the period of the contract.

410.080 PROGRAMME:
Provide a detailed programme(s) clearly illustrating how the overall programme

- Will be achieved within the contract period.
- Demonstrate compliance with the Main Contract programme.

Provide the detailed programme

- within one month of the award of the contract

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

- Statutory authority approvals including Building Regulations.
- The latest dates for release of final information required from the CA.
- Ordering dates and manufacturing periods. The proposed delivery to site for each item of major plant to be clearly defined.
- Installation periods for each system
- Work resulting from instructions issued in respect to the expenditure of provisional sums.
- Concurrent work by other trades.
- Any temporary works necessary for the completion of the engineering services installations.
- Period required for operating the systems, load simulation tests and final adjustment.
- Environmental load testing.
- Period for instructing the Employer training.
- Pre-commissioning, commissioning and performance testing of the engineering services installations.
- The period required and latest dates for the production, approval and issue of record drawings and operating and maintenance instruction manuals.

- Provide a separate and detailed commissioning programme for agreement with the CA. Make due allowance for the following.
  - Commissioning, demonstration and instruction procedures.
  - Provision of written notice before each (or series of) test, inspection, commissioning or demonstration procedures are to be carried out, not less than 1 week
  - Demonstration to the CA that test instruments and equipment are accurate.

410.120 DRYING OUT:
Make due allowance in the sequence of the work to provide heat for drying out. This activity shall not relieve any responsibilities to hand over the installation in good order.

The interim period from the time of commencement of use for drying out to the handover shall not be considered as constituting any part of the defect liability period.

410.190 USE OR DISPOSAL OF MATERIALS:
Remove from the site any rubbish and debris arising out of the execution of the contract works on a daily basis. Do not discharge any oil, noxious liquids or gases and all water discharged shall be reasonably free from impurities. All waste is to be recycled where possible.

410.200 STORAGE:
Weatherproof, safe and secure storage shall be provided for all materials and equipment.

All materials and equipment and materials shall be offloaded, stored and transported in accordance with manufacturer's recommendations.

All electrical equipment and components shall be kept dry and free from dust.

Plug, cap or seal open ends on all ductwork, tubes, conduit, trunking and associated equipment whilst in storage and during transportation to site.

Provide racks to prevent distortion of pipes, conduit and similar materials.

410.210 PROTECTION AND PACKAGING:
All plant, equipment, materials and prefabricated elements of the Works shall be properly packaged and protected against damage during delivery, storage and until fully, finally and properly installed and set to work.

Protection shall also include adverse effects of environmental conditions prevalent in the stored and installed location.

Any plant or equipment subject to incorrect storage or inadequate protection will be deemed unacceptable for incorporation into the works and new plant or equipment will be required as a replacement.

Damaged plant, equipment and materials or that suffering from deterioration shall be replaced prior to handover.

All plant, equipment and materials shall be protected against ingress of water and dust, formation of condensation, extremes and rapid changes of temperature, building works and operations of others.

All open ends of pipes, ducts, conduit, and trunking etc shall be capped except when being worked upon.

- After removal of any temporary protection paint parts liable to corrosion.
- Filter media shall only be installed when the plant items concerned are commissioned and tested.

Install items such as grilles, diffusers, light fittings, switches, electrical accessories etc as near to practical completion as practicable.

410.240 MATERIALS USED:
No acoustic insulation or thermal insulation or sound attenuation materials shall be manufactured with any form of animal hair.

All materials supplied shall be a type that will not support bacteria.

Substances publicised by the Health and Safety Executive, Building Research Establishment, British Standards Institution or other authorities or professional bodies as being deleterious to Health and Safety shall not be incorporated into any part of the Works.

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

- halon/CFC's
- asbestos or products containing asbestos
- urea formaldehyde or materials which may release formaldehyde
- materials comprised in whole or part of man-made and/or naturally occurring mineral fibres which have a diameter of 3 microns or less and a length of 200 microns or less or which contain fibres not sealed or otherwise not stabilised to ensure that fibre migration is prevented
- lead where the metal or its corrosion products may be directly ingested, inhaled or absorbed
- polyurethane or polyisocynate foam
- polychlorinated biphenyls (PCBs) or similar compounds
- pentachlorophenol, lindane or tributyltin (TBT) oxide
- extruded polystyrene other than low ozone depletion materials
- any other substances generally known to be deleterious at the time of installation
- The Contractor shall alert the Employer and CA to the risks in respect of any installed material that is subsequently identified as deleterious or potentially deleterious and shall advise as to the best and most economic course of action.

All jointing materials shall be of a type approved by the respective authority.

Warrant that deleterious materials are not incorporated in the Works.

Notify the CA, in writing, as soon as reasonably practicable of any material designated by the Building Research Establishment, British Standards or codes of practice as deleterious at any time during the contract.

410.270 BENEFICIAL USE OF INSTALLATIONS:
- Systems shall not be used before practical completion without prior approval of the EA.

- Systems used before practical completion not for the benefit of the Employer must have all defective consumable elements replaced by new including:
  - lamps and tubes
  - filters

Replacement of consumable elements shall be not more than 14 days prior to practical completion.

- If instructed by the EA operate the installations or any part of them prior to practical completion, provided that such operation is practicable and does not prejudice the responsibilities and obligations under the contract.
- All costs arising from the use of such installations will be reimbursed at rates or where no such rates are applicable at reasonable rates agreed with the EA before commencing operation of the installations.

410.280 DEFECTS LIABILITY:
Liability for making good defects in the Works shall be for a period of 12 months from the date of issue of the certificate of practical completion for the installations.

If it is necessary to replace or renew any portion of the contract works as part of liability for defects, the defects liability period in respect of that portion of the contract Works shall be deemed to commence from the date of such replacement or renewal.

The CA may require that new tests be carried out to demonstrate that the plant is continuing to work satisfactorily if the replacement or renewal may affect the efficiency of the Works or any portions thereof.

In the remedying of defects in the contract Works take all necessary precautions to minimise the risk of damage to the buildings, the decorations, the fittings and the equipment.

- In the event of such damage occurring bear the cost of replacement or making good, subject to the proviso of being granted the benefit of any settlement in respect of such damage accepted by the insurers under the insurance policies taken out in accordance with the requirements of the contract.

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

- Prior to practical completion submit a method statement for the approval of the CA outlining how the defects which arise during the defects liability period will be rectified to ensure that disruption to the use of the building is kept to a practical minimum.

- No additional costs will be accepted for undertaking works executed out of normal hours.

- Prepare and submit records of failures or malfunctions of any part of the contract Works during the defects liability period, together with details of remedial action taken, subsequent re-testing and the results.

- Notify the CA of damage, failures or malfunctions to the contract Works demonstrably caused by incorrect operation of the installations, vandalism or other actions by a third party.

- Inform the CA in writing when all defects are finally rectified so that an inspection may be carried out prior to the issue of a Final Certificate.

410.290 RIGHT OF ACCESS DURING DEFECTS LIABILITY PERIOD:
Right of access will not be unreasonably withheld, at all reasonable working hours and at own risk and expense, to any part of the contract works for the purpose of inspecting the working of the installations or to the records of the working and the performance thereof.

Subject to CA approval, that shall not be unreasonably withheld, undertake any tests considered necessary at own risk and expense.

During the defects liability period and all necessary remedial works and/or rectification of defective materials and equipment liaise closely with the Employer's staff. All such work shall be carried out in such a manner as to avoid or minimise shut-down time and inconvenience to the Employer.

410.320 FIRE PRECAUTIONS:
Take all reasonable fire precautions in respect of stores, workshops and other installations. Where it is necessary to use any naked flame or welding equipment in executing the contract works and where combustible materials are in use, adequate protection shall be given to other adjacent materials and personnel. Suitable fire extinguishers shall be readily available at the position where such work is proceeding.

410.330 DAMAGE TO STRUCTURE:
- Exercise due care and attention in carrying out the contract works and be fully responsible for any damage caused to the structure or building finishes.

- Obtain permission from the CA before any holes are cut in floors, walls or steelwork, etc.

410.340 INSPECTION BEFORE CONCEALMENT:
Whenever work requiring inspection or testing is subsequently to be concealed give the following the notice to the CA so that inspections may be made or tests witnessed before concealment

- 5 days notice

410.350 EQUIPMENT GUARANTEES:
Plant and equipment guarantees shall commence at the date of practical completion and run for a minimum of 12 months after this date.

Any costs associated with this requirement shall be included in the contract price.

410.360 SITE MODIFICATIONS:
Site modifications to assemblies shall not be made without written approval of the CA.

Where site modifications to assemblies are authorised undertake in accordance with manufacturer's certified drawings and instructions.

Ensure that all modifications undertaken comply with the relevant standards and all test certification obtained.

410.370 DIMENSIONS:
- Where installations are dependent upon site dimensions ensure that these are available before proceeding with the Works.

- Dimensions should not be scaled from drawings.

- Where dimensions are indicated on drawings check these on site, as appropriate, to ensure building construction tolerances and manufacturing tolerances can be accommodated.

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

430.000 QUALITY

430.020 WORKMANSHIP AND MATERIALS:
All materials, articles and workmanship shall be of the best quality and execution as detailed in the specification and drawings.

All equipment and materials to be installed shall be new unless otherwise indicated.

All equipment shall be installed in accordance with the manufacturer's written instructions and recommendations.

All materials considered by the CA to be unsound or not in accordance with the specification shall immediately be removed and properly replaced to the satisfaction of the CA at no additional cost. All work carried out imperfectly or with faulty materials must be immediately removed and properly replaced to the satisfaction of the CA at no additional cost.

The manufactured articles specified shall serve as a quality standard.

Where manufactured items are not specified by name submit with the tender all necessary details of proposed articles. The CA shall approve these articles before their use is permitted.

510.000 SUBMITTALS AND APPROVALS

510.010 GENERAL:
This section outlines the requirements and procedures for submittals to the CA.

510.030 SCHEDULE OF DRAWINGS AND SUBMITTALS:
Provide a schedule of all proposed drawings and submittals required for comment. The schedule shall be provided

- No later than 4 weeks from contract appointment

Indicate as a minimum the following information on the schedule:

- Drawing number and revision number
- Drawing title and service
- Scale
- Latest date required on site and/or for manufacturing purposes
- Date required for final comment
- Date for submission for comment
- Date of commencement of drawing production

The schedule shall be updated as necessary on a regular basis at intervals agreed with the CA during the contract period.

The programme for production of drawings and other submittals should include the necessary time for:

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

Allow adequate time in the programme in order not to cause delays.

The full extent of all submittals shall be indicated in the schedule.

Group submittals for a particular part of the building or building engineering service as agreed with the CA.

510.040 CALCULATIONS:
All calculations must be presented in a logical format and prepared to a recognised and agreed format and be suitably indexed.

All software programs used in the preparation of designs shall be agreed with the EA prior to commencement of design activities. The use of unverified software must be declared and the initial outputs justified by full and complete hand calculations.

Software used in calculating the energy performance of buildings, as required under Part L of the Building Regulations, shall be as approved by Government and agreed with CA prior to commencement of use.

Calculations that are preliminary in nature, i.e. do not form part of the final submittal, are to be referenced independently and clearly indicated 'Preliminary'.

State the methodology, formulae, design criteria, assumptions and all design margins used in the calculations.

Where necessary calculation sheets shall be accompanied by an annotated layout drawing identifying terminals, fittings and the particular sections of ductwork or pipework.

Each calculation sheet, drawing or schedule shall clearly identify the originator, date of production, checker (who signs or initials) and date of check.

The timescale for review or comment or otherwise on all submittals shall be 14 working days from the date of receipt by the EA

510.050 EQUIPMENT PERFORMANCE DETAILS:
Details of the equipment selected for inclusion into the Works shall include the following information:

- Plant item description, reference identification and serial number.
- Electrical input rating - kVA, Volts, Phase.
- Operating mode - duty, standby, generator etc.
- Starting characteristics - starter type, current, starts/hour and starting time.
- Performance characteristics - (full load current and power factor).
- Noise level.
- Weight.

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

510.051 PREPARATION OF DRAWINGS:
Agree with the CA a document numbering system prior to preparing any documents.

All drawings shall be prepared using a computer aided draughting system and the software used to produce drawings shall be approved prior to commencement of drawing production.

Each service shall be represented by a separate layer/overlay, for subsequent easy modification.

Prior to commencement of drawing production agree the sequence of layers, pen colours and sizes.

The medium for transfer of information shall be PDF at A1 size with a scale selected to convey clearly the proposals.

510.060 REVIEW OF SUBMITTALS:
The CA will take up to 2 weeks to review submittals. The contractor is to allow sufficient time in his programme for this review process.
The CA or their appointed representative may review proposals and drawings (including Installation Drawings) submitted by the Contractor for these Works or parts thereof, for general compliance with the design intent and performance criteria. The CA will not 'approve' any drawings or other information submitted for review.

Review will not relieve the Contractor of any responsibilities or obligations under the contract and it will remain the sole responsibility of the Contractor to ensure the contract requirements are met. The Contractor will remain liable for any defects in or omissions from the information supplied by them.
Any changes to drawings or other information that are needed to meet the contract requirements are deemed to have been taken into account within the contract sum and programme.

510.070 MISTAKES IN SUBMITTALS:
Examination and/or issue on a CA instruction of submittals shall not be deemed to remove any duties, obligations and responsibilities under the contract.

Be responsible for any error, discrepancy or omission in any submittal, presentation or drawing prepared or where others have prepared these for submittal.

The said indemnity shall be subject to the proviso that such error, discrepancy or omission is not due to any inaccurate data, drawing or information provided by the employer or by the CA on his behalf.

510.090 REVISIONS TO DRAWINGS:
Where revisions take place either under the authority of a CA instruction, or by written agreement with the CA or when revised architectural, structural or services information is issued, all drawings shall be modified accordingly and shall be re-issued for construction purposes subject to examination by the CA.

The issue of revised drawings shall be in accordance with and with regard to the agreed programme for construction and where time is available re-issues shall be grouped together, as agreed with the CA.

510.100 FORM AND NUMBER OF SUBMITTALS TO BE PROVIDED:
Drawn information provided by the Contractor is to be produced using the latest version of AutoCAD, or in a CAD package fully compatible with AutoCAD.
Each service shall be represented by a separate layer for subsequent easy modification.
Agree with the CA a document numbering system prior to preparing any documents.
Drawing plots shall be A size to British Standard, with an agreed logo/title block.
Provide drawn information for the design team and client in the following forms:-
Design & Installation drawings
As-installed/Record drawings
Plant room schedules and schematics

520.000 OBLIGATIONS AND RESPONSIBILITIES

520.010 GENERAL:
This section details the specific obligations, duties and responsibilities undertaken as part of the contract works.

Undertake responsibility for all works detailed in the contract, engineering specification and shown on the drawings.

Detailed design responsibilities are as stated below, in addition to those activities normally undertaken through the custom and practice of the industry.

Comply with the obligations as designers under all Health and Safety Regulations.

Responsibility of the suitability and correctness of the design or other obligations as defined in the contract documentation will not be affected by comments of the CA.

Refer to the preliminaries section of the contract and elsewhere in this specification for those items of attendance provided, free of charge.

The schedule below outlines the responsibilities and obligations to be undertaken relating to the engineering services works. The listing is not exhaustive and does not relieve any responsibilities stated or implied within the contract documents or stated elsewhere in the specification.

520.040 ALTERNATIVE EQUIPMENT:
Where the CA has accepted proposed alternative equipment or materials prior to the award of the contract and which subsequently varies the main works and/or the Works in any way whatsoever, then:

- Be responsible for meeting all the additional costs and technical requirements arising from such a change
- No claim for additional costs or delay to the completion of the works will be allowed.
- Undertake the redesign of all engineering services and builder's work affected by these equipment changes at no additional cost or extension or delay to the programme.

Should any alternative item proposed not carry appropriate certification, ensure independent testing is carried out to confirm compliance at no additional cost.

520.060 CO-ORDINATION OF SERVICES ON SITE:
Allow for co-ordinating the contract works with the works of other trades and installations which may be on site during the period of the contract either during or prior to their incorporation into the works.

Where minor clashes of services occur on site that were not foreseeable at the design or co-ordination drawing stage then these clashes or minor co-ordination matters shall be resolved by discussion and agreement with other trades and disciplines. The CA shall be informed of the action to be taken by an approved means.

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

520.080 SITE DIMENSIONS AND LEVELS:
Install all engineering services using a laser levelling system wherever possible and co-ordinate the measurements with all other trades and disciplines to prevent any clashes.

Obtain all dimensions and levels on site for the actual setting out of the works.

As the development advances measure on site all works by others that may foreseeably affect the works. These dimensions shall be incorporated into the installation drawings or marked up on revised drawings if already issued.

- No extra cost or claim will be allowed for any errors arising from inaccurate setting out or failure to check actual site dimensions.

520.090 MAINTAINABILITY:
At all times give proper consideration to the future maintenance of the installed plant and services, and shall include for such component parts as are provided by the manufacturer of equipment and plant for this purpose.
Ensure that adequate space for maintenance is provided and that all serviceable components can be dismantled and replaced with minimal disturbance to the surrounding installations and building components.
Demonstrate that all plant and equipment incorporated into the Works can be safely and easily maintained in full compliance with:
- Health and Safety legislation.
- CDM requirements.
- British Standards.
- Health Technical Memoranda.

All parts of the service installations are to be selected and designed for minimum maintenance during their life. The planned and preventative maintenance requirements of the installed services and plant are to be coordinated within the design.
All conduit, trunking, pipework and the like for future use will be installed with draw wires and located to afford access for and to facilitate or addition of further circuits etc. without the removal of fixed sections of walls, ceilings and the like.
Where pipes cross access routes at low level purpose made step-overs shall be installed to provide safe access and prevent damage to the services.

530.000 LOCAL AUTHORITY AND BUILDING REGULATIONS REQUIREMENTS

530.020 STATUTORY AUTHORITY APPROVALS:
- Notify the District Surveyor, Building Control Officer and Fire Officer directly in respect of all tests and demonstrations relevant to life safety installations, and include for all necessary attendance, documentation, etc., to ensure full Statutory Authority approval of the installation.

530.040 BYE-LAWS, NOTICES, ETC:
Observe and comply with the requirements of all Statutes and Bye-Laws.

Serve notices on the Authorities having control of the road surfaces before the same are broken up and likewise serve notices on the owners of sewers, drains, water, gas or other mains, electric cables and other services which may in any way be affected by the execution of the Works.

Inform all necessary parties when work necessitates such notices to be given.

540.000 HEALTH AND SAFETY

540.010 GENERAL:
- Refer to the Main Contract Preliminaries for the requirements of safety, health and welfare.

540.020 CDM REGULATIONS:
- The management of health and safety is to be undertaken in conformity with the requirements of The Construction (Design and Management) Regulations, The Construction (Design and Management) (Amendment) Regulations 2015, and the corresponding Approved Code of Practice.
- Comply with the requirements of the CDM Regulations by
  - Compiling risk assessments
  - Preparing method statements
  - Providing information on the contract works that might affect the health and safety of any person
  - Providing all necessary input to the health and safety plan
  - Providing all necessary input to the health and safety file
- Supply any method statements and comply with all CDM procedures required by the Principal Designer and the Principal Contractor.

540.030 HEALTH AND SAFETY PLAN:
- A tender stage health and safety plan is included as part of the tender documents.
- The tender stage health and safety plan provides information required by the CDM Regulations and highlights significant risks to health and safety identified during the design stage.
- Develop the tender stage health and safety plan in accordance with the requirements of the CDM Regulations prior to the commencement of works on site
- The development of the health and safety plan shall not be limited to those particular risks identified in the tender stage health and safety plan but shall include consideration of all reasonably foreseeable risks
- The health and safety plan must be adequately developed, as far as is reasonably practicable allowing for any phasing of works, etc., in sufficient time to allow it to be submitted for approval prior to the commencement of any works on site.
- In the case of phased works the health and safety plan relating to the work content of any phase must be adequately developed and submitted for approval prior to the commencement of any work within that phase of the project.
- Where design activities are undertaken or there is involvement in the design of any elements of the contract works co-operate with and provide information to the Planning Supervisor in accordance with the designer's duties under the CDM regulations.
- Ensure that all sub-contractors are issued with copies of the health and safety plan prior to the submission of their tenders and that they price for compliance.
- Ensure that all sub-contractors complete appropriate assessments of the risks to health and safety in respect of their works as required under applicable statutory legislation, including The Management of Health and Safety at Work Regulations, The Control of Substances Hazardous to Health Regulations and The Control of Substances Hazardous to Health (Amendment) Regulations 2003.
- The health and safety plan shall be reviewed and revised as necessary in line with any information received or any changes in the requirements of the contract works. Any changes shall be promptly advised to all relevant parties.
- Ensure, so far as is reasonably practicable, that all sub-contractors, employees and self employed persons who are at work on the construction of the project conform with the requirements of the health and safety plan.

540.040 COSHH REGULATIONS:
- Comply with The Control of Substances Hazardous to Health Regulations and The Control of Substances Hazardous to Health (Amendment) Regulations 2003.
- Provide with the tender an assessment of the risks in undertaking the contract works
- Provide with the tender a method statement on the steps proposed to meet the requirements of the Regulations
- Undertake COSHH assessments for all activities and substances provided or used on site to assess their potential health hazards.
- Copies of all relevant COSHH assessments must be issued to the operatives concerned and strictly monitored. Particular attention must be given to the use of glues and sealant.
- Where the use of substances falling within the scope of the Regulations forms part of the contract works notify the EA in writing, together with the additional costs, if any, of use of non-hazardous alternative.
- Ensure during the course of the contract works, and under all circumstances, that all substances falling within the scope of the Regulations are positively so identified at all times and that they are transported, handled, stored, used and disposed of in strict accordance with their manufacturer's/supplier's recommendations.
- Where use of substances falling within the scope of the Regulations are required for the operation and maintenance of the completed contract works, ensure that
  - Suitable facilities are available for the on site storage of such substances and that all necessary warning/instruction notices are provided at the point of their storage and use
  - Provision of any special protective clothing, eye protection and similar safety equipment for the operation and maintenance of the Works and in sufficient quantity for
    - 1 year operation
  - Employer's staff have been fully trained in the use, handling, storage, transport and disposal of the substances concerned prior to handover.

- The type, use and control of the substances have been fully and correctly identified in the operating and maintenance manuals/health and safety file.

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

540.060 RISKS TO HEALTH AND SAFETY:
Submit a statement with the tender describing any significant and unavoidable risks which may arise as a result of carrying out the contract works and the measures proposed to safeguard the health and safety of operatives and of any person who may be affected by the contract works.

550.000 BUILDING REGULATIONS REQUIREMENTS

550.010 GENERAL:
This section details the requirements for compliance with the Building Regulations.

550.020 BUILDING REGULATIONS APPROVALS:
- Notify the District Surveyor, Building Control Officer and Fire Officer directly in respect of all tests and demonstrations relevant to life safety installations, and include for all necessary attendance, documentation, etc., to ensure full relevant Authority approval of the installation.

610.000 Existing MEP systems, Equipment and temporary works

610.010 Surveys:
Ascertain the nature of the site and all local conditions and restrictions likely to affect the execution of the MEP Engineering Services works.

Before commencing work, carry out a survey and examination of buildings, structure and engineering services affected by the works.

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

Site Dimensions and Levels:
Install all engineering services using a laser levelling system wherever possible and co-ordinate the measurements with all other trades and disciplines to prevent any clashes.

Obtain all dimensions and levels on site for the actual setting out of the works.

As the development advances measure on site all works by others that may foreseeably affect the works. These dimensions shall be incorporated into the installation drawings or marked up on revised drawings if already issued.

No extra cost or claim will be allowed for any errors arising from inaccurate setting out or failure to check actual site dimensions.

Facilities for Removal of Equipment:
Ensure isolation and drain down of any item of equipment without isolating large sections of the remaining system.

Risks to Health and Safety:
The nature and condition of the existing services have not been fully ascertained. All information relating to the existing services should be checked by the contractor on site. The contractor shall carry out risk assessments and ascertain the nature and condition of the existing services prior to working around or amending existing services.

Maintenance of Existing Services:
Fully maintain the following existing services during the progress of the contract works

Include in the contract price all costs to maintain the existing services at all times during the duration of the contract works.

Submit with the tender a method statement outlining how the maintenance works is to be undertaken including any necessary specialist maintenance.

Prior to commencement of the contract works submit a method statement to the CA/EA outlining how the existing services are to be maintained including all planned and preventative maintenance measures.

Provide any additional work and materials necessary to maintain these services at all times during the duration of the contract works.

Existing services disturbed or damaged during the contract works are to be reinstated

Submit to the CA/EA a method statement outlining the method and procedures for the remedial and reinstatement works.

Any shut down of existing services to undertake remedial and reinstatement works shall be to an agreed procedure.

Reinstate fully in accordance with the standards of quality as defined in the specification and to the satisfaction of the CA/EA.

Maintain new services during the rectification period.

Strip-out
Provide method statements for surveying, identifying, isolating and stripping out existing services

Interruption of Supply
Work that requires interruption or interference with the operation of any existing services or buildings shall not be commenced without prior written permission of the CA/EA.

610.100 EXISTING & NEW STATUTORY AUTHORITY CONNECTIONS
Existing Mains:
Existing incoming utility services shall not be interfered with, nor interrupted in any way without the prior written permission of the CA/EA.
Be responsible for any damage entailed and make good any such damage to the satisfaction of the CA/EA at no extra cost.

New Connections:
Orders for incoming services connections shall be:
- included in this contract and
- undertaken by the Main Contractor

Liaise with the Statutory Authorities and provide any test notices required to ensure final connections are made in accordance with the requirements of the programme.

710.000 GENERAL DESIGN CRITERIA AND STANDARDS

710.010 GENERAL:
This section outlines the general design criteria and definitions applicable to the engineering services forming the contract Works.

710.020 GENERAL DESIGN CRITERIA:
- The criteria listed in the following clauses apply to all work sections included in the contract unless specified otherwise.
- The design of the engineering services is based on the criteria and design data stated in the following clauses
  - Changes or amendments shall be by prior written notice from the CA.

710.070 PLANT OPERATING CONDITIONS:
- Ensure all plant items are suitable for operation in the environment in which they are to be located.
- Ensure all plant, motors, starters and ancillary equipment etc. are suitable for operation at full capacity under the following conditions
  - Height above sea level not exceeding 1000m.
  - Air cooling at an average temperature over 24 hours not exceeding 35ºC dry bulb.
  - Maximum conditions of 40ºC dry bulb and 50 per cent relative humidity.
  - Supply voltage approximately sinusoidal

710.090 ELECTRICAL WIRING:
Where systems are specified as being maintained under fire conditions ensure wiring selected is suitable for the temperatures to be encountered.

710.100 ELECTRICAL SUPPLY CHARACTERISTICS:
The characteristics of the electrical supply or supplies:

- Nominal voltage(s) 230/400V
- Nature of the current and frequency 50Hz
- Prospective short-circuit current at the origin of the installation TBC by Contractor in survey
- Earth fault loop impedance (Z_e) of that part of the system external to the installation TBC by Contractor in survey
- Confirm with the Supply Authority before ordering any equipment dependent upon voltage or frequency.
- Ensure all electrical equipment supplied and installed is suitable for the power supply indicated.

710.110 STANDARDS AND REGULATIONS:
- Unless stated otherwise the Works shall comply with the appropriate British Standard (BS) or Code of Practice (CP) and where no BS or CP is applicable comply with
  - the Agrement Certificate for the particular item.

- CIBSE recommendations and guides to current practice.
- BS 7671 Requirements for Electrical Installations
- Guidance published by IEE and IET.
- Building Regulations.

- 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 in the same location.
- All product and materials shall have product conformity certification (eg BSI Kitemark, BSI Safety Mark or CARES scheme) or product approval (eg British Board or Agrement Certificate)
- All products must have the recognised 'CE' or 'UKCA'mark attached.
- In the absence of specific design, performance or installation standards being stated seek the instructions of the CA prior to commencement of the Works and with adequate time so as not to cause delay.
- When new editions, versions and amendments are published during the construction, seek the instructions of the CA with respect to any modifications or changes necessary.
- References to BSI documents shall be to the versions and amendments listed in the British Standards Catalogue and in subsequent issues of BSI Update Standards up to
  - one month prior to the tender issue date.

710.130 ELECTROMAGNETIC COMPATIBILITY:

- Ensure all equipment and systems are installed to provide electromagnetic compatibility within the system and with any other systems installed in the same area.
- Ensure all systems and buildings are assessed for protection to, and that such protection meets the requirements of, BS 6651.
- Ensure all equipment meets the requirements of the appropriate electromagnetic compatibility standard.
- Ensure all apparatus covered by the Wireless Telegraphy Act meets regulations issued by the Radiocommunications Agency.
- Ensure all equipment and systems meet the requirements of BS 6701 and BS EN 41003.
- Ensure that all cable installations meet the minimum guidance separation in EMC of Installations and Recommended Cable Separations, published by the ECA.

710.140 PRESSURE DIRECTIVE:

All pressure equipment and assemblies with a maximum allowable pressure greater than 0.5 bar shall comply with the European Community (EU) Pressure Equipment Directive (PED) 97/23/EC. Pressure equipment shall include vessels, piping, safety accessories and pressure accessories. Assemblies shall mean several pieces of pressure equipment assembled to form an integrated, functional whole.

Pressure equipment shall be marked 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

Provide a declaration of conformity for all pressure equipment.

- Provide copies as part of the record documentation.

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) Where necessary, pressure equipment must be designed and fitted with suitable accessories to meet damage-limitation requirements in the event of external fire.

Ensure all components or sub-assemblies in their finished assembly are used within their safe operating range and correctly installed and tested.

Ensure that 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.

Pressure equipment and assemblies below the specified pressure / volume thresholds must:

a) be safe.

b) be designed and manufactured according to sound engineering practice.

710.160 FACILITIES FOR REMOVAL OF EQUIPMENT:

- Ensure isolation and drain down of any item of equipment without isolating large sections of the remaining system.

710.170 SOFTWARE:

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

710.180 EU DECLARATION OF CONFORMITY:

Provide an EU Declaration of Conformity prior to delivery to site.

- As requested by the CA

The declaration shall state the following as a minimum:

- The manufacturer or his authorised representative.
- Description of equipment.
- The harmonised standard(s) that have been applied.
- The signatory who has been empowered to enter into commitments on behalf of the manufacturer.
- The last two digits of the year in which the CE marking was affixed.

720.000 BUILDERS WORK

720.010 BUILDERS WORK PROVIDED:

- Where structural and/or architectural facilities or provisions, for engineering services are already indicated check that these are correct, satisfactory and adequate for the purpose and confirm same in writing to the CA.

  Timescale:

  Within weeks of the award of contract (no) 4

- Where the preliminary builder's work facilities issued prior to the award of contract are not correct or insufficient advise the EA immediately and obtain further instructions.
- Where alternative equipment or materials has been offered that the EA has accepted and which subsequently varies the works in any way whatsoever, then undertake the redesign of the associated builder's work.

720.020 BUILDER'S WORK RESPONSIBILITIES:

- Comply with Appendix B Table B
- Confirm and amplify any information provided by the CA.
- Provide builder's work information, appropriate to the stage of design development. Revise, supplement and/or issue final information, drawings/details for the actual requirements of the contract works.
- Provide fully dimensioned drawings showing both size and position of builder's work making due reference to the structural engineering and architectural final dimensioned detailed drawings.
- As approved by the CA Mark out on site, all cut holes and chases required, any pockets cast in concrete, any inserts, any built in sleeves or similar items.
  - All builders work information shall be provided to comply with the programme and include sufficient time for the necessary approvals.

720.040 MARKING OUT OF BUILDER'S WORK HOLES ON SITE:

Mark out on site actual locations of minor non-structural holes through walls, partitions, floors, etc and also chases in non fair-faced walls and the like in preference to providing drawings of such builder's work requirements.

720.050 BUILDER'S WORK INFORMATION TO BE PROVIDED:

- All builder's work drawings shall be fully dimensioned.
- Builder's work drawings to be provided shall be as follows:
- Details of all bases for plant formed in concrete, brickwork or blockwork
- Details of all attendant builders work, holes, chases, etc for conduits, cables and trunking etc and any item where access for a function of the installation is required
- Details of all types of purpose made brackets for supporting service or plant/equipment
- Details of all accesses into ceilings, ducts, etc
- Details of all special fixings, inserts, brackets, anchors, suspensions, supports etc
- Details of all sleeves, puddle flanges, access chambers
- Submit all necessary load and thrust calculations with drawings/details.

720.060 STRUCTURAL STEELWORK:

- No steelwork shall be cut, drilled or welded without written approval from the EA.
- The cutting and drilling of structural steelwork shall be agreed with the EA prior to the commencement of the work and shall require application in writing with all necessary drawings/details.
- All fixings shall be of the correct size and type for the fixing load applied and the type shall be approved prior to commencement of the works.

- Permitted holes in steelwork must be drilled - burning by means of welding equipment is prohibited.

720.070 PRE-CAST CONCRETE:
- Holes may not be cut in precast concrete without written approval from the EA.
- Under no circumstances will holes be cut in pre-stressed concrete.

720.080 SECONDARY STEELWORK:
The Contractor shall include in his tender for the supply and installation of all steelwork required to support the services from the primary structure within his works package unless specifically detailed as the responsibility of the Main Contractor on the drawings provided with this package.

720.090 ADDITIONAL REQUIREMENTS OF DESIGNING & INSTALLING SERVICES AROUND INTUMESCENT COATED STRUCTURE

For situations with intumescent coated structure (such as steel, timber or other), the Contractor is to carry out [the detailed design and] installation of the services to comply with the require project specific intumescent coating expansion distances. Typically this will requires that no services are to be within 25mm to 75mm of intumescent coated elements.

It is the M&E contractors responsibility to obtain the relevant project specific intumescent coating manufacturers data and guidance to understand and confirm the distances. It is the main contractors responsibility to provide the M&E contractor with the relevant information.

Prior to the start of the M&E installations the contractor is to provide a tech sub of the relevant manufactures data and a report stating what the project specific intumescent expansion distances are. Provide a set of project 1:50 plans that clearly label the locations where these are located and the distances required.

Provide a post completion survey report carried out by appropriate specialist that certifies that all of the M&E installations adhere to the relevant intumescent coating expansion distance requirements.

740.000 COMMISSIONING AND TESTING

740.005 GENERAL:
The Contractor is to comply with the requirements of Appendix A Table D "Allocation of Commissioning Responsibilities", drawing no A(64)500 "Testing, Commissioning & Handover Schedules", and the following clauses:

740.010 DEFINITIONS:
Where used in the documentation the following definitions shall apply and shall be interpreted as such:

- Commissioning: The advancement of an installation from the stage of static completion to working order to the specified requirements

- Testing: The measurement and recording of specified quantifiable characteristics of an installation or parts thereof and includes off site testing.

- Setting to work: The process of setting a static system in motion

- Regulation: The process of adjusting the rates of fluid flow in a distribution system to achieve specified values

- Environmental testing: The measurement and recording of internal environmental conditions

- System proving: the measuring, recording, evaluating and reporting on the seasonal performance of the systems against their design values

- System demonstration: Demonstrating the capability of the installation to achieve and maintain the specified performance criteria

- Fine-tuning: The adjustment of the system where usage and system proving has shown such a need and includes the re-assessment of design values and control set points to achieve the required system performance.

740.020 PROGRAMME:
Prepare comprehensive programmes for the pre-commissioning checks, setting to work, testing, commissioning, system proving and environmental testing of the contract works.

Timescale:

- To be completed and co-ordinated with other trades at least 6 weeks before the start of commissioning.

Review and update the commissioning programme at agreed intervals and if necessary revise and amend the programme to suit the progress of the contract works.

- Due account shall be taken of any phasing requirements.

740.040 COMMISSIONING AND TESTING:
Generally comply with CIBSE Commissioning Code M.
Compile a separate and comprehensive testing and commissioning programme, coordinated with the main project programme, on a system by system basis.
Issue to the CA for comment at least 1 month prior to the testing and commissioning commencement date. Due allowance is to be made for, but not limited to, the following:
Provide formal method statements supported by risk assessments detailing the procedures for carrying-out on (and off) site testing and commissioning.
Review the design of the works in relation to "commissionability" (i.e. the ability of a system to be commissioned satisfactorily).
During the testing and commissioning period provide weekly progress reports detailing the status of each system to be commissioned including results, technical issues, the input of others over the next week, etc. Issue to the CA.
Up-date the commissioning programme as the work proceeds taking into account true progress on site. Issue revised programme as part of the weekly report.
Give notice to the CA of when testing and commissioning is ready of inspection and/or witnessing. Give not less than 5 working days.

The CA will only witness testing and commissioning results once it has been confirmed by the Contractor, in writing, that satisfactory results have been achieved. The purpose of witnessing by the CA is to confirm recorded results and determine if the specified requirements have been satisfied, and in no way relieves the Contractor of their responsibilities under the Contract. If following test or inspection any system or plant item is shown to be defective or not conforming to the specification the CA will reject such defective parts, and after rectification by the Contractor may wish to re-inspect the system or systems involved.

Provide all the necessary labour and facilities to enable tests to be witnessed and inspections carried out on site and/or at manufacturer's works. Provide all specialised personnel (including manufacturer's representatives) and co-ordinate their activities. Allow for all the costs incurred.
Test all equipment, material and systems as detailed in Work Sections. If an inspection or test fails, repeat the procedure, until satisfactory results are obtained.

Complete all tests before any paint, cladding or similar materials are applied or before services are concealed.
Ensure all requirements such as cleanliness, protection from harmful external and internal elements etc. are provided prior to commencement of commissioning.
Following satisfactory completion of testing and when the installations are in a safe and satisfactory condition, set to work, regulate and adjust, as necessary, to meet the specified design requirements.
Provide all necessary instruments and recorders to monitor systems during commissioning and performance testing.
Provide test equipment subject to a quality assurance procedure complying with BS 5781.
Do not start performance testing, including system demonstration, system proving or environmental and capacity testing, until commissioning of the system is completed to the satisfaction of the 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 review by the CA before any system is offered for final acceptance.
Provide a written statement to the CA confirming that each installation has been correctly tested and commissioned and that the performance requirements can be achieved.
Demonstrate to the CA that all system components are operating correctly, and the completely integrated installation will function in accordance with the specified performance requirements.
Only after a successful demonstration to the CA will the Contractor be able to commence staff training as clause 900.090.

740.050 STATIC TESTING:
Progressive static testing shall include the following tests, but other tests may be required and witnessed:

- Insulation resistance
- Earth fault loop impedance
- Earth continuity
- Pressure testing of hydraulic systems
- Air leakage testing of ductwork systems

The CA shall be given the opportunity to witness all static tests.

Advance notice of the tests shall be given to the CA.

Timescale:

- days prior to test (no) 7

740.060 PRE-COMMISSIONING CHECKS:
Ensure all pre-commissioning examinations and tests have been undertaken and that each system, including components, or item of equipment is complete and in a safe condition prior to start-up.

All necessary notices shall be 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, with CA and Contractor and agree access required for controls, etc.

740.080 SYSTEM DEMONSTRATION:
- Subsequent to the completion of all testing and commissioning to the satisfaction of the CA and when directed operate the plant and demonstrate that the overall systems function correctly in accordance with the requirements of the specification.
- The period of operation shall be:
    - weeks (no) 1
    - allowed in the programme.
- During this period be responsible for the recording of results and the operation and maintenance of the plant.
- Provide the following:
    - An operational report of the demonstration
    - Schedule of the conditions maintained within the space for a period of

740.160 ROTATING EQUIPMENT:
Immediately prior to practical completion adjust, ease and lubricate moving parts as necessary to ensure easy and efficient operation.

Ensure that temporary electrical supplies are provided to enable rotating plant items delivered and/or installed to be run at regular intervals to avoid damage or deterioration.

If temporary electrical supplies are not available ensure that rotating plant is hand-turned.

810.000 RECORD DOCUMENTATION

810.010 STANDARDS:
Provide operating and maintenance manuals, system records and full documentation in accordance with the following standards

- BS 4737 and BS EN 50131-1 - Intruder alarm systems.
- BS 5839 - Fire detection and alarms in buildings.
- BS 7671 - Requirements for electrical installations.(IET Wiring regulations)

810.020 RECORD DOCUMENTS:
Provide:

- Record drawings and schedules.
- Plant room and switch room drawings, schedules and schematics.
- Operating and maintenance manuals.
- Ensure record documents clearly record the arrangements of the various sections of the Works as actually installed and identify and locate all component parts.
- Ensure record documents make it possible to comprehend the extent and purpose of the Works and the method of operation thereof.
- Ensure record documents set out the extent to which maintenance and servicing is required and how, in detail, it should be executed.
- Ensure record documents provide sufficient, readily accessible and proper information to enable spares and replacements to be ordered.
- Correlate record documents so that the terminology and the references used are consistent with those used in the physical identification of the component parts of the installations.
- Demonstrate as required throughout the execution of the contract works that complete and accurate records are being maintained and that the record documents are being progressively compiled as the work on site proceeds.

810.030 RECORD DRAWINGS AND SCHEDULES:
- Prepare record drawings and schedules based on the As Installed Drawings maintained on site during the progress of the contract works.

    The scale of the drawings shall be not less than the scale at which the design or installation drawings were produced..
- Each record drawing shall show the following information:
    - The name of the contract and, where appropriate, the zone or floor designation.
    - Description of drawing, drawing reference and scale.
    - Name and address of the installer and the consultant.
- Endorse all such documents
    - 'Record drawings'
- Where agreed with the CA certain detailed information may be provided in schedule form.
- Where portions of the work are to be concealed, draft copies of record drawings shall be supplied to the CA before the work is concealed in order to facilitate checking and examination.
- Prepare electrical drawings in accordance with BS EN 61082.
- Issue at practical completion the complete approved package of record drawings in the following numbers and format:
    - CAD format on CD disk. Each CD shall be labelled and the CD jewel cases shall be labelled identifying project title, issue date and index of contents.
        - Number of sets of complete record drawings (no) 2
    - 'White' prints.
        - Number of sets of complete record drawings (no) 2
- Provide reduced scale copies for inclusion in the operating and maintenance manuals as stated elsewhere.

Record drawings and schedules must include, but are not limited to:

- Location, including level if buried, of utility service connections, including those provided by the appropriate Authority, indicating points of origin and termination, size and material of service, emergency shut-off isolation locations, pressure and/or other relevant information.
- Disposition and depth of all underground systems.
- Schematic drawings of each system indicating principal items of plant, equipment, zoning, means of isolation, etc. in sufficient detail to make it possible to comprehend the system operation and the inter-connections between various systems.
- Details of the principles of application of automatic controls and instrumentation.
- Diagrammatic dimensioned plans and sections of each system or service showing sizes and locations of all ancillaries, plant, equipment controls, test points, and means of isolation etc. including any items forming an integral part of the engineering systems provided by others (such as plenum ceilings, builders' work shafts, chimneys etc.).
- Identification of all terminals/cables etc. by size/type and duty/rating as recorded from the approved commissioning results.
- Detailed wiring drawings/diagrams/schedules for all systems, including controls, showing origin, route, cable/conduit size, type, number of conductors, length, termination size and identification, and measured conductor and earth continuity resistance of each circuit. Ensure routes indicate if cable/conduit is surface mounted, concealed in wall chase, in floor screed, cast in-situ, above false ceiling etc.
- Details of co-ordination of wiring and connections with cable core identification, notation of fire alarm, security, control and instrumentation and similar systems provided as part of the Works.

- Manufacturer's drawings of equipment indicating
  - general arrangement and assembly of component parts which may require servicing.
  - internal wiring diagrams together with sufficient physical arrangement details to locate and identify component parts.
- Schedules as required to locate, reference and provide details of ratings and duty of all items incorporated into the Works together with all fixed and variable equipment settings established during commissioning.
- For each programmable control item
  - schedules indicating for each input and output point connected
    - full data in respect of that point including reference
    - type of input/output
    - connected equipment reference
    - set values of temperature or pressure etc
    - set values of start/stop/speed change times etc
    - alarm priority
    - control specification reference
    - any other such applicable parameters
  - Each spare input and output point including reference, type of input/output and space for future entry of appropriate parameters as listed above.
- 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.

810.060 PRESENTATION OF THE OPERATING AND MAINTENANCE MANUALS:

- Agree format and contents with the CA.
- Provide the operating and maintenance manuals in the following form:
  - Electronic format stored on USB Flash Drive
- Provide copies of the operating and maintenance manual as follows:
  - Draft copies for comment (no) 1
  - Final copies for Client use (no) 3
- Provide a draft copy of the operating and maintenance manual to the CA for comment

Timescale:

- Weeks before the contract completion date (no) no less than 6

- The draft copy of the manual shall conform to the final format required by the specification to enable all relevant comments to be made by the CA.
- Although it will not be necessary for the draft copy to contain testing and commissioning certificates, it will be complete in every other way.

810.070 OPERATING AND MAINTENANCE MANUALS:

The operating and maintenance manuals must include:

- A full description of each of the systems installed, written to ensure that the client fully understands the scope and facilities provided.
- A description of the mode of operation of all systems including services capacity and restrictions.
- Diagrammatic drawings of each system indicating principal items of plant, equipment, valves etc.
- A photo-reduction of all record drawings together with an index. Reduced size of drawings to be A3
- Legend of all colour-coded services.
- Schedules (system by system) of plant, equipment, valves, etc., stating their locations, duties and performance figures. Each item must have a unique number cross-referenced to the record and diagrammatic drawings and schedules.
- The name, address and telephone number of the manufacturer of every item of plant and equipment together with catalogue list numbers.
- Manufacturer's technical literature for all items of plant and equipment, assembled specifically for the project, excluding irrelevant matter and including detailed drawings, electrical circuit details and operating and maintenance instructions.
- A copy of all test certificates, inspection and test Records, commissioning and performance test records including, but not limited to, electrical circuit tests, corrosion tests, type tests, start and commissioning tests, for the installations and plant, equipment, valves, etc., used in the installations.
- A copy of all manufacturer's guarantees or warranties, together with maintenance agreements offered by subcontractors and manufacturer's.
- Copies of insurance and inspecting Authority certificates and reports.
- Starting up, operating and shutting down instructions for all equipment and systems installed.
- Control sequences for all systems installed.
- Schedules of all fixed and variable equipment settings established during commissioning.
- Procedures for seasonal change-overs and/or precautions necessary for the care of apparatus subject to seasonal disuse.
- Detailed recommendations for the preventative maintenance frequency and procedures which should be adopted by the Employer to ensure the most efficient operation of the systems.
- Details of lubrication for lubricated items including schedules of lubricant type, frequency, etc.
- Details of regular tests to be carried out (e.g. water analysis for pseudonomas.)
- Details of procedures to maintain plant in safe working conditions.
- Details of the disposal requirements for all items in the works.
- A list of normal consumable items.
- A list of recommended spares to be kept in stock by the Employer, being those items subject to wear or deterioration and which may involve the Employer in extended deliveries when replacements are required at some future date.
- A list of any special tools needed for maintenance cross-referenced to the particular item for which required.
- Procedures for fault finding.
- Emergency procedures, including telephone numbers for emergency services.
- Back-up copies of any system software.
- Documentation of the procedures for updating and/or modifying software operating systems and control programmes.
- Details of the software revision for all programs provided.
- Two back-up copies of all software items, as commissioned.
- Contractual and legal information including but not limited to
  - details of local and public authority consents
  - details of design team, consultants, installation contractors and associated subcontractors
  - start date for installation, date of practical completion and expiry date for the defects liability period
  - details of warranties for plant and systems including expiry dates, addresses and telephone numbers.
- A provision for update and modification.

900.000 COMPLETION AND HANDOVER

900.015 PRODUCTION OF HANDOVER INFORMATION:
The Contractor is to comply with the requirements of Appendix A Table E "Production of Handover Information" and drawing no A(64)500 "Testing, Commissioning & Handover Schedules", and the following clauses:

900.020 HANDOVER REQUIREMENTS:
As a pre-requisite to Practical Completion in respect of the contract works or part thereof, demonstrate to the satisfaction of the CA that:

- All the contract works are complete.
    - With the exception of minor snags or limited defects as agreed with the CA that could be reasonably completed within an agreed programme without causing disruption to the Employer's use of the building or part thereof.
- All spares, keys, tools and other consumables as stated elsewhere have been supplied and handed over to the Employer.
- The instruction of the Employer's staff in the use and correct operation of the installation has been completed satisfactorily. In particular, safety devices and controls demonstration.
- All commissioning and testing completed
    - including the issue of a final commissioning report signed by an approved competent person
- A complete demonstration of the contract works with fully functional operational controls tested has been undertaken in the presence and to the satisfaction of the CA.
- All necessary certification by the Employer's insurers has been completed.
- All approved record documentation including record drawings, operation and maintenance manuals, etc is issued
- All information required for the health and safety file is issued to the satisfaction of the Planning Supervisor.

  The information shall include:
    - A written description of plant operation.
    - 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.
- All necessary Statutory Authority approvals have been undertaken and written confirmation established
- Completion and issue of log books in accordance with Building Regulations.
    - It should be noted that this log-book is in addition to the Operating & Maintenance Manuals and is to be issued as a separate document. The log-book is in effect a summary of the O&M manuals suitable for day-to-day use by the building managers/users.
- Air permeability test certificate in accordance with Building Regulations.
- Should adequate record documentation not be available Practical Completion will not be granted.

900.030 READING OF METERS:
Record readings of all water and electricity meters immediately on completion of the Works and forward to the CA.

900.040 RECOMMENDED SPARE PARTS:
Before Practical Completion submit to the CA a schedule of spare parts as stated elsewhere and recommend any that should be obtained and kept in stock by the Employer for maintenance of the installations included in the Works.

Time scale

- 4 weeks before Practical Completion

State against each item the manufacturer's current price, including packaging and delivery to site. Identify those items that are additional to those specified for inclusion as stated elsewhere.

900.060 RECOMMENDED TOOLS:
Prior to Practical Completion submit to the CA a schedule of tools and portable instruments as stated elsewhere and recommend any that should be obtained and kept in stock by the Employer for maintenance of the installations included in the Works.

Time scale

- 4 weeks before Practical Completion

900.080 INSPECTION BY EMPLOYER'S INSURERS:
Where indicated elsewhere installations, equipment, plant or materials are to be inspected by a representative acting for the Employer's insurers.

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

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

900.090 TRAINING OF EMPLOYER
Prior to 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

Submit to the CA for approval a detailed programme for the training of the Employer

Time scale

- Weeks before commencement of training (no) 4
- Employ the services of relevant specialists and suppliers for the purpose of training and instruction.
- Provide each person with a comprehensive set of teaching notes and diagrams.
- Be responsible for the correct operation and maintenance of the installation during such periods of instruction.
- All costs associated with the instruction of the Employer and required attendance following practical completion shall be included in the contract price.
- Following practical completion and occupation be available for a period as agreed with the CA to assist the Employer in the operation of the various systems together with the
    - various specialist designers/installers involved in the works (e.g. controls, security, fire alarm, etc..)

Training

- Number of persons to be included for training is up to 3
- Include for not less than 1 day for this purpose and demonstrate the safe day to day running and maintenance of all systems, plant and equipment.
- Provide training for the operation of the controls, monitoring installations as follows.
    - Include hands on experience of equipment and software similar to the installation.
    - Include instruction on the procedures for testing and routine inspection of sensors and actuators to enable the operator to assess the nature of faults and extent of remedial action required.
    - Provide all appropriate reference and training manuals.
    - Complete initial instruction prior to commissioning of the installed system.
    - Provide site instruction on the installed system.
    - Include for training operating staff (no) 1
    - Include for not less than 1 further day for this purpose and demonstrate the safe day to day running and maintenance of all systems, plant and equipment.

900.120 OBLIGATIONS DURING DEFECTS LIABILITY PERIOD:
Prepare and submit records of failures or malfunctions of any part of the Contract Works during the Defects Liability Period, together with details of remedial action taken, subsequent re-testing and the results.
Notify the CA of damage, failures or malfunctions to the Contract Works demonstrably caused by incorrect operation of the installations, vandalism or other actions by a third party.

Inform the CA in writing when all defects are finally rectified so that an inspection may be carried out prior to the issue of a Final Certificate.

910.000 MAINTENANCE

910.030 PROVISION FOR 12 MONTHS MAINTENANCE:
Maintain the works covered by this specification for twelve months, or for the period of the Defects Liability Period if longer, from the date of Practical Completion.
The maintenance works shall be in accordance with the recommendations set out in the appropriate standard.
The maintenance works shall include:
- planned preventative maintenance to maintain the installations in efficient working order including routine checks, adjustments, lubrication and replacement of consumable spares, etc.
- preparation of work schedules and recording activities.
- providing breakdown and emergency cover.
- planning and undertaking shut-downs for maintenance works.
- employing of all necessary specialist maintenance to ensure optimium operation of plant items and specialist systems.
- attendance on and supervision of specialist maintenance.
- carrying out all necessary safety checks .
- carrying out system proving of the works to include the measuring, recording, evaluating and reporting on the seasonal performance of the systems against their design values.
- water sampling including laboratory analysis and monitoring of heating, chilled, domestic water systems.
- liaison with the employer.

Emergency maintenance response times shall be 4 hours.
Ensure that the maintenance recommendations set out in the appropriate standard can be achieved and are appropriate for the installations. Advise with the tender submission

No longer than 4 weeks prior to Practical Completion submit to the CA a detailed planned preventative maintenance programme for the works and a method statement outlining how the maintenance works is to be undertaken including any necessary specialist maintenance.

APPENDIX A – MEP ENGINEERING SERVICES TENDER DOCUMENT LIST

Drawing Number	Drawing Name
J7609-MXF-XX-XX-SP-J-30000	Stockland Bristol St Mary Magdalene - MEP Specification and Preliminaries
J7609-MXF-MXF-ZZ-00-DR-E-00100	Combined Electrical and ELV – All Levels
J7609-MXF-MXF-ZZ-XX-DR-E-22200	Low Voltage Distribution – Schematic
J7609-MXF-MXF-ZZ-00-DR-E-30100	Lighting – All Levels
J7609-MXF-MXF-ZZ-00-DR-M-00100	Combined Mechanical – All Levels
J7609-MXF-MXF-ZZ-XX-DR-P-20200	Piped Supply (Detail) - Schematic
J7609-MXF-XX-XX-SH-E-00000	Combined Consumer Unit, Electrical Equipment and Light Fittings Schedule
J7609-MXF-XX-XX-SH-J-30000	Combined Mechanical and Public Health Equipment Schedule

APPENDIX B - DESIGN, COMMISSIONING & HANDOVER INFORMATION RESPONSIBILITIES

Allocation of Design Responsibilities

Table B: the Contractor completes the design

The Contractor shall complete the design of the MEP Engineering Services Works or specialist elements.

TABLE B DESIGN & DRAWING PRODUCTION ACTIVITIES

	Design Activity	Responsibility			Comments
		MFLLP	Cont'r	Other	
B1	Verify and develop the Consultant's design detailed within the tender documents, to a form agreed with the EA.		✓		
B2	Prepare proposals for the installations for the agreement of the EA. Investigate the options available and describe the performance that can be achieved.		✓		
B3	Design and detail the installations as part of the overall co-coordinated building design allowing for every stage of the design to be brought to a successful conclusion by the process of repeated refinement until it is clear that the Installation and Coordination Drawings can be completed.		✓		
B4	Provide copies of calculations if requested by the EA.		✓		
B5	Provide copies of any risk assessments undertaken in compliance with the requirements of Regulation 13 of the Construction (Design and Management) Regulations 1994.		✓		
B6	If appropriate, negotiate and agree all details with regulatory bodies as necessary.		✓		Where the Contractor's proposals modify or add to the Consultant's tender information.
B7	If appropriate, negotiate and agree all details with the Statutory Authorities as necessary.		✓		Where the Contractor's proposals modify or add to the Consultant's tender information.
B8	If appropriate, meet with Building Control and provide the EA with written confirmation of the various stages including detailed Building Control Approval for the installations proposed, prior to construction.		✓		Where the Contractor's proposals modify or add to the Consultant's tender information.
B9	Modify the design and/or an installation, should the installation not meet the specification and/or agreed proposals, Statutory requirements, etc.		✓		
B10	Production of Drawings				See Preliminaries for definitions and BRSIA BG6/2014 for example drawings.
	Sketch Drawings	✓			Provided by the Consultant to indicate the design intent for the purposes of tender and production of Contractor's Proposals
	Schematic Drawings	✓	✓		
	Detailed Design Drawings	✓	✓		
	Coordinated Working Drawings		✓		Services co-ordination is to be managed by the Mechanical Contractor
	Installation Drawings		✓		Co-ordination of the Installation Drawings is to be managed by the Mechanical Contractor
	Installation Wiring Diagrams		✓		
	Manufacturer's Drawings		✓		
	Manufacturer's Certified Drawings		✓		

TABLE B DESIGN & DRAWING PRODUCTION ACTIVITIES

	Design Activity	Responsibility			Comments
		MFLLP	Cont'r	Other	
	As-installed Drawings		✓		To be marked up on site as the work proceeds.
	Record Drawings				
	Builders Work Drawings		✓		Co-ordination of the Builders Work Drawings is to be managed by the Mechanical Contractor
	Specialist Drawings		✓		
B11	Spatial Co-ordination (i.e. overall responsibility for resolving difficult spatial clashes).		✓		Process to be managed by the Mechanical Contractor
B12	Confirmation of plant or system sizing.		✓		
B13	On-site Co-ordination.		✓		Process to be managed by the Mechanical Contractor
B14	System Compatibility. Confirm the compatibility of plant/equipment specified for use within the same system or where an interface is required between systems.		✓		

For the avoidance of doubt, Tables A and C are not used

TABLE D SPECIFYING SYSTEM COMMISSIONING ACTIVITIES

Design Activity		Responsibility			Comments
		MFLLP	Cont'r	Other	
Design					
D1	Ensure that the selected systems will meet the employer's brief and that their commissioning requirements are compatible with any project restraint concerning sectional handover/phasing.	✓	✓		The Contractor is responsible for those services, systems or work elements design by them and/or specialist sub-Contractors appointed by them.
D2	Identify and incorporate into system designs the essential components and features necessary to enable the proper preparation and commissioning of building services.	✓	✓		Note as D1.
D3	Review all designs to ensure that systems can be properly prepared, and are commissionable.	✓	✓		Note as D1.
D4	Prepare the commissioning specification.	✓	✓		Note as D1.
Management					
D5	a) Produce a commissioning method statement and logic diagram for integration into the building Contractor's construction and finishes programmes.		✓		
	b) Produce a "commissioning plan" as required by Part L2 of the Building Regulations.		✓		It is for the Contractor is to demonstrate to the local Building Control office that the person(s) providing this report are suitably qualified. See Preliminaries clause Error! Reference source not found..
D6	Produce a flushing, chemical cleaning and water treatment method statement, logic diagram and programme for integration into the building Contractor's construction, commissioning and finishes programmes.		✓		
D7	Attend commissioning meetings as necessary OR Arrange and chair commissioning meetings as necessary.		✓		Give notice to MFLLP of when these meetings are taking place. MFLLP will only attend meetings as and when they feel necessary.
D8	Comment on the adequacy of systems for commissioning as detailed on specialists' drawings and manufacturers' shop drawings prior to actual manufacture at works. Ensure comments are incorporated into finished products.		✓		
D9	Carry out site inspections, to ensure that the commissioning facilities are being installed. Check compliance with specified guides and standards.		✓		
D10	Monitor the on-going progress of the procurement, manufacture, installation and commissioning of all plant items.		✓		
D11	Assess the effects of any anticipated delays to the services installation and the completion of interfaces with the building works critical to the commissioning programme. Formulate strategies to overcome potential delays.		✓		
D12	Establish an agreed set of pro forma documentation relating to the commissioning and testing of plant and systems.		✓		Issue to MFLLP for comments.
D13	Approve the proposed set of instruments of the commissioning and testing works.		✓		

TABLE D SPECIFYING SYSTEM COMMISSIONING ACTIVITIES

	Design Activity	Responsibility			Comments
		MFLLP	Cont'r	Other	
D14	Ensure that the instrumentation is periodically calibrated as necessary and records retained.		✓		
D15	Witness the flushing, cleaning and treatment of systems in accordance with the specification.	✓	✓		Contractor is to be fully satisfied with the pre-commissioning cleaning before inviting MFLLP to witness.
D16	Witness pre-commissioning activities in accordance with the specification.	✓			
D17	a) Commission all systems to methods, logic and programme (see 9.4) and record results.		✓		
	b) Witness specified demonstration of system commissioning results.	✓	✓		Contractor is to be fully satisfied with the commissioning results before inviting MFLLP to witness.
D18	Witness and record the specified demonstration and testing of plant items and systems in accordance with the specification.	✓	✓		Contractor is to be fully satisfied with the commissioning results before inviting MFLLP to witness.
D19	Establish procedures to allow the demonstration of normal emergency, shutdown and standby mode operation of plant and systems.		✓	✓	"Other" = manufacturers or suppliers of plant items.
D20	Witness demonstration of same (D19) to specified requirements.	✓	✓		Contractor is to be fully satisfied with the demonstration results before inviting MFLLP to witness.
D21	Demonstrate the partial load testing of plant to the employer and designer in accordance with the specification.		✓		
D22	Witness the operation of the BMS on site to the specified requirements.	✓	✓	✓	"Other" = BMS Specialist Designer. Contractor is to be fully satisfied that the performance of the BMS meets the requirements of the contract documents before inviting MFLLP to witness.
D23	Witness the functional testing of all safety interlocks in accordance with the commissioning specification.	✓	✓		Contractor is to be fully satisfied with the commissioning results before inviting MFLLP to witness.
D24	Witness the demonstration of acoustic tests, if any, in accordance with the specification.	✓	✓		Contractor is to be fully satisfied with the commissioning results before inviting MFLLP to witness.
D25	Witness the operation of plant and systems for specified periods of time to prove plant reliability.	✓	✓		
D26	a) Produce commissioning report detailing the results of the commissioning and commenting on the performance of systems		✓		
	b) Produce a "commissioning report" as required by Part L2 of the Building Regulations for submission to the local Building Control office.		✓		It is for the Contractor is to demonstrate to the local Building Control office that the person(s) providing this report are suitably qualified. See Preliminaries clause Error! Reference source not found..
D27	Ensure that all plant settings are recorded, including appropriate reference to plant items. The records should be incorporated within the operating and maintenance manuals.		✓		

Table taken from BSRIA Technical Note TN 21/97 "Allocation of Design Responsibilities for Building Engineering Services"

TABLE E PRODUCTION OF HANDOVER INFORMATION

	Design Activity	Responsibility			Comments
		MFLLP	Cont'r	Other	
E1	Define the scope and content of operating and maintenance manuals appropriate to the size of project, the employer's operating and maintenance strategy and the technical capability of the maintenance staff.	✓			
E2	Define the requirement for record drawings appropriate to the employer's operating and maintenance strategy.	✓			
E3	Advise on the need for a specialist author for production of operating and maintenance manuals.	✓			
E4	Advise on the need for a separate survey of installed systems to facilitate production of record drawings.	✓			This survey will only be required if the Contractor has failed in their duty to fully record the installed services as the work proceeds and before it is covered up. The cost of this survey, if required, will be recovered through the Contract.
E5	Prepare a specification for operating and maintenance manuals. Specify the section headings and required technical content.	✓			See Preliminaries for details of the level of information required.
E6	Prepare a specification for record drawings. Specify content, form of delivery and the method of production of the drawings to be produced.	✓			See Preliminaries for details of the level of information required.
E7	Define what level of documentation, commissioning results and other information must be available prior to practical completion and handover. Take into account possible implications of phased handover and partial possession.	✓			In order to comply with the CDM Regulations the Contractor is to ensure that complete O&M information and Record Drawings are available to the employer prior to Practical Completion. See Preliminaries for further information.
E8	Produce operation and maintenance manuals in accordance with the specified requirements.		✓		
E9	Ensure that information needed for inclusion in the operating and maintenance manuals is obtained as the works progress. Identify individual sources of information.		✓		
E10	Establish target dates for when information must be available to the author of the operating and maintenance manuals. Advise on timescales for production of maintenance information relative to key dates i.e. installation start date, setting to work, start dates for testing and commissioning and handover dates.		✓		
E11	Monitor the programme for production of operating and maintenance manuals and adjust dates to allow for progress of the project.		✓		
E12	Receive, inspect and comment on the contents of the operating and maintenance manuals in order to confirm general compliance with the specified requirements.	✓	✓		The Contractor is to inspect and comment on the manuals where produced by others on their behalf prior to submission to MFLLP. The Contractor is to ensure that drafts of the O&M manual(s) are available for comment at least 8 weeks prior to Practical Completion.
E13	Modify and update operating details to reflect commissioning results.		✓		

TABLE E PRODUCTION OF HANDOVER INFORMATION

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TABLE E PRODUCTION OF HANDOVER INFORMATION

	Design Activity	Responsibility			Comments
		MFLLP	Cont'r	Other	
E14	Accept the completed operating and maintenance manuals on behalf of the employer.	✓			
E15	Identify key dates and intervals at which draft record drawings will be inspected.		✓		Contractor is to provide schedule of dates for the release of this information.
E16	Modify the record drawings as the works progress so that all alterations from the installation drawings are recorded as work proceeds.		✓		Contractor is to ensure that the As-installed Drawings are maintained on site and updated as the work proceeds. The As-installed Drawings are to be made available for inspection when requested by the EA.
E17	Receive, inspect and comment on the Record Drawings in order to confirm general compliance with the specified requirements.	✓	✓		The Contractor is to inspect and comment on the record drawings where produced by others on their behalf prior to submission to MFLLP.
E18	Accept the completed record drawings on behalf of the employer.	✓			
E.19	Prior to handover, make recommendations for the commencement and carrying out of operation and maintenance during and after the Defects Liability Period.		✓		When stated in the preliminaries the Contractor is to provide a priced proposal for the maintenance of the installed services during the period concurrent with the Defects Liability Period within their contract price.
E20	Provide the employer with a log-book as required by statute under Part L2 of the Building Regulations.		✓		

Table taken from BSRIA Technical Note TN 21/97 "Allocation of Design Responsibilities for Building Engineering Services"

1.0 PR_65_52_00_00 PIPELINES

PR_65_52_00_00.1010 PRE-FABRICATED PIPEWORK:
Supply pre-fabricated pipework in accordance with relevant materials and workmanship clauses.

PR_65_52_00_00.1020 FITTINGS:
For changes in direction use centreline radius/nominal bore of not less than 1.5 unless otherwise directed. For reductions and enlargements, use easy transition type with inclined angle not exceeding 30 degrees.

PR_65_52_00_00. 1030 FABRICATED FITTINGS:
Use only with approval, if manufacturer's standard fittings are not available.

PR_65_52_00_00.1040 PIPE JOINTS:
Obtain approval from the Local Water Authority or Water Research Centre for materials used in water supplies.

PR_65_52_00_00.2270A COPPER HALF HARD:
- Kitemarked.
- Material - Copper.
- Standard - BS EN 1057, R250, (Class X).
- Dimensions - BS EN 1057 table 3.
- Ends - Plain, grooved for mechanical joints.
- Finish - Uncoated.

PR_65_52_00_00.2270B CHROMIUM PLATED COPPER, HALF HARD:
- Kitemarked.
- Material - Copper.
- Standard - BS EN 1057, R250, (Class X).
- Dimensions - BS EN 1057 table 3.
- Ends - Plain
- Finish - Chromium plated.

PR_65_52_00_00.2270C POLYETHYLENE SHEATHED COPPER, HALF HARD:
- Kitemarked.
- Material - Copper.
- Standard - BS EN 1057, R250, (Class X).
- Dimensions - BS EN 1057 table 3.
- Ends - Plain
- Finish - Sheathed in profiled white polyethylene.

PR_65_52_00_00.2310A CAPILLARY FITTINGS FOR COPPER TUBING, GENERAL POTABLE RANGE:
- Material - Copper or de-zincifiable resistant copper alloy.
- Standard - BS EN 1254-1.
- Size range - 6mm to 67mm.
- Dimensions - BS EN 1254-1 table 2.
- Ends - Integral (lead-free) solder ring.
- Finish - Natural.

PR_65_52_00_00.2310B CAPILLARY FITTINGS FOR CHROME PLATED COPPER TUBING, POTABLE RANGE:
- Material - Copper or de-zincifiable resistant copper alloy.
- Standard - BS EN 1254-1.
- Size range - 6mm to 67mm.
- Dimensions - BS EN 1254-1 table 2.
- Ends - Integral (lead-free) solder ring.
- Finish - Chrome plated.

PR_65_52_00_00.2310C CAPILLARY FITTINGS FOR COPPER TUBING, HIGH DUTY RANGE:
- Material - Gunmetal (LG2 and LG4) or aluminium brass.
- Standard - BS EN 1254-1.
- Size range - 6mm to 54mm.
- Dimensions - BS EN 1254-1 table 2.
- Ends - Integral (cadmium-free) silver brazing ring.
- Finish - Natural.

PR_65_52_00_00.2310D CAPILLARY FITTINGS FOR COPPER TUBING, WEDGE FITTING RANGE:
- Material - Gunmetal and copper/DZR copper alloy.
- Standard - BS EN 1254-1.
- Size range - 76mm and 108mm.
- Dimensions - BS EN 1254-1 table 2.
- Ends - Integral (lead-free) solder ring.
- Finish - Natural.

PR_65_52_00_00.2310E CAPILLARY FITTINGS FOR COPPER TUBING, WASTE SYSTEM RANGE:
- Material - Copper or DZR copper alloy.
- Standard - BS EN 1254-1.
- Size range - 28mm to 54mm.
- Dimensions - BS EN 1254-1 table 2.
- Ends - Integral (lead-free) solder ring.
- Finish - Natural.

PR_65_52_00_00.2320A TYPE A COMPRESSION FITTINGS FOR COPPER TUBING:
- Kitemarked.
- Material – de-zincifiable resistant copper alloy
- Standard - BS EN 1254-2, type A, non-manipulative.
- Size range - 6mm to 54mm.
- Dimensions - BS EN 1254-2, table 2 and 3.
- Ends - Socket.
- Finish - Natural.

PR_65_52_00_00.2320B TYPE A COMPRESSION FITTINGS FOR CHROME PLATED COPPER TUBING:
- Kitemarked.
- Material – de-zincifiable resistant copper alloy and brass.
- Standard - BS EN 1254-2, type A, non - manipulative.
- Size range - 6mm to 54mm.
- Dimensions - BS EN 1254-2, table 2 and 3.
- Ends - Socket.
- Finish - Chrome plated.

PR_65_52_00_00.2320C TYPE B COMPRESSION FITTINGS FOR COPPER TUBING:
- Kitemarked.
- Material – de-zincifiable resistant copper alloy and brass.
- Standard - BS EN 1254-2, type B manipulative.
- Size range - 6mm to 54mm.
- Dimensions - BS EN 1254-2, tables 2 and 3.
- Ends - Socket.
- Finish - Natural.

PR_65_52_00_00.2322 CAPILLARY FITTINGS, SHORT, FOR BRAZING TO COPPER TUBING:
- Material – de-zincifiable resistant copper alloy.
- Standard - BS EN 1254-5
- Size range - BS EN 1254-5 - 67mm to 159mm.
- Dimensions - BS EN 1254-5, table 2.
- Ends - Plain.
- Finish -Natural.

PR_65_52_00_00.2325A PUSH-FIT FITTINGS FOR COPPER TUBING:
- Material - de-zincifiable resistant copper alloy and brass.
- Standard - Manufacturer's standard.
- Size range - 15mm to 54mm.
- Dimensions - to suit copper tube to BS EN 1057.
- Ends - push-fit with EPDM O ring.
- Finish - Natural.

PR_65_52_00_00.2330A COPPER TO BS EN 12449:
- Material - Copper.
- Standard - BS EN 12449, seamless, round tubes.
- Dimensions - BS EN 12449.
- Ends - Plain or screwed.
- Finish - Uncoated.

PR_65_52_00_00.2332A COPPER TO BS EN 12450:
- Material - Copper.
- Standard - BS EN 12450, seamless, round copper capillary tubes.
- Dimensions - BS EN 12450.
- Ends - Plain or screwed.
- Finish - Uncoated.

PR_65_52_00_00.2538 POLYETHYLENE FUSION FITTINGS TO BS EN 1555:
- Material - Polyethylene.
- Standard - BS EN 1555-1, BS EN 1555-3 and BS EN 1555-5.
- Dimensions - BS EN 1555-3, Section 6, to suit pipes to BS EN 1555-2.
- Marking - BS EN 1555-3, table 7.
- Ends - Sockets with heating elements for fusion jointing.
- Finish -
o Black
o Yellow.

PR_65_52_00_00.2599A PLASTICS PIPING SYSTEMS TO BS EN ISO 15876 - PIPES:
- Plastics piping systems for hot and cold water systems, including heating, within buildings.
- Material - polybutylene (PB).
- Standard - BS EN ISO 15876-5.
- Dimensions - Length - manufacturer's standard range. BS EN ISO 15876-2 - tables 2 to 6.
- Ends - Plain, sockets for fusion fittings, suitable for electrofusion fittings, mechanical fittings, or fittings with incorporated inserts.
- Finish - Natural or coloured.

PR_65_52_00_00.2600A PLASTICS PIPING SYSTEMS TO BS EN ISO 15876 - FITTINGS:
Plastics piping systems for hot and cold water systems, including heating, within buildings.
- Material - polybutylene (PB).
- Standard - BS EN ISO 15876-5.
- Size range - 16mm to 160mm.
- Dimensions - BS EN ISO 15876-3 - tables 3 to 5, and clause 6.3.
- Ends - Plain, sockets for fusion fittings, suitable for electrofusion fittings, mechanical fittings, or fittings with incorporated inserts.
- Finish - Natural or coloured.

PR_65_52_00_00.2705A PLASTICS PIPES TO BS 7291-2 AND BS 7291-3:
- Material - Polybutylene (PB) BS 7291-2; or crosslinked polyethylene (PE-X) BS 7291-3.
- Standard - BS 7291.Classification H unless otherwise indicated.
- Dimensions - BS 7291-2 (PB) or BS 7291-3 (PE-X); Table 1 (CU) or Table 2 in accordance with BS ISO 11922-1, BS ISO 4065 or to BS 2782-11: Method 1121B.
- Ends - Plain.
- Finish - Natural.

PR_65_52_00_00.2708A POLYBUTYLENE (PB) PIPE AND FITTINGS:
- Material - Polybutylene (PB).
- Dimensions - 16mm to 25mm o.d. as flexible pipe-in-sleeve coils; and 16mm to 110mm o.d. in straight lengths.
- Ends - Plain.
- Finish - Natural.

PR_65_52_00_00.3010A CIRCULAR FLANGES FOR PIPES, PN DESIGNATED - WELDED FLANGE:
- Material - BS EN 1092-1.
- Flange type - Weld neck flange or hubbed slip-on flange for welding.
- Flange facings - Raised face - type B.
- Bolting - In accordance with BS EN 1092-1.

PR_65_52_00_00.3010B CIRCULAR FLANGES FOR PIPES, PN DESIGNATED - THREADED FLANGE:
- Material to BS EN 1092-1.
- Facings - Raised face type B.
- Bolting - in accordance with BS EN 1092-1.
- Threaded flanges - BS 21 and BS EN 10226-1 parallel thread.

PR_65_52_00_00.3010C CIRCULAR FLANGES FOR PIPES, PN DESIGNATED - CAST IRON FLANGE:
- Material - BS EN 1092-2 - Ductile cast iron.
- Bolting - In accordance with BS EN 1092-2.

PR_65_52_00_00.3020A JOINTING RINGS - NON-METALLIC FLAT GASKETS:
Non-metallic flat gaskets for flanges to BS EN 1092-4.
- Standard - BS EN 1514-1
- Gasket type - Full face for type B.

PR_65_52_00_00.3020B JOINTING RINGS - METALLIC GASKETS:
Corrugated, flat or grooved metallic and filled metallic gaskets for flanges to BS EN 1092-4.
- Standard - BS EN 1514-4
- Gasket type - Corrugated metal.
- Gasket design - Self centring for type B.

PR_65_52_00_00.3060A BRAZED JOINTS:
Use filler metals to BS EN 1044.

PR_65_52_00_00.3060B ZINC FREE BRAZED JOINTS:
Use nickel bearing zinc free grades of filler metals to BS EN 1044.

PR_65_52_00_00.3070A CAPILLARY JOINTS FOR COPPER:
Use materials as follows:
- Solder - BS EN ISO 9453.
- Flux - Copper pipe - BS EN 29454-1.

PR_65_52_00_00.3070B CAPILLARY JOINTS FOR POTABLE WATER:
Use materials as follows:
- Solder - Use lead-free fittings in accordance with BS EN 1254-1, on potable water systems.
- Flux - Copper pipe - BS EN 29454-1.

PR_65_52_00_00.3097C JOINTING EQUIPMENT FOR POLYBUTYLENE (PB) PIPES - ELECTROFUSION:
Provide the equipment recommended by the manufacturer to carry out electrofusion jointing on polybutylene pipes and fittings.

PR_65_52_00_00.3190A WALL, FLOOR AND CEILING CHROMIUM PLATED MASKING PLATES:
- Material - Copper alloy, chromium plated.
- Type - Heavy, split on the diameter, close fitting to outside of pipe.
- Fixing - Chrome raised head fixing screws.

PR_65_52_00_00.3190B WALL, FLOOR AND CEILING PLASTIC MASKING PLATES:
- Material - Plastic.
- Fixing - Clipped with plastic lug.

PR_65_52_00_00.3200A PIPE RINGS AND CLIPS, STEEL PIPEWORK:
Use suitable pipe, hangers, slider and roller type supports, taking into account the pipe load, material and pipe/insulation surface temperature.

PR_65_52_00_00.4010 APPEARANCE:
Arrange all exposed pipe runs to present neat appearance, parallel with other pipe or service runs and building structure, subject to gradients for draining or venting.
Ensure all vertical pipes are plumb or follow building line.

PR_65_52_00_00.4020 SPACING:
Space pipe runs in relation to one another, other services runs and building structure, allow for specified thickness of thermal insulation and ensure adequate space for access to pipe joints, etc.
The following are recommended as minimum clearances in spacing of pipe runs:-

Between	and	Clearance (mm)
Pipeline insulated or uninsulated	Wall Finish	25
	Ceiling Finish	50
	Soffit Floor Finish	150
Insulated Pipeline	Adjacent service runs	25
Uninsulated pipeline	Adjacent service runs	50
Adjacent pipelines	Both uninsulated	150
	One uninsulated	75
	Both insulated	25

PR_65_52_00_00.4030 GRADIENTS:
Install pipework with gradients to allow drainage and/or air release, and to the slopes where indicated.

PR_65_52_00_00.4040B AUTOMATIC AIR VENTS:
Provide a means of venting the pipe system at all high points.
Provide an automatic air vent valve with a copper outlet pipe from the valve to a tundish in an adjacent drain line or to another suitable location.

PR_65_52_00_00.4050 DRAIN REQUIREMENTS:
Grade pipework to allow system to be drained. Provide a means of draining the system at all low points.

PR_65_52_00_00.4060 EXPANSION AND CONTRACTION:
Arrange supports and fixings to accommodate pipe movement caused by the thermal changes; generally allow the flexure at changes in direction. Allow for movement at branch connections.

PR_65_52_00_00.4070A PIPE FITTINGS, BENDS/SWEPT TEES:
Use eccentric type reductions and enlargements on horizontal pipe runs to allow draining and venting, concentric on vertical pipes, with easy transition and an included angle not exceeding 30 degree. Do not use bushes, except at radiators and at fittings where required size is not of standard manufacture. Where required, use eccentric bushes to allow draining or venting; maximum aspect ratio not to exceed two pipe sizes; above this ratio use reducing fittings. Use square tees at venting and draining points. Square elbows are not acceptable. Use bends and swept tees where practical.

PR_65_52_00_00.4070B PIPE FITTINGS, ELBOWS/SQUARE TEES:
Use eccentric type reductions and enlargements on horizontal pipe runs to allow draining and venting, concentric on vertical pipes, with easy transition and an included angle not exceeding 30 degree. Do not use bushes, except at radiators and at fittings where required size is not of standard manufacture. Where required, use eccentric bushes to allow draining or venting; maximum aspect ratio not to exceed two pipe sizes; above this ratio use reducing fittings. Use square tees at venting and draining points. Square elbows are not acceptable. Use elbows and square tees.

PR_65_52_00_00.4110 PIPES THROUGH WALLS AND FLOORS:
Where no other form of a seal is installed, such as fire batt or fire wrap, enclose pipes passing through building elements, (walls, floors, partitions, etc.) concentrically within purpose made sleeves. Fit masking plates where visible pipes pass through building elements, including false ceilings of occupied rooms. Masking plates are only suitable for small-bore pipework such as final connection to radiators etc. Install the pipework insulation continuously through non-fire rated walls and then sleeved around and mastic/mortar around sleeve to wall. Where pipework is fire stopped with batt then the batt should be TIGHT around pipework, and the broken pipe insulation should then be tight against the Batt.

PR_65_52_00_00.4120A PIPE SLEEVES:
Where pipe insulation is not carried through pipe sleeve, cut sleeves from material same as pipe one or two sizes larger than pipe to allow clearance. Do not use sleeves as pipe supports.
Install sleeves flush with building finish. In areas where floors are washed down install with a 100mm protrusion above floor finish.

PR_65_52_00_00.4120B PIPE SLEEVES WITH INSULATION CARRIED THROUGH:
Where pipe insulation is carried through pipe sleeve, cut sleeves from material same as pipe one or two sizes larger than pipe and insulation to allow clearance. Do not use sleeves as pipe supports.
Install sleeves flush with building finish. In areas where floors are washed down install with a 100mm protrusion above floor finish.

PR_65_52_00_00.4125 PIPE SLEEVES THROUGH FIRE BARRIERS:
Pack annular space between pipe and sleeve or insulation and sleeve with non-flammable and fire resistant material to form a fire/smoke stop of required rating. Apply 12mm deep cold mastic seal at both ends within sleeve.

PR_65_52_00_00.4130 CONNECTIONS TO EQUIPMENT:
Make final connections to equipment in accordance with manufacturer's instructions and as indicated.

PR_65_52_00_00.4140 DISTRIBUTION HEADERS:
Terminate ends with a cap, a blank flange, a grooved blank end or as indicated.

PR_65_52_00_00.4150A TEMPORARY PLUGS, CAPS AND FLANGES:
Seal all open ends as installation proceeds by plugs, caps or blank flanges, to prevent ingress of foreign matter.
Use plugs of metal, plastic or wood to suit pipework material.
In the event of such precautions not being taken, strip out pipework adjacent to open ends to demonstrate that fouling of bores has not occurred.

PR_65_52_00_00.4160 FLANGED JOINTS GENERAL:
Use number and diameters of bolts to standard. Fit bolts of length to give not less than one thread, or more than 3mm protrusion beyond nut when joint is pulled up.
Fit washers under each nut.

PR_65_52_00_00.4170 DISSIMILAR METALS:
Take appropriate means to prevent galvanic action where dissimilar metals are connected together.

PR_65_52_00_00.4180 PIPE RINGS AND CLIPS:
Select type according to the application and material compatibility; give particular attention where pipes are subject to axial movement due to expansion or contraction.

PR_65_52_00_00.4190 ANCHORS:
Construct to resist axial stress transmitted by flexure of horizontal and vertical pipe runs or loading on vertical pipes assuming that unbalanced forces exist at all anchor points, even when these are situated in intermediate positions between two expansion loops or bellows. Use similar or compatible materials to the attached pipe.
Provide and fix all associated backing plates, nuts, washers and bolts for attachment to or into building structure; ensure structure is suitable for transmitted stress. Set out and line up anchors accurately in position. Inspect final grouting into building structure.

PR_65_52_00_00.4200 SLIDE GUIDES:
Direct movement of expansion and contraction from pipe anchor points towards loops, bellows or flexible inserts. Ensure that thrust is linear relative to the axis of pipe.
Apply a friction reducing material between metal faces subjected to movement.

PR_65_52_00_00.4205 PIPE SUPPORTS:
Arrange supports and accessories for equipment, appliances or ancillary fitments in pipe runs, so that no undue strain is imposed upon pipes.
Ensure that materials used for supports are compatible with pipeline materials.

PR_65_52_00_00.4220 SUPPORT SPACING:
Provide pipe supports at spaces required by the manufacturer and such that the pipework is secure and does not result in movement caused by water hammer.
Vertical support spacing
Check total self-weight and pressure loading against manufacturer's recommendations when using mechanical joints or end load capable flexible couplings. Ensure adequate pipe support when using non-end load capable flexible couplings.
Space vertical supports for plastics pipe at not greater than twice horizontal intervals tabulated.
Where multiple pipe runs of differing bores are supported from a common point, use support spacing of pipe requiring closest spacing.
Spacings for PVC-U pipe; refer to BS EN 1452.

PR_65_52_00_00.4230A ISOLATION AND REGULATION:
Provide valves, cocks and stop taps for isolation and/or regulation where indicated, and on:-
- Mains to isolate major sections of distribution;
- The base of all risers and drops except in cases where one item of apparatus only is served which has its own local valve or stop tap;
- Points of pipe connection of all items of apparatus and equipment except where the item could conveniently be isolated or regulated by valves provided for other adjacent items;
- Draw-off fittings except where ranges of fittings are served by a common float, the isolator then being fitted with the float.

PR_65_52_00_00.4240 MAINTENANCE AND RENEWAL:
Arrange pipework, valves, drains, air vents, demountable joints, supports, etc., for convenient routine maintenance and renewals. Provide all runs with a regularly spaced pattern of demountable joints in the form of unions, flanges, etc., and also at items of equipment to facilitate disconnection.
Locate valves, drains, flanges etc. in groups.

PR_65_52_00_00.4250 CLEANING:
Remove cement and clean off all pipework and brackets.

PR_65_52_00_00.4260 NON-FERROUS COMPONENTS:
Thoroughly clean and degrease.

PR_65_52_00_00.6030 COMPRESSION JOINTS, COPPER PIPES, LIGHT GAUGE:
Preparation for fittings to BS EN 1254-2.
Type `A' fitting - Ensure that plain ends are cut square. Reamer out bore at plain ends to full bore size. Clean plain ends with fine steel wool or fine sandpaper.
Type `B' fitting - Ensure that plain ends are cut square. Reamer out bore at plain ends to full bore size. Clean plain ends with fine steel wool or fine sandpaper. Then comply with manufacturer's instructions.
Making and Sealing - As manufacturer's instructions.

PR_65_52_00_00.6040 CAPILLARY JOINTS, COPPER PIPES, LIGHT GAUGE:
Preparation - Ensure that plain ends are cut square. Reamer out bore at plain ends to full bore size. Clean plain ends with fine steel wool.
Making and sealing - Use specified flux ensuring no excess material used. Make joint in accordance with manufacturer's instructions. Clean off traces of flux when joint is completed.

PR_65_52_00_00.6060A ANCHORS, COPPER PIPES, SADDLE CLAMPS:
Provide anchors constructed by fitting two flanges to copper female adapters in pipe run at anchor point. Bolt together through an interposed mild steel channel section attached to or grouted into building structure.

PR_65_52_00_00.6060B ANCHORS, COPPER PIPES, SADDLE CLAMPS:
Anchor pipework using saddle clamps to mild steel channel section attached to or built into building structure.
PR_65_52_00_00.7010 FLANGED JOINTS, CAST IRON/DUCTILE IRON PIPES:
Preparation - Ensure that flange mating faces are parallel, flange peripheries are flush with each other and bolt holes are correctly aligned.
Making and Sealing - Coat both sides of joint ring with jointing compound to BS 6956-5 or BS EN 751-2. Insert joint ring between flange mating faces. Pull up joint with bolts, nuts and washers, ensuring that excess compound does not intrude into the pipe. Leave joint clean.

PR_65_52_00_00.8020 FUSION JOINTS, POLYETHYLENE PIPES:
Preparation - Square cut plain ends. Form pipe ends for socket type joints.
Making and Sealing - In accordance with fitting manufacturer's instructions.

PR_65_52_00_00.8030 MECHANICAL FITTINGS FOR POLYETHYLENE PIPE:
Preparation - Ensure that cut ends are square. Check wall thickness/pressure rating of fitting.
Making and sealing - Ensure correct gasket type is used for service (e.g. water or gas). Assemble fitting in accordance with manufacturer's instructions.

PR_65_52_00_00.9030 PROTECTION OF UNDERGROUND PIPEWORK:
Protect where indicated against corrosion by the application of a compatible anti-corrosive, non-cracking, non-hardening waterproof sealing tape.
Apply, after cleaning pipework, by wrapping contra wise with two layers spirally around the pipe, ensuring a 50% minimum overlap.

PR_65_52_00_00.9040A PROTECTION OF BURIED PIPES, UNMARKED:
Provide earth cover as follows:
- Water pipework - 900 mm minimum; 1200 mm maximum where practicable.
- Fuel oil and gas - 500 mm minimum.
- Under roadways provide minimum cover of 900 mm.

PR_65_52_00_00.9040B PROTECTION OF BURIED PIPES, MARKED:
Provide earth cover as follows:
- Water pipework - 900 mm minimum; 1200 mm maximum where practicable.
- Fuel oil and gas - 500 mm minimum.
- Under roadways provide minimum cover of 900 mm.

Provide a marker tape to identify buried pipe services.

2.0 PR_20_85_00_00 PIPELINE ANCILLARIES
PR_20_85_00_00.1010 SAFETY AND RELIEF VALVES, SELF OPERATED, APPLICATION:
Safety - To discharge with rapid opening action to prevent pre-determined safe pressure being exceeded.
Relief - To discharge with opening action proportional to increase in pressure above set pressure.

PR_20_85_00_00.1020 EXPOSED VALVES:
Fit easy-clean covers over glands and bonnets to small copper alloy valves exposed in areas other than plant rooms. Fit thermoplastic valve wheels. Fit dust caps to lockshield valves.

PR_20_85_00_00.1030 TESTING:
Ensure that valves and cocks are pressure tested at manufacturer's works, in accordance with appropriate British Standards specification. Test valves in accordance with BS EN 12266-1 and BS EN 12266-2.

PR_20_85_00_00.2015A STOP VALVES TO BS EN 1213 FOR POTABLE WATER SUPPLIES - COMPRESSION ENDS FOR COPPER:
- Pattern - Straight.
- Material - copper alloy.
- Flow rate class - VA (straight and angle pattern stopvalves).
- End connections - Compression to BS EN 1254-2.

PR_20_85_00_00.2015C STOP VALVES TO BS EN 1213 FOR POTABLE WATER SUPPLIES - CAPILLARY:
- Pattern - Straight.
- Material - copper alloy.
- Flow rate class VA (straight and angle pattern stop valves).
- End connections - Capillary to BS EN 1254-1.

PR_20_85_00_00.2080A THREADED END BALL TYPE VALVES - SCREW DRIVER/KEY OPERATED:
- Materials - Bronze or DZR copper alloy body.
- Ends - Threaded to BS 21 and BS EN 10226-1.
- Chrome or nickel plated DZR sphere with full bore flow aperture. PTFE seats and stem seals. Anti-blowout stem.
- Operation - Screw driver operated or key operated.

PR_20_85_00_00.2080B COMPRESSION END BALL TYPE VALVES - SCREW DRIVER/KEY OPERATED:
- Materials - Bronze or DZR copper alloy body.
- Ends - Compression fittings to BS EN 1254-2.
- Chrome or nickel plated DZR sphere with full bore flow aperture. PTFE seats and stem seals. Anti-blowout stem.
- Operation - Screw driver operated or key operated.

PR_20_85_00_00.2080C THREADED END BALL TYPE VALVES - LEVER OPERATED:
- Materials - Bronze or DZR copper alloy body.
- Ends - Threaded to BS 21 and BS EN 10226-1.
- Chrome or nickel plated DZR sphere with full bore flow aperture. PTFE seats and stem seals. Anti-blowout stem.
- Operation - lever operated.

PR_20_85_00_00.2080D COMPRESSION END BALL TYPE VALVES - LEVER OPERATED:
- Materials - Bronze or DZR copper alloy body.
- Ends - Compression fittings to BS EN 1254-2.
- Chrome or nickel plated DZR sphere with full bore flow aperture. PTFE seats and stem seals. Anti-blowout stem.
- Operation - lever operated.

PR_20_85_00_00.2080E THREADED END BALL TYPE VALVES - LOCKSHIELD:
- Materials - Bronze or DZR copper alloy body.
- Ends - Threaded to BS 21 and BS EN 10226-1.
- Chrome or nickel plated DZR sphere with full bore flow aperture. PTFE seats and stem seals. Anti-blowout stem.
- Operation - lockshield.

PR_20_85_00_00.2080F COMPRESSION BALL TYPE VALVES - LOCKSHIELD:
- Materials - Bronze or DZR copper alloy body.
- Ends - Compression fittings to BS EN 1254-2.
- Chrome or nickel plated DZR sphere with full bore flow aperture. PTFE seats and stem seals. Anti-blowout stem.
- Operation - lockshield.

PR_20_85_00_00.2090A LEVER OPERATED BUTTERFLY VALVES TO BS EN 593 BETWEEN FLANGES:
- Construction - Provide controlled elastomer compression on flange faces; semi-lugged wafer type design, for installation between flanged pipework connections, body to suit BS EN 1092-2.
- Provide lever and gear operated valves with long body neck for lagging clearance.
- Seat - Bonded.
- Materials - Cast iron body; stainless steel shaft; aluminium bronze disc; EPDM seat.
- Operation - Lever and graduated notch plate.

PR_20_85_00_00.2090B GEAR OPERATED BUTTERFLY VALVES TO BS EN 593 BETWEEN FLANGES:
- Construction - Provide controlled elastomer compression on flange faces; semi-lugged wafer type design, for installation between flanged pipework connections, body to suit BS EN 1092-2.
- Provide lever and gear operated valves with long body neck for lagging clearance.
- Seat - Bonded.
- Materials - Cast iron body; stainless steel shaft; aluminium bronze disc; EPDM seat.
- Operation - gear operated.

PR_20_85_00_00.2090C LEVER OPERATED BUTTERFLY VALVES BETWEEN MECHANICAL JOINTS:
- Construction - Wafer type design, for installation between mechanical joints, body with grooved ends.
- Provide lever operated valves with long body neck for lagging clearance.
- Seat - Bonded.
- Materials - Ductile iron body; stainless steel shaft; electroless nickel coated ductile iron disc; EPDM seat.
- Operation - Lever and graduated notch plate.

PR_20_85_00_00.2090D GEAR OPERATED BUTTERFLY VALVES BETWEEN MECHANICAL JOINTS:
- Construction - Wafer type design, for installation between mechanical joints, body with grooved ends.
- Provide gear operated valves with long body neck for lagging clearance.
- Seat - Bonded.
- Materials - Ductile iron body; stainless steel shaft; electroless nickel coated ductile iron disc; EPDM seat.
- Operation - gear operated.

PR_20_85_00_00.2210A LEVER OPERATED REGULATING BUTTERFLY VALVES TO BS EN 593 BETWEEN FLANGES:
- Construction - Provide controlled elastomer compression on flange faces; semi-lugged wafer type design, for installation between flanged pipework connections, body to suit BS EN 1092-2.
- Provide lever and gear operated valves with long body neck for lagging clearance.
- Seat - Bonded seat.
- Materials - Cast iron body; stainless steel shaft; aluminium bronze disc; EPDM seat.
- Operation - Infinitely variable setting with travel stops and indicator, lever operation.

PR_20_85_00_00.2210B GEAR OPERATED REGULATING BUTTERFLY VALVES TO BS EN 593 BETWEEN FLANGES:
- Construction - Provide controlled elastomer compression on flange faces; semi-lugged wafer type design, for installation between flanged pipework connections, body to suit BS EN 1092-2.
- Provide lever and gear operated valves with long body neck for lagging clearance.
- Seat - Bonded seat.
- Materials - Cast iron body; stainless steel shaft; aluminium bronze disc; EPDM seat.
- Operation - Infinitely variable setting with travel stops and indicator, gear operation.

PR_20_85_00_00.2210C LEVER OPERATED REGULATING BUTTERFLY VALVES TO BS EN 593 BETWEEN MECHANICAL JOINTS:
- Construction - Installation between mechanical joints with grooved ends.
- Provide lever operated valves with long body neck for lagging clearance.
- Seat - Bonded seat.
- Materials - Ductile iron body; stainless steel shaft; rubber coated ductile iron disc; EPDM seat.
- Operation - Infinitely variable setting with travel stops and indicator, lever operation.

PR_20_85_00_00.2210D GEAR OPERATED REGULATING BUTTERFLY VALVES TO BS EN 593 BETWEEN MECHANICAL JOINTS:
- Construction - Installation between mechanical joints with grooved ends.
- Provide gear operated valves with long body neck for lagging clearance.
- Seat - Bonded seat.
- Materials - Ductile iron body; stainless steel shaft; rubber coated ductile iron disc; EPDM seat.
- Operation - Infinitely variable setting with travel stops and indicator, gear operation.

PR_20_85_00_00.2220A THREADED END DOUBLE REGULATING VALVES TO BS 7350, COPPER ALLOY:
- BS 7350, section 3.1.
- Ends - Threaded to BS 21 and BS EN 10226-1.
- Material - Bronze or DZR copper alloy to BS 5154.
- Series B; oblique or Y pattern; inside screw non-rising stem; manufacturer's standard trim material.
- Options - Provide drain plug facility; independent means for positive isolation on pressure tapping or adapter; and test and manufacturer's certificates.

PR_20_85_00_00.2220B FLANGED DOUBLE REGULATING VALVES TO BS 7350, COPPER ALLOY:
- BS 7350, section 3.1.
- Ends - Flanged to BS EN 1092-2.
- Material - Bronze or DZR copper alloy to BS 5154.
- Series B; oblique or Y pattern; inside screw non-rising stem; manufacturer's standard trim material.
- Options - Provide drain plug facility; independent means for positive isolation on pressure tapping or adapter; and test and manufacturer's certificates.

PR_20_85_00_00.2220C FLANGED DOUBLE REGULATING VALVES TO BS 7350, CAST IRON:
- BS 7350, section 3.1.
- Ends - Flanged to BS EN 1092-2.
- Material - Cast iron to BS EN 13789.
- Oblique or Y pattern; copper alloy, nickel alloy or resilient valve face; rising stem outside screw or non-rising stem inside screw; manufacturer's standard materials.
- Options - Provide drain plug facility; independent means for positive isolation on pressure tapping or adapter; and test and manufacturer's certificates.

PR_20_85_00_00.2230A THREADED ENDS FLOW MEASUREMENT DEVICES TO BS 7350, COPPER ALLOY:
- BS 7350, section 3.2 - type 3
- A fixed orifice either integral with or as a fixed orifice fitting close coupled to a double regulating globe valve.
- Ends - Threaded to BS 21 and BS EN 10226-1.
- Material - Double regulating globe valve, bronze or DZR copper alloy to BS 7350 table 6.
- Options - Independent means for positive isolation on pressure tapping or adapter.

PR_20_85_00_00.2230B FLANGED ENDS FLOW MEASUREMENT DEVICES TO BS 7350 TYPE 3, COPPER ALLOY:
- BS 7350, section 3.2 - type 3
- A fixed orifice either integral with or as a fixed orifice fitting close coupled to a double regulating globe valve.
- Ends - Flanged to BS EN 1092-3.
- Material - Double regulating globe valve, bronze or DZR copper alloy to BS 7350 table 6.
- Options - Independent means for positive isolation on pressure tapping or adapter.

PR_20_85_00_00.2230C FLANGED FLOW MEASUREMENT DEVICE TO BS 7350 CAST IRON, TYPE 3:
- BS 7350, section 3.2 - type 3
- A fixed orifice either integral with or as a fixed orifice fitting close coupled to a double regulating globe valve.
- Ends - Flanged to BS EN 1092-2.
- Material - Double regulating globe valve to BS EN 13789 and close coupled fixed orifice fitting to BS 7350, table 6.
- Options - Independent means for positive isolation on pressure tapping or adapter.

PR_20_85_00_00.2230E THREADED ENDS FLOW MEASUREMENT DEVICES TO BS 7350 TYPE 4, COPPER ALLOY:
- BS 7350, section 3.2 - type 4, variable orifice valve.
- Ends - Threaded to BS 21 and BS EN 10226-1.
- Material - Variable orifice, double regulating globe valve, bronze or DZR copper alloy to BS 5154 series B.
- Options - Independent means for positive isolation on pressure tapping or adapter.

PR_20_85_00_00.2230F FLANGED FLOW MEASUREMENT DEVICES TO BS 7350 TYPE 4, COPPER ALLOY:
- BS 7350, section 3.2 - type 4, variable orifice valve.
- Ends - Flanged to BS EN 1092-3.
- Material - Variable orifice, double regulating globe valve, bronze or DZR copper alloy to BS 5154 series B.
- Options - Independent means for positive isolation on pressure tapping or adapter.

11.2230G FLOW MEASUREMENT DEVICES TO BS 7350 TYPE 4, CAST IRON:
- BS 7350, section 3.2 - type 4, variable orifice valve.
- Ends - Flanged to BS EN 1092-2.
- Material - Variable orifice, double regulating globe valve, cast iron to BS EN 13789.
- Options - Independent means for positive isolation on pressure tapping or adapter.

PR_20_85_00_00.2315A OPEN/CLOSE CONTROL BALL VALVES:
- Valve - Open/Close valve.
- Rotary Actuator - Open/close.
- Material - Nickel-plated brass; stainless steel ball; PTFE seal; stainless steel spindle; EPDM spindle seal.
- Connections - Threaded to BS 21 and BS EN 10226-1.
- Ancillaries - Lever for manual operation.

PR_20_85_00_00.2315B TWO WAY CONTROL BALL VALVES:
- Valve - Two way control valve.
- Rotary Actuator - Modulating.
- Material - Nickel-plated brass; stainless steel ball; PTFE seal; stainless steel spindle; EPDM spindle seal.
- Connections - Threaded to BS 21 and BS EN 10226-1.
- Ancillaries - Lever for manual operation.

PR_20_85_00_00.2315C THREE WAY CONTROL BALL VALVES:
- Valve - Three way control valve.
- Rotary Actuator - Modulating.
- Material - Nickel-plated brass; stainless steel ball; PTFE seal; stainless steel spindle; EPDM spindle seal.
- Connections - Threaded to BS 21 and BS EN 10226-1.
- Ancillaries - Lever for manual operation.

PR_20_85_00_00.2320A THREADED ENDS SWING CHECK VALVES TO BS 5154:
- Series B; horizontal pattern.
- Ends - Threaded to BS 21 and BS EN 10226-1.
- Trim material - Manufacturer's standard.

PR_20_85_00_00.2320B FLANGED SWING CHECK VALVES TO BS 5154:
- Series B; horizontal pattern.
- Ends - Flanged to BS EN 1092-3.
- Trim material - Manufacturer's standard.

PR_20_85_00_00.2330A FLANGED SWING CHECK VALVES TO BS EN 12334
- Check valve type to BS EN 736-1 - Swing.
- Body type - Flanged.
- Ends - Flanged to BS EN 1092-2.
- Body and cover materials - Grey cast iron or SG cast iron.
- Orientation of pipework - Horizontal or vertical.

PR_20_85_00_00.2330B WAFER BODY SWING CHECK VALVES TO BS EN 12334:
- Check valve type to BS EN 736-1 - Swing.
- Body type - Wafer.
- Body and cover materials - Grey cast iron or SG cast iron.
- Orientation of pipework - Horizontal or vertical.

PR_20_85_00_00.2330C FLANGED LIFT CHECK VALVES TO BS EN 12334:
- Check valve type to BS EN 736-1 - Lift.
- Body type - Flanged.
- Ends - Flanged to BS EN 1092-2.
- Body and cover materials - Grey cast iron or SG cast iron.
- Orientation of pipework - Horizontal or vertical.

PR_20_85_00_00.2330D WAFER BODY LIFT CHECK VALVES TO BS EN 12334:
- Check valve type to BS EN 736-1 - Lift.
- Body type - Wafer.
- Body and cover materials - Grey cast iron or SG cast iron.
- Orientation of pipework - Horizontal or vertical.

PR_20_85_00_00.2340A FLANGED SWING CHECK VALVES TO BS EN 12334:
- Wafer pattern design suitable for installation between flanged pipework, body to suit BS EN 1092-2.
- Disc - Double disc.
- Type - Light spring type.
- Seat - Bonded.
- Materials - Cast iron body; bronze disc; EPDM seat.

PR_20_85_00_00.2430A SAFETY VALVES TO BS EN ISO 4126-1, COPPER ALLOY, SINGLE SPRING:
- Material - Bronze or DZR copper alloy body.
- Ends - Threaded to BS 21 and BS EN 10226-1.
- Spring type - Single spring loaded, high lift type.

PR_20_85_00_00.2430B SAFETY VALVES TO BS EN ISO 4126-1, COPPER ALLOY, DOUBLE SPRING:
- Material - Bronze or DZR copper alloy body.
- Ends - Threaded to BS 21 and BS EN 10226-1.
- Spring type - Double spring loaded, high lift type.

PR_20_85_00_00.2430C SAFETY VALVES TO BS EN ISO 4126-1, CAST IRON, SINGLE SPRING:
- Material - Cast iron body.
- Ends - Flanged to BS EN 1092-2.
- Spring type - Single spring loaded, high lift type.

PR_20_85_00_00.2430D SAFETY VALVES TO BS EN ISO 4126-1, CAST IRON, DOUBLE SPRING:
- Material - Cast iron body.
- Ends - Flanged to BS EN 1092-2.
- Spring type - Double spring loaded, high lift type.

PR_20_85_00_00.2440A DRAIN COCKS, THROUGHWAY GLAND COCK:
- Bronze body threaded male to BS 21 and BS EN 10226-1.
- Tapered plug with square shank for loose lever; bolted gland; strap and blank cap screwed on hand tight.
- Outlet to accept hose union.

PR_20_85_00_00.2450 DRAIN COCKS - SCREWDOWN TO BS 2879, TYPE 1:
- Bronze body threaded male to BS 21 and BS EN 10226-1.
- Screw down plug with square shank for loose lever.
- Serrated outlet to accept hosepipe, fixed or union pattern. Lockshield to accept key.

PR_20_85_00_00.2460 DRAIN COCKS - BALL TYPE:
- Bronze or DZR copper alloy body; chrome-plated DZR ball; PTFE seats and stem seals; blow-out proof stem; strap and blank cap screwed on hand tight; serrated outlet to accept hose pipe. Lockshield key operated.

PR_20_85_00_00.2470 VENT COCKS - TWO WAY GLAND COCK TYPE:
- Bronze body threaded to BS 21 and BS EN 10226-1; tapered plug with square shank for loose lever; plug position indicator; bolted gland.

PR_20_85_00_00.2480 VENT COCKS - BALL TYPE:
- Bronze or DZR copper alloy body; chrome-plated DZR ball; PTFE seats and stem seals; blow-out proof stem.
- Permanently identified ports in T-configuration.
- Lever operated.

PR_20_85_00_00.2490 VENT COCKS - THREE WAY GLAND COCK TYPE:
- Bronze body threaded to BS 21 and BS EN 10226-1; tapered plug with square shank for loose lever; plug position indicator; port markings to indicate inlet,vent, waste; bolted gland.
- Port configuration, T port.

PR_20_85_00_00.2500A THREE WAY PLUG VALVE VENT COCKS - WRENCH OPERATED:
- Cast iron body, plug and bottom cover. PTFE thrust washer.
- Ends - Flanged to BS EN 1092-2.
- T port configuration. Wrench operation.

PR_20_85_00_00.2500B THREE WAY PLUG VALVE VENT COCKS - GEAR OPERATED:
- Cast iron body, plug and bottom cover. PTFE thrust washer.
- Ends - Flanged to BS EN 1092-2.
- T port configuration. Gear operation.

PR_20_85_00_00.2510A AUTOMATIC AIR VENTS, FLOAT TYPE:
- Construction - Bronze or DZR copper alloy body with threaded inlet to BS 21 and BS EN 10226-1. Solid polypropylene float and air release valve. Ensure valve is self-closing.
- Operating Conditions - Maximum temperature 130oC. Maximum pressure 10 bar.
- Options - Provide connection for piping away released air and integral non-return valve where indicated.

PR_20_85_00_00.2520A LTHW PRESSURE DIFFERENTIAL DEAERATORS:
- Unit - Provide a self-circulating unit connected to the system by two 15mm connections at least 500mm apart.
- Isolation - Provide valves to isolate the vessel from the main system.
- Operating conditions - Maximum temperature 110oC, maximum pressure 10 bar.

PR_20_85_00_00.2520B CHILLED WATER PRESSURE DIFFERENTIAL DEAERATORS:
- Unit - Provide a self-circulating unit connected to the system by two 15mm connections at least 500mm apart. Insulate to prevent condensation.
- Isolation - Provide valves to isolate the vessel from the main system.
- Operating conditions - Maximum temperature 110oC, maximum pressure 10 bar.

PR_20_85_00_00.2522A GRAVITATION DIRT SEPARATORS:
- Construction - Vertical mild steel housing with internal reservoir, sludge pipe, perforation plate and automatic air release mechanism.
- Ends - Line size with flanges to BS EN 1092-1, PN 16.
- Operating conditions - Maximum temperature 110oC, maximum pressure 10 bar.

PR_20_85_00_00.2620 EXPANSION LOOPS - COPPER:
- Provide expansion loop in material and finish of associated pipeline. Size to limit total stress set up in material of pipe wall to less than 51.5 MPa.
- Forge bend from a single length of pipe.

PR_20_85_00_00.2670A TEST PLUGS, SELF SEALING:
- Provide DZR copper alloy self-sealing test plugs for measurement of temperature and pressure, complete with captive cap for sealing when not in use. Ensure test plugs are suitable for system operating temperature and pressure.
- Provide one thermometer and pressure gauge for each range of conditions, for use with test plugs.

PR_20_85_00_00.2670B TEST PLUGS, VALVE CONTROLLED:
- Provide DZR copper alloy self-valve controlled test plugs for measurement of temperature and pressure, complete with captive cap for sealing when not in use. Ensure test plugs are suitable for system operating temperature and pressure.
- Provide one thermometer and pressure gauge for each range of conditions, for use with test plugs.

PR_20_85_00_00.2680A THREADED PIPELINE STRAINERS, BRONZE:
- Material - Bronze to BS EN 1982.
- Ends - Threaded to BS 21 and BS EN 10226-1.
- Pattern - Y pattern body.
- Screen free area - Not less than 250% of pipe bore.
- Screen perforations
- 15 to 50mm nominal size, within range 0.7 - 0.9 mm diameter.
- 65mm and over nominal size, within range 1.5 - 1.8mm diameter.
- Internal to external flow through screen. Provide plugged connections for drain, air vent and differential pressure monitoring, threaded to BS 21 and BS EN 10226-1.

PR_20_85_00_00.2680B FLANGED PIPELINE STRAINERS, BRONZE:
- Material - Bronze to BS EN 1982.
- Ends - Flanged to BS EN 1092-3.
- Pattern - Y pattern body.
- Screen free area - Not less than 250% of pipe bore.
- Screen perforations
- 15 to 50mm nominal size, within range 0.7 - 0.9 mm diameter.
- 65mm and over nominal size, within range 1.5 - 1.8mm diameter.
- Internal to external flow through screen. Provide plugged connections for drain, air vent and differential pressure monitoring, threaded to BS 21 and BS EN 10226-1.

PR_20_85_00_00.2680C COMPRESSION PIPELINE STRAINERS, BRONZE:
- Material - Bronze to BS EN 1982.
- Ends - Compression fittings to BS EN 1254-2.
- Pattern - Y pattern body.
- Screen free area - Not less than 250% of pipe bore.
- Screen perforations
- 15 to 50mm nominal size, within range 0.7 - 0.9 mm diameter.
- 65mm and over nominal size, within range 1.5 - 1.8mm diameter.
- Internal to external flow through screen. Provide plugged connections for drain, air vent and differential pressure monitoring, threaded to BS 21 and BS EN 10226-1.

PR_20_85_00_00.2680D PIPELINE STRAINERS, CAST IRON:
- Material - Cast iron.
- Ends - Flanged to BS EN 1092-2.
- Pattern - Y pattern body.
- Screen free area - Not less than 250% of pipe bore.
- Screen perforations
- 15 to 50mm nominal size, within range 0.7 - 0.9 mm diameter.
- 65mm and over nominal size, within range 1.5 - 1.8mm diameter.
- Internal to external flow through screen. Provide plugged connections for drain, air vent and differential pressure monitoring, threaded to BS 21 and BS EN 10226-1.

PR_20_85_00_00.2690A TUNDISHES, COPPER:
- Provide tundishes located adjacent to equipment.
- Use 3mm minimum thickness copper sheet. Form sheet into a tapered reducing cone with a minor diameter to suit drain line.
- Major diameter nominally 50 mm larger than minor diameter, tapering at approximately 30 degrees.

PR_20_85_00_00.2700A GAUGES, GENERAL:
150mm black stove enamel finish
- 150MM DIAMETER, FLUSH PANEL:
  - Dial case - 150mm diameter, heavy pattern, finished in black stove enamel for flush mounting.
  - Mount gauges with dial face in vertical plane flush to panel and conceal casing within a steel metal cubicle.
- 150MM DIAMETER, DIRECT MOUNTING:
  - Dial case - 150mm diameter, heavy pattern finished in black stove enamel, for direct connection to instrument.
  - Mount gauges with dial face in vertical plane and support casing by connection to instrument.
- 150MM DIAMETER, FLANGED:
  - Dial case - 150mm diameter, heavy pattern finished in black stove enamel, with annular mounting flange.
  - Mount gauges with dial face in vertical plane and surface mount casing to equipment or building element, as required.

100mm - finish
- 100MM DIAMETER, FLUSH MOUNTING:
  - Dial case - 100mm diameter for flush mounting to steel panel.
  - Mount gauges with dial face in vertical plane flush to panel and conceal casing within a steel metal cubicle.
- 100MM DIAMETER, DIRECT MOUNTING:
  - Dial case - 100mm diameter for direct connection to instrument.
  - Mount gauges with dial face in vertical plane and support casing by connection to instrument.
- 100MM DIAMETER, FLANGE MOUNTING:
  - Dial case - 100mm diameter with annular mounting flange.
  - Mount gauges with dial face in vertical plane and surface mount casing to equipment or building element, as required.

Use dial type gauges of robust construction, enclosed in dust tight metal cases. Retain dial glass with bezels screwed to case. Finish with chromium plating.
Use white dial scales indelibly and clearly marked with black lettering to indicate measured values. Select scale ranges which indicate `Normal' when pointer is vertical or central on scale.

PR_20_85_00_00.2700B GAUGES, 150MM DIAMETER, FLUSH PANEL:
- Dial case - 150mm diameter, heavy pattern, finished in black stove enamel for flush mounting.
- Mount gauges with dial face in vertical plane flush to panel and conceal casing within a steel metal cubicle.

PR_20_85_00_00.2700C GAUGES, 150MM DIAMETER, DIRECT MOUNTING:
- Dial case - 150mm diameter, heavy pattern finished in black stove enamel, for direct connection to instrument.
- Mount gauges with dial face in vertical plane and support casing by connection to instrument.

PR_20_85_00_00.2710A TEMPERATURE GAUGES, GENERAL:
- MERCURY IN STEEL:
  - Provide mercury in steel temperature gauge, mounted direct in pocket.
  - Vapour pressure to BS EN 13190
- VAPOUR PRESSURE TO BS 5235 FOR DIRECT MOUNTING:
  - Vapour pressure type to BS EN 13190, mounted direct in pocket, with horizontal or vertical stem as appropriate.
- VAPOUR PRESSURE TO BS 5235 FOR REMOTE MOUNTING:
  - Vapour pressure type to BS EN 13190, for remote mounting with capillary tube of sufficient length to allow slack run to immersion bulb. Protect capillary along full length by a flexible sheath jointed to dial case and bulb.
- TEMPERATURE GAUGES GENERALLY:
  - Use temperature gauges with pocket and provided with gland attachment on thermometer stem.
  - Type:
    - Mercury in steel, mounted direct in pocket.
    - Vapour pressure to BS EN 13190, mounted direct in pocket with horizontal or vertical stem as appropriate.
    - Vapour pressure to BS EN 13190, for remote mounting with capillary tube of sufficient length to allow slack run to immersion bulb. Protect capillary along full length by a flexible sheath jointed to dial case and bulb.
  - Use separable type pockets, threaded 15/19mm BSP and manufactured from stainless steel.
  - Screw pockets into tapped bosses or stools set in pipelines or vessels. Fill pockets with oil to BS 7207 to ensure contact with thermometer bulb.
  - Provide gauges with dial graduation in degrees Celsius marked on a logarithmic scale. Ensure pointer movement is clockwise for increase in temperature.
  - Provide sensing elements for air and gas systems, where indicated, and fix to provide airtight joints.
  - Provide with metal shielding around sensing element to prevent effects of local radiation from equipment.

PR_20_85_00_00.2720 PRESSURE AND ALTITUDE GAUGES:
- Use vapour pressure type gauges to BS EN 837-1. Connect to pipeline systems via matched gauge cocks and cock connectors.
- Ensure dial graduation is from zero to between 1.5 and 3.0 times normal working pressure. Graduate in bar (gauge) on gauges reading head or working pressure, or in Pascals where pressure differences across plant items are to be established. Where fitted on boilers and pressure vessels, clearly mark with operating and maximum permissible working heads in accordance BS 759. Elsewhere provide gauges with normal working pressure. Ensure dial movement is clockwise for an increasing in head.
- Fit syphons on steam systems.
- Provide flexible piping where gauge is subject to noticeable vibration.
- Fit gauge cocks preceding all connections to altitude and pressure gauges. Copper alloy, tapered ground plug, with ebonite lever. Unless flanged joints are required, screw inlet ends female and fit outlet ends with union connections allowing removal of gauges.

PR_20_85_00_00.2730 VACUUM GAUGES:
- Use vacuum gauges complying with BS EN 837-1. Calibrate in mm of mercury.

PR_20_85_00_00.2750A GAUGE MOUNTING BOARDS, HARDWOOD:
- Manufacture from 12mm thick, polished hardwood.
- Mount on walls or purpose made steel frames at a height approximately 1.3m above floor level.

PR_20_85_00_00.3010A LOOSE ITEMS, KEYS FOR SPINDLE SHANK VALVES:
Provide tee handled short shank keys suitable for each size of valve spindle shank.

PR_20_85_00_00.3010B LOOSE ITEMS, FOR DRAIN COCKS:
Provide lever pattern keys suitable for each drain cock and loose hose unions for drain cocks.

PR_20_85_00_00.4010 INSTALLATION:
Install pipeline ancillaries in accordance with manufacturer's recommendations and BS 6683.

PR_20_85_00_00.4020 LOCATION:
Ensure valves, cocks, traps, strainers, test plugs, tundishes and other ancillary equipment are located in positions which facilitate access and maintenance.

PR_20_85_00_00.4030 POSITIONING OF COMPONENTS:
Locate flow and pressure measurement valves to ensure manufacturer's recommended straight length of pipe upstream and downstream of valve is provided.

PR_20_85_00_00.4040 POSITIONING OF DOUBLE REGULATING VARIABLE ORIFICE VALVE:
Install double regulating variable orifice valve to ensure equivalent of 10 diameters of straight pipe upstream and 5 diameters downstream of double regulating valve.

PR_20_85_00_00.4045 INSTALLATION OF CONTROL BALL VALVES:
Install control ball valves in accordance with manufacturer's recommendations.

PR_20_85_00_00.4060 VENT COCKS:
Provide outlets of vent cocks with discharge pipes.

PR_20_85_00_00.4070 VALVE STUFFING BOXES:
Adjust glands of all stuffing boxes at normal plant operating temperature and pressure in accordance with manufacturer's instructions. Ensure that valve action is not impaired by over tightening.

PR_20_85_00_00.4080A DISCHARGE CONNECTIONS, SAFETY VALVES:
Fit pipework connections, where indicated, to provide discharge connection to Safety and Relief valves terminating at a safe discharge point.

PR_20_85_00_00.4080B DISCHARGE CONNECTIONS, VENT COCKS:
Fit pipework connections, where indicated, to provide discharge connection to vent cocks terminating 150mm above floor level.

PR_20_85_00_00.4080C DISCHARGE CONNECTIONS, AIR BOTTLES:
Fit pipework connections, where indicated, to provide bleed connection from air bottles terminating with air cock or needle valve in a convenient position.

PR_20_85_00_00.4080D DISCHARGE CONNECTIONS, AUTOMATIC AIR VENTS:
Fit pipework connections, where indicated, to provide discharge pipe to automatic air vents terminating over a suitable gully or drain line in a visible location.

PR_20_85_00_00.4090 EXPANSION DEVICES:
Where expansion and contraction cannot be accommodated by selected route, provide pipework loops as required. Limit total stress set up in material of pipe wall, taking into account components due to internal pressure, tension and bending to less than 69 MPa for steel pipelines and less than 51.5 MPa for copper pipe lines.
Where location does not permit sufficient flexibility, provide proprietary devices as required.

PR_20_85_00_00.4100 EXPANSION COMPENSATORS INSTALLATION:
Provide anchors and guides to contain all movement and resist maximum loads imposed. Install expansion compensators strictly in accordance with manufacturer's instructions.

PR_20_85_00_00.4110 FLEXIBLE CONNECTIONS INSTALLATION:
Fit rubber bellows as close to source of vibration as practicable. Ensure the pipe at other end of bellows is a fixed point.
Install flexible connections strictly in accordance with manufacturer's instructions.
Ensure flexible connections are tied when the plant is on vibration isolation mountings.
PR_20_85_00_00.4120 TERMINAL UNIT CONNECTIONS INSTALLATION:
Install hose connections strictly in accordance with manufacturer's instructions.

3.0 PR_65_53_00_00 PUMPS
PR_65_53_00_00.1010 PUMPS:
Provide pumps manufactured and tested in accordance with appropriate British Standard, in particular BS EN 809, BS EN 60335-2-41 and BS EN 60335-2-51 where applicable.

PR_65_53_00_00.1020 PUMP SELECTION:
Select pump at or near most efficient part of performance curve for duty required.

PR_65_53_00_00.1030 SAFETY GUARDS:
Fit safety guards around revolving parts on close coupled and belt drive pumps.

PR_65_53_00_00.1040 PUMP TESTING:
Ensure pumps comply with BS EN ISO 5198 and BS EN ISO 9906 as appropriate.

PR_65_53_00_00.2010C CENTRIFUGAL PUMP - CLOSE COUPLED:
- Configuration
  - Pump casing and motor mounted on a bedplate in line (close coupled).
- Casing
  - Provide casing with drain connection fitted with plug.
  - Provide threaded connections in accordance with BS 21 and BS EN 10226-1 for drains, vents, water jackets, cooling lines, etc.
  - Provide pump with split casing to allow access to the impeller for service and maintenance.
- Impeller
  - Ensure impellers are accurately machined and finished smooth, free from blowholes and other defects and designed to be in dynamic balance at all speeds.
  - Provide open or semi-open type impellers for removal of sludge or other foreign material to prevent clogging.
  - Fix impellers to shafts to ensure that they remain firm if direction of rotation is reversed.
  - Indicate direction of rotation on pump casing.
- Shaft
  - Ensure shaft is of adequate diameter to withstand all imposed loading and has a critical speed when assembled with its impeller at least 10% above normal operating speed.
- Material
  - Casing - Cast iron to BS EN 1561.
  - Impeller - Manufacturer's standard.
  - Shaft - Manufacturer's standard.
  - Seal Housing - Cast iron to BS EN 1561.
- Bearings - Sleeve.
- Glands and seals - Mechanical.

PR_65_53_00_00.2010D CENTRIFUGAL PUMP - DIRECT DRIVE IN-LINE:
- Configuration
  - Direct driven unit with pump body incorporating inlet and outlet connections in line, to allow pump to be mounted in pipework.
- Casing
  - Provide casing with drain connection fitted with plug.
  - Provide threaded connections in accordance with BS 21 and BS EN 10226-1 for drains, vents, water jackets, cooling lines, etc.
  - Provide pump with split casing to allow access to the impeller for service and maintenance.
- Impeller
  - Ensure impellers are accurately machined and finished smooth, free from blowholes and other defects and designed to be in dynamic balance at all speeds.
  - Provide open or semi-open type impellers for removal of sludge or other foreign material to prevent clogging.
  - Fix impellers to shafts to ensure that they remain firm if direction of rotation is reversed.
  - Indicate direction of rotation on pump casing.
- Shaft
  - Ensure shaft is of adequate diameter to withstand all imposed loading and has a critical speed when assembled with its impeller at least 10% above normal operating speed.
- Material
  - Casing - Cast iron to BS EN 1561.
  - Impeller - Manufacturer's standard.
  - Shaft - Stainless steel to BS EN 10088.
  - Seal Housing - Cast iron to BS EN 1561.
- Bearings
  - Sealed-for-life or pre-packed type requiring no maintenance (in-line pumps).
- Glands and seals - Mechanical.

PR_65_53_00_00.2020A POSITIVE DISPLACEMENT PUMP - HELICAL:
- Material
  - Casing - Cast iron to BS EN 1561 or SG cast iron to BS EN 1563 and BS EN 1564.
  - Seal Housing - Cast iron to BS EN 1561.
- Bearings - Spherical roller.
- Glands - Mechanical.

PR_65_53_00_00.4010 GENERAL:
Comply with manufacturer's recommendations for installation of pumps. For in-line pumps ensure that motor is positioned in accordance with manufacturer's requirements.

PR_65_53_00_00.4020 PIPELINE CONNECTIONS:
Support pumps independently from connecting pipework to ensure no load is transmitted from pipework to pump casing on pump suction and discharge.

PR_65_53_00_00.4030 MOUNTINGS:
Mount motors and pumps for belt drive pumps resiliently.

PR_65_53_00_00.4040 ALIGNMENT:
Align pump to prevent undue restraint and thrust on interconnecting pipework. Align drives to prevent undue wear and restraint on pump shaft. For belt drives, align pulleys and tension belts to prevent undue wear and out of balance forces.

PR_65_53_00_00.4050 ACCESS:
Locate pump within the system with adequate space around it for service and maintenance.

PR_65_53_00_00.4060 MAINTENANCE REQUIREMENTS FOR SEWAGE PUMPS:
For ease of service and maintenance, install submersible sewage pumps on guide rails or with lifting cables. Fit pumps with automatic discharge connections, which locate on to permanent pipework at low level in chamber.

4.0 PR_60_50_96_00 WATER TANKS/CISTERNS

PR_60_50_96_00.1010 TANK DESIGN:
Design and fabricate tanks/cisterns in accordance with British Standards.

PR_60_50_96_00.1020 DOMESTIC STORAGE WATER CISTERNS:
Ensure storage cisterns for domestic water purposes comply with the Water Supply (Water Fittings) Regulations 1999 and amendment.

PR_60_50_96_00.2020A SECTIONAL A1 GLASS FIBRE REINFORCED SECTIONAL TANK TO BS EN 13280:
Class A1 - for potable water incorporating screened air inlet, vent pipe entry device for the cover, screened warning and overflow pipes and particle ingress limitation between a one-piece cistern or sectional tank, cover and fittings.
Sectional tanks - External flanges.

PR_60_50_96_00.4010 GENERAL:
Store, handle and erect all in accordance with manufacturer's recommendations and relevant British Standards.
Make due allowance for valves, fittings, access, etc., to accommodate insulation and weathering where indicated.

PR_60_50_96_00.4020 PROTECTION AND CLEANING:
Ensure adequate protection from damage and ingress of foreign matter to tanks and cisterns during storage, erection and commissioning. Thoroughly clean out all tanks and cisterns prior to site testing and commissioning.

21.4030 INSPECTION AND ACCESS:
Install tanks and cisterns to allow internal and external surfaces to be easily inspected and cleaned.

PR_60_50_96_00.4040 INSTALL MOULDED PLASTIC CISTERNS: IN ACCORDANCE WITH APPENDIX
Install moulded plastic cisterns in accordance with Appendix R of BS 4213.

PR_60_50_96_00.4050 INSTALL SECTIONAL STEEL TANKS:
Install sectional steel tanks in accordance with manufacturer’s recommendations.

PR_60_50_96_00.4060 INSTALL GLASS REINFORCED PLASTICS CISTERNS:
Install glass reinforced plastics cisterns in accordance with BS EN 13280.

6.0 PR_60_60_38_00 STORAGE CYLINDERS AND CALORIFIERS

PR_60_60_38_00.1010 STANDARDS:

Comply with British Standards indicated.

- Unvented hot water storage systems to be completed with "unvented kits" and pressure regulating valve to comply with Building Regulations safety requirements. Indirectly heated storage water heaters to comply with BS EN 12897.¬

PR_60_60_38_00.1020 DEFINITIONS:

- Direct cylinder - a closed cylindrical vessel with domed ends.
- Indirect cylinder - a closed cylindrical vessel with domed ends having separate integral means of heating contents by annular or coil type element.
- Calorifier - a closed cylindrical vessel having separate integral means of heating contents by 'U' tube chest type element.
- Primary heater - a heater mounted inside a cylinder or calorifier for transfer of heat to stored water from primary medium.
- Capacity - the volume of water storage excluding contents of any primary heater.
- Secondary working head - the vertical distance between bottom of cylinder or calorifier and water line of cistern supplying cylinder or calorifier.

PR_60_60_38_00.2030 COPPER DOUBLE FEED INDIRECT CYLINDERS:

Where copper double feed indirect cylinders are used, ensure:

- Standard - BS 1566-1
- Connections as BS 1566-1
- Test certificates to BS 1566-1
- Provide connections and supports as shown on drawings as required to meet the manufacturer's requirements.
- Mountings to meet the manufacturer's requirements.
- Provide protective isolation material to prevent electrolytic action where mild steel is used.

PR_60_60_38_00.2040 COPPER SINGLE FEED INDIRECT CYLINDERS:

Where copper single feed indirect cylinders are used, ensure:

- Standard - BS 1566-2
- Connections as BS 1566-2
- Test certificates to BS 1566-2
- Provide connections and supports as shown on drawings as required to meet the manufacturer's requirements.
- Mountings to meet the manufacturer's requirements.
- Provide protective isolation material to prevent electrolytic action where mild steel is used.

PR_60_60_38_00.2045 STAINLESS STEEL INDIRECT CYLINDER:

- Standard - BS 853-1:1990+A3:2011
- Connections as BS 853-1:1990+A3:2011
- Material test certificates to BS 853 clause 5.3.
- Hydraulic test certificates to BS 853 clause 11.2.
- Provide connections and supports as shown on drawings as required to meet the manufacturer's requirements.
- Mountings to BS 853
- Pressure relief devices as BS 853 clause 10.2; stop valves as clause 10.3; pressure gauge as clause 10.4; thermometer as clause 10.5; draining taps as clause 10.6; and vacuum breaker valve as clause 10.7.

PR_60_60_38_00.2060 GALVANIZED STEEL CALORIFIER/STORAGE VESSEL TO BS853-1:

- Standard - BS 853-1:1990+A3:2011
- Connections as BS BS 853-1:1990+A3:2011
- Material test certificates to BS 853 clause 5.3.
- Hydraulic test certificates to BS 853 clause 11.2.
- Provide connections and supports as shown on drawings as required to meet the manufacturer's requirements.
- Mountings to BS 853
- Pressure relief devices as BS 853 clause 10.2; stop valves as clause 10.3; pressure gauge as clause 10.4; thermometer as clause 10.5; draining taps as clause 10.6; and vacuum breaker valve as clause 10.7.

PR_60_60_38_00.2065 COPPER CALORIFIER/STORAGE VESSEL TO BS853-1:

- Standard - BS 853-1:1990+A3:2011
- Connections as BS BS 853-1:1990+A3:2011
- Material test certificates to BS 853 clause 5.3.
- Hydraulic test certificates to BS 853 clause 11.2.
- Provide connections and supports as shown on drawings as required to meet the manufacturer's requirements.
- Mountings to BS 853
- Pressure relief devices as BS 853 clause 10.2; stop valves as clause 10.3; pressure gauge as clause 10.4; thermometer as clause 10.5; draining taps as clause 10.6; and vacuum breaker valve as clause 10.7.

PR_60_60_38_00.4010 GENERAL:

Store, handle and erect all equipment in accordance with manufacturer's recommendations and relevant British Standards. Make due allowance for valves, fittings, access etc., to accommodate insulation where specified. Support equipment such that all component parts, connections or insulation have clearance from supports.

PR_60_60_38_00.4020 FLANGE DRILLINGS:

Ensure flange drillings are uniform to facilitate interchange of tube assemblies.

PR_60_60_38_00.4030 PROTECTION AND CLEANING:

Provide protection from damage and ingress of foreign matter to storage cylinders and calorifiers during storage, installation and testing.

PR_60_60_38_00.4040 INSPECTION:

storage cylinders and calorifiers such that internal and external surfaces can be readily inspected and cleaned.

PR_60_60_38_00.4050 RUST PROTECTION:

Ensure storage cylinder and calorifier shells are completely free of rust and corrosion and coated with factory applied primer.

5.0 PR_60_55_96_00 CLEANING AND CHEMICAL TREATMENT

PR_60_55_96_00.1010 CONDITIONS FOR CLEANING AND CHEMICAL TREATMENT:

Ensure treatment complies with statutory authority and health and safety regulations.
Notify manufacturers and suppliers of equipment of proposed system cleaning and chemical treatment processes.
Establish if any manufacturer or supplier of equipment requires any particular cleaning and chemical treatment process due to size of waterways or materials used.
All chemicals used are to be compatible with the metallurgy of the systems.

PR_60_55_96_00.1015 METHOD STATEMENT:

Provide a method statement covering the sequence of events, chemicals to be used etc. Statement to be provided at least two months prior to the start of any flushing and/or chemical cleaning works.

PR_60_55_96_00.2010 CLEANING AND CHEMICAL TREATMENT SPECIALIST:

Use a specialist for analysis and for design, supply, installation and operation of any system cleaning and chemical treatment process.

PR_60_55_96_00.2020A MAINS WATER ANALYSIS:

Obtain an analysis of mains water taken from site supply point. Check with local water authority to ensure analysis results are typical for site area and report variances for instruction; or submit a sample of water to water treatment specialist as appropriate.
Carry out tests to establish total viable counts and Pseudomonas and sulphate reducing bacteria.

PR_60_55_96_00.2030A PRELIMINARY CHECKS:
- Prior to carrying out cleaning or chemical treatment process, ensure that
  - All foreign matter is removed.
  - Certified pressure tests have been carried out in the parts of the system to be cleaned. Carry out further pressure tests on the isolated sections of the system independently.
  - All water used for pressure testing is inhibited. Leave remaining pipework sections full after testing.
  - Where there is a risk of freezing inhibited mono-ethyleneglycol is used.
  - Circulation has been demonstrated and approval obtained on all parts of the system. Manipulate and leave fully open all valves other than those used to isolate sections. Carry out balancing and certification after the flushing, cleaning and passivation operations.
  - No damage can occur to any item of plant or equipment due to cleaning and chemical processes.
  - Chemicals used are compatible with system materials.
  - All items of plant and equipment subject to damage or blockage due to cleaning and chemical treatment processes are isolated or removed.
  - Permanent or temporary by-passes are provided as indicated on drawings.
  - Dirt pockets are installed at low points to facilitate solids removal. Supply dirt pockets with drain valves sized to pipework size.
  - All drains provided have been tested and approved and that any pumping equipment associated with the drainage system is fully commissioned.
  - Dead legs, that are more than 3 pipe diameters in length are looped to allow effective cleaning.
  - Strainer baskets and filter media, incorporated within systems, are removed; and where necessary spool or stool pieces are installed.
  - Temporary strainers and filters are installed as required for removal of solids during cleaning and chemical treatment processes.
  - Strainers are clean prior to the start of the cleaning process, throughout the cleaning and on completion.
  - Suitable supply and drainage points are provided with 50mm minimum connections, properly sited and installed, either valved or plugged.
  - All automatic/manual air vents are fully commissioned.
  - All requirements of COSHH regulations are complied with during the chemical cleaning and chemical treatment of the system.
- Where required by local water authority, provide effluent tanks for storage of all waste products of cleaning and chemical treatment processes.
- Following local water authority approval, either neutralize and dispose to drain of all waste products or ensure authorised disposal at registered sites.
- Comply with Waste Management Duty of Care: A Code of Practice and The Hazardous Waste (England & Wales) Regulations 2005 where appropriate.

PR_60_55_96_00.2040A PROCEDURAL PRECAUTIONS FOR CLEANING AND CHEMICAL TREATMENT:
- Carry out tests to ensure that cleaning and chemical treatment processes are operating as required.
- Carry out tests to ensure that cleaning and chemical treatment processes are operating as required. and detailed in the Method Statement.
- Submit all test and sample results for certification and approval.

PR_60_55_96_00.2040B PROCEDURAL PRECAUTIONS FOR CLEANING AND CHEMICAL TREATMENT INCLUDING TAKING SAMPLES:
- Take samples during and following chemical treatment and/or cleaning.
- Submit samples to an independent analyst.
- Use sterile containers to take samples.
- Carry out tests to ensure that cleaning and chemical treatment processes are operating as required.
- Submit all test and sample results for certification and approval.
- Ensure all samples are witnessed.

PR_60_55_96_00.2060A CHEMICAL INJECTION AND DOSING METHODS FOR CLOSED SYSTEMS:
- Method of introducing chemicals:
  - Dosing pots; manually initiated timer controlled dosing; or proportional dosing as appropriate.

PR_60_55_96_00.2060C PACKAGED CHEMICAL INJECTION AND DOSING PLANT:
Provide packaged monitoring and treatment plants.

PR_60_55_96_00.2060D DOSING - CLOSED SYSTEMS:
- Chemical feed:
  - Provide feeder (dosing pots) with a tundish for filling; separate air vent with discharge tube; drain and isolating valves.
- Install in each water system a means of taking a sample as follows:
  - Chilled water systems - provide a gate valve and discharge.
  - Heating systems - provide a sample cooler with a copper coil and cooling jacket with cooling water valve and drained to waste.

PR_60_55_96_00.2065 CHEMICALS - DOSING:
Provide biocides effective against Legionella Pnueumophilia, algae, fungi, moulds and slime forming bacteria including pseudomonas and sulphate reducing bacteria.
Supply biocides as recommended by water treatment specialist.
Incorporate a bio dispersant in the programme to break up and disperse any slime masses, where required.
The water treatment specialist shall select the appropriate corrosion inhibitors, to minimise corrosion, and biocides to prevent any proliferation to mild steel, copper and copper alloys.
Provide a specific inhibitor to protect aluminium when it is present in the system.
The cleaning agent is to be specified by the water treatment specialist.

PR_60_55_96_00.2070A MONITORING:
Provide monitoring system to enable on-line analyses, system alarms and chemical stock levels to be monitored by water treatment specialist.
Where indicated, provide facility for system to be monitored by water treatment specialist at remote location.

PR_60_55_96_00.2070B SAMPLING:
Provide testing equipment to carry out tests for all inhibitors used in treatment programme indicated.

PR_60_55_96_00.2070C SAMPLING KITS:
Provide the following test kits as appropriate.
- Boiler water test kit for steam boilers; conductivity test kit; pH test kit; inhibitor test kit; hardness test kit where a softener is installed; chloride level test kit.
- Install a corrosion test rig to enable corrosion rates to be monitored using corrosion coupons.
- Bacteriological monitoring with use of dipslides.
- Log sheets for recording of test results, bacteriological analysis and any actions required or taken.

PR_60_55_96_00.2080A CHEMICAL PROVISION, STANDARD ARRANGEMENT:
Provide consumables for a period of 12 months.
Where indicated, provide for supply of chemicals from containers refilled by drumless delivery system.
Include for supply of chemicals for all systems using the basis of:
- Open circuit systems operating at 100 % load for 2080 hours per annum.
- Closed circuit systems make-up 1% system volume/month.

PR_60_55_96_00.3010A FLUSHING:
Fill the system by one of the following methods:
- Temporary connection from mains in compliance with the Water Supply (Water Fittings) Regulations 1999, and the Water Supply (Water Fittings) (Amendment) Regulations 1999.
- Temporary connection from fire hydrant pipework.
- By installation of temporary tank and pump arrangement.

Carry out flushing of water systems in accordance with BSRIA BG 29/2021 Pre-commission cleaning of pipework systems.
In particular:
- Section 2 Installation considerations
- Section 3 System dynamic flushing.
- C1 Flushing objectives
- C2 Dynamic flushing procedure.
- Inspection and witnessing, as section 1.4.

PR_60_55_96_00.3010B FLUSHING:
All water used for pressure testing, flushing and system filling is of good quality. Leave remaining pipework sections full and treated after pressure testing.
Install all necessary pipework ancillaries to enable a specialist to carry out flushing, inspection and witnessing of water systems in accordance with BSRIA BG 29/2021 Pre-commission cleaning of pipework systems.
Temporary connection from the mains must be in compliance with the Water Supply (Water Fittings) Regulations 1999 and amendment, or by installation of a temporary tank and pump arrangement.
Domestic water systems are to be flushed and disinfected in accordance with the requirements of BS EN 806 and BS 8558, and to the satisfaction of the local water supply authority. Flush systems using mains water until the water is clear.

PR_60_55_96_00.3030 CHEMICAL CLEANING AND SOLIDS REMOVAL
Carry out chemical cleaning procedure in accordance with BSRIA BG 29/2021 Pre-commission cleaning of pipework systems. In particular:
- 4.1 Introduction.
- 4.2 Cleaning options.
- 4.2.1 Degreasing.
- 4.2.2 Biocide wash.
- 4.2.3 Removal of surface oxides - Inhibited acid cleaning.
- 4.2.4 Effluent disposal/final flushing.
- 4.2.5 Neutralisation.
- 4.2.6 Passivation
- 4.2.7 Corrosion inhibitor/biocide dosing.
- 4.2.8 Treatment up to system handover.
- 4.3 On-going water treatment.
- Inspection and witnessing, as section 1.4.

PR_60_55_96_00.3040 STERILIZATION - GENERAL:
After flushing process, carry out sterilization in accordance with BS EN 806 and BS 8558.
Prior to sterilization ensure each system is flushed, cleaned and drained.
Provide temporary connections to system terminal points suitable for introduction of sterilization chemicals and fluids and 22mm minimum valved drain connection on incoming main immediately downstream of mains isolating valve.
Fill system with clean, fresh water.

PR_60_55_96_00.3050 STERILIZATION - MAINS WATER SYSTEM:
Carry out the following operations in accordance with BS EN 806 and BS 8558.
- Flush system and introduce sterilisation chemical.
- Take samples from all sentinel points to ensure correct chlorine concentration.
- Leave system to stand for period of time indicated.
- Repeatedly flush system with clean water until all traces of chlorine have been removed - leave system filled.
- Submit samples to registered laboratory for microbiological analysis and report.

Certificate of conformity
- Immediately prior to handover, retake samples and submit for analysis and report.

Where necessary, repeat sterilisation of potable water system immediately prior to handover.

PR_60_55_96_00.3060 STERILIZATION - WATER STORAGE SYSTEMS:
Carry out the following operations in accordance with BS EN 806, BS 8558 and HSE L8 Legionnaires' disease - control of legionella bacteria in water systems ACOP and guidance.
- Carry out operations on all water storage tanks and cisterns, cold and hot.
- Carry out procedures as for mains water systems.

PR_60_55_96_00.3080 SERVICE VISITS:
Provide monthly service visits for one full year by a fully qualified chemist, to carry out the following:-
- Review water analysis records, correspondence and reports since previous visit.
- Test water samples on site for hardness; all inhibitors; dissolved solids; pH; total alkalinity.
- Check performance of feeding equipment, softeners, and testing equipment on site.
- Submit a written report.
- Carry out micro-biological analysis using dipslides.
- Special requirements as indicated.

25.3090 DOCUMENTATION:
Provide an electronic copy and one copy in a hard cover binder containing details of:
- Programme outlines.
- Purpose of chemical treatment.
- Chemicals used and quantity.
- On site testing procedures.
- Control limits of tests.
- Equipment data and drawings.
- Product notes and material safety data sheets for all chemicals used.

Provide a complete training programme for site operatives covering
- Methods of basic water testing.
- Explanation of results obtained.
- Actions to be taken on test results.

6.0 AC_60_00_00_00 TESTING AND COMMISSIONING

AC_60_00_00_00.2010 PRESSURE TESTING - GENERAL:
Comply with procedures given in HVCA TR/6 Guide to Good Practice for Site Pressure Testing of Pipework. Ensure safety precautions detailed in HSE Guidance Note GS4 Safety in Pressure Testing are adopted.
Provide a blanked connection to accommodate a check gauge in addition to the accurate gauge fitted to section under test.
Test concealed or buried pipework before any permanent covering is applied.
Advise appropriate personnel, in advance, of the time pressure tests may be witnessed.

AC_60_00_00_00.2020 PRESSURE TESTING - WATER CIRCULATING AND SUPPLY SYSTEMS AND STEAM AND CONDENSE LINES:
Carry out Hydraulic Pressure Testing as described in HVCA TR/6 Guide to good Practice for Site Pressure Testing of Pipework. Test section by section for one hour, as the work proceeds and prior to application of thermal insulation as follows:
- Operating gauge pressure less than 3.5 bar, test gauge one and a half times operating pressure.
- Operating gauge pressure 3.5 - 7.0 bar, test gauge pressure twice operating pressure.
- Operating gauge pressure greater than 7.0 bar, test gauge pressure 14.0 bar or one and a half times operating pressure, whichever is the greater.

AC_60_00_00_00.2030# PRESSURE TESTING - UNDERGROUND PIPEWORK:
- Test to a gauge pressure not less than twice the operating pressure for 1 hour.
- Test to a gauge pressure twice the operating pressure or 7 bar, whichever is the greater, for 4 hours.

AC_60_00_00_00.2030A PRESSURE TESTING - UNDERGROUND PIPEWORK, 1 HOUR:
Test to a gauge pressure not less than twice the operating pressure for 1 hour.

AC_60_00_00_00.2030B PRESSURE TESTING - UNDERGROUND PIPEWORK, 4 HOURS:
Test to a gauge pressure twice the operating pressure or 7 bar, whichever the greater, for 4 hours.

AC_60_00_00_00.2040 PRESSURE TESTING - WATER MAINS:
Test to Local Authority requirements. Ensure the provisions laid down in HVCA TR/6 Guide to Good Practice for Site Pressure Testing of Pipework for testing underground CWS mains are carried out.

AC_60_00_00_00.2080 PRESSURE TESTING - SOIL, WASTE, VENTILATION, ANTI-SYPHON AND RAINWATER PIPEWORK:
Test section by section as the work proceeds and subsequently on completion with all sanitary fittings fixed and working.
Submit systems to two separate tests, Air test and Hydraulic Performance test in accordance with BS EN 12056-2.

AC_60_00_00_00.2090 PRESSURE TESTING - UNDERSLAB DRAINAGE:
Test section by section as the work proceeds and subsequently after completion of backfilling and compaction to the satisfaction of the Engineers and the local Authority.
Individually test sections which will be permanently embedded in the structure or concealed in ducts or voids.
Submit sections to two separate tests Water test and Test for Straightness and Obstruction in accordance with BS EN 752.

AC_60_00_00_00.2100 VACUUM TESTING:
Test vacuum mains in accordance with HVCA TR/6 Guide to Good Practice for Site Pressure Testing of Pipework, Table 1.

AC_60_00_00_00.2110 TESTING RECORDS:
Keep a systematic record of tests. Distribute records to CA/EA, the Client and any other interested parties.

AC_60_00_00_00.3010 CLEANING DUCTWORK SYSTEMS:
Clean ductwork before plant is first run, using access openings in ductwork.

AC_60_00_00_00.3020 COMMISSIONING CODES:
Carry out commissioning of installations in accordance with the procedures, checks and tolerances given in the BSRIA Application Guides for water systems and air systems to achieve the standards set in the CIBSE Commissioning Codes.

AC_60_00_00_00.3030A COMMISSIONING WATER DISTRIBUTION SYSTEMS INCLUDING BSRIA PRE-COMMISSIONING CHECKLIST:
Preliminary checks:
- Carry out checks and procedures as detailed in CIBSE Commissioning Code W, Section W1. Ensure system is statically complete as defined in BSRIA Guide BG 29/2021 Pre-Commissioning Cleaning of Pipework Systems.
- Use pre-commissioning checklist from BSRIA Guide 29/2021.

Setting to work and regulation - Set to work and regulate water distribution systems in accordance with CIBSE Commissioning Code W, Sections W2 and W3, and BSRIA Guide BG 2/2010.
Measurement - Use instruments for measurement detailed in BSRIA Guide 2/2010.

AC_60_00_00_00.3040A COMMISSIONING AIR DISTRIBUTION SYSTEMS INCLUDING BSRIA PRE-COMMISSIONING CHECKLIST:
Preliminary checks
- Carry out checks and procedures as detailed in BSRIA Guide BG 49/2015 Commissioning of air systems in buildings.
- Use pre-commissioning checklist in BSRIA Guide BG 49/2015.

Setting to work and regulation - Set to work and regulate air distribution systems in accordance with CIBSE Commissioning Code A, Section A2, and sections 7.2 and 9.1 in BSRIA Guide BG 49/2015.
Measurement of air flow - Use instruments for measurement and methods of measurement detailed in BSRIA Guide BG 49/2015 and CIBSE commissioning guide, section A3.

AC_60_00_00_00.3070 COMMISSIONING AUTOMATIC CONTROL SYSTEMS:
Carry out commissioning of Automatic Control Systems in accordance with Manual prepared by the controls equipment manufacturer. Carry out the Checking and Setting-Up procedure detailed in the CIBSE Commissioning Code C, Section C1.
Measurement - Carry out measurements in accordance with CIBSE Commissioning Code C, Appendix C2.1.

AC_60_00_00_00.3080 COMMISSIONING PLANT ITEMS:
Comply with the manufacturer's recommendations for setting to work.
AC_60_00_00_00.3090A INSTRUMENTS AND GAUGES:
Ensure instruments are correctly calibrated. Record details of instruments on record sheets.
Submit evidence of correct calibration of instruments to be used in connection with commissioning and testing.

AC_60_00_00_00.3100A AIR SYSTEMS COMMISSIONING RECORDS TO BSRIA Guide BG 49/2015:
Keep a systematic record of commissioning results and distribute as indicated.
For air systems, use record sheets as described in BSRIA Guide BG 49/2015 Commissioning air systems in buildings.

AC_60_00_00_00.3100B WATER SYSTEMS COMMISSIONING RECORDS TO BSRIA BG 29/2021:
Keep a systematic record of commissioning results and distribute as indicated.
For water systems, use record sheets as detailed in BSRIA Guide BG29/2020 Commissioning water systems in buildings.

AC_60_00_00_00.4010 SYSTEM PERFORMANCE TESTING:
Demonstrate the performance of installations including single, standby, multi-duty plants and systems, and of plants specified for future use.

AC_60_00_00_00.4015 TESTING OF RESIDENTIAL VENTILATION SYSTEMS:
Demonstrate the performance of residential ventilation systems through performance testing and installation checks in accordance with BS EN 14134.

AC_60_00_00_00.4020# ENVIRONMENTAL TESTS:
- Carry out environmental testing to prove the performance of the systems.
- Apply artificial loads or provide test arrangements to simulate the full range of operating conditions and duties.
- Carry out ambient air quality tests in accordance with BS EN 13528-1, BS EN 13528-2 and BS EN 13528-3.

AC_60_00_00_00.4020A ENVIRONMENTAL TESTS, ARTIFICIAL LOADS:
Carry out environmental testing to prove the performance of the systems.
Apply artificial loads or provide test arrangements to simulate the full range of operating conditions and duties.

AC_60_00_00_00.4020B ENVIRONMENTAL TESTS, AMBIENT AIR QUALITY
Carry out environmental testing to prove the performance of the systems.
Carry out ambient air quality tests in accordance with BS EN 13528-1, BS EN 13528-2 and BS EN 13528-3.

AC_60_00_00_00.4030 RECORDERS:
- Seven day space temperature recorders
- Number
- For (weeks)
- Relative humidity recorders
- Number
- For (weeks)

Provide and maintain on free loan portable seven day space temperature and relative humidity recorders, as indicated, together with adequate charts.

AC_60_00_00_00.4040 TESTING TO SPECIFIED CONDITIONS:
AC_60_00_00_00.4040A RAINWATER SYSTEMS:
Demonstrate by flow tests that the systems give satisfactory performance.

AC_60_00_00_00.4040B SANITARY SYSTEMS:
Comply with performance tests given in BS EN 12056.

AC_60_00_00_00.4040C COLD WATER SYSTEMS:
Demonstrate that outlets supply adequate rates of flow.

AC_60_00_00_00.4040E HYDRAULIC SYSTEMS:
Comply with requirements as indicated within the main specification.

AC_60_00_00_00.4040I SILENCERS AND ACOUSTIC TREATMENT:
Demonstrate by measured tests that noise criteria indicated have been achieved.

AC_60_00_00_00.4050 PERFORMANCE TEST RECORDS:
Keep a systematic record of tests. Distribute records to the CA/EA, the Client and any other interested party.

7.0 PR_65_70_36/48_00 HV/LV CABLES AND WIRING
PR_65_70_36/48_00.1010 CABLE MANUFACTURER:
- Use new cables, delivered to site with seals intact, manufactured not more than one year prior to delivery, labelled with manufacturer's name, size, description, BS number, classification, length, grade and date of manufacture. If any of this information is missing the cable should not be installed without seeking approval.

PR_65_70_36/48_00.1020 CABLE CERTIFICATION MARKING:
- Mark all types of cables with CENELEC cable certification marking or if included in British Approvals Service for Cables (BASEC) in accordance with BASEC regulations.

PR_65_70_36/48_00.2005 LSOH SHEATHING:
- Supply cables with Low Smoke Zero Halogen (LSOH) sheathing, tested in accordance with BS EN 50267 and BS EN 60332.

PR_65_70_36/48_00.2010D STANDARD ORDINARY FLEXIBLE CORDS - MULTI COPPER CORES:
- Standard - BS EN 50525-2-21, Clauses 4.1, 4.2, 4.3 and 6.3.

PR_65_70_36/48_00.2020A STANDARD POWER SUPPLY CABLES, COPPER CONDUCTORS, THERMOSETTING INSULATION, SHEATHED:
- Standard - BS 5467, Tables 4, 6, 8, and 10.
- Mechanical protection - Unarmoured.

PR_65_70_36/48_00.2020B STANDARD POWER SUPPLY CABLES, COPPER CONDUCTORS, THERMOSETTING INSULATION, SHEATHED AND ARMOURED:
- Standard - BS 5467, Tables 4, 6, 8, and 12.
- Mechanical protection - Armour.

PR_65_70_36/48_00.2020E STANDARD POWER SUPPLY CABLES, COPPER CONDUCTORS, LSF SHEATHED AND ARMOURED:
- Standard - BS 6724, Tables 4, 6, 8, and 10.
- Mechanical protection - Armour.

PR_65_70_36/48_00.2020G STANDARD CABLES FOR CONDUIT AND TRUNKING, COPPER CONDUCTORS, LSF INSULATED:
- Standard - BS EN 50525-3-41, Clauses 4.1 and 4.3.
- Mechanical protection - Conduit and trunking.

PR_65_70_36/48_00.2020J STANDARD FLAT CABLES, 2-CORE OR 3-CORE, COPPER CONDUCTORS WITH OR WITHOUT CPC, LSF INSULATED SHEATHED:
- Standard - BS 7211, Table 5.

PR_65_70_36/48_00.2020K STANDARD POWER SUPPLY CABLES, COPPER CONDUCTORS LSF INSULATION, SHEATHED:
- Standard - BS 7211, Tables 3 and 4.
- Mechanical protection - Unarmoured.

PR_65_70_36/48_00.2020M STANDARD CABLES WITH DEFINITE FIRE PERFORMANCE:
- Standard - BS 7629-1 type as shown on drgs/schedules.
- Fire performance BS 5839-1 Standard.
- Sheath colour - red.
- Mechanical protection, as shown on drgs/schedules.

PR_65_70_36/48_00.2050B PAIRED, SCREENED CONTROL CABLES WITH OR WITHOUT METALLIC PROTECTION:
- Standard - BS EN 50288-7.
- Paired, screened control cables, with or without metallic protection.

PR_65_70_36/48_00.2050G MULTI-CORE UNARMOURED LSF, SHEATHED AUXILIARY CABLES:
- Standard - BS 7211, Table 4
- Mechanical protection - Unarmoured.

PR_65_70_36/48_00.2070B STANDARD COMMUNICATIONS CABLES FOR INDOOR USE:
- Standard - BT CW 1308; BT CW 1370; BT CW 1700; and BT CW 1750.

PR_65_70_36/48_00.2080A STANDARD COAXIAL CABLES, FOR BROADCAST RECEIVING:
- Standard - BS EN 50117. CAI benchmark status, cable types CT 100, CT 125, CT 165.

PR_65_70_36/48_00.2100A INFORMATION TECHNOLOGY CABLES - STRUCTURED WIRING: CATEGORY 5:
- Provide IT cables in accordance with the IT system suppliers specification.
- Type of system - Structured cabling - BS EN 50173-1.
- Standard - BS EN 50288-3-1.
- Termination reference - EIA/TIA TSB-40.
- Cable construction - Multi pair; unshielded (UTP)

PR_65_70_36/48_00.3010A CABLES GLANDS - UNARMOURED CABLES:
- Cable type
  - Flexible; wiring and power; control and auxiliary; and communications.
- Standard - BS EN 50262 non-metallic, cable retention, IP54; Type A1 as BS 6121-5 Annex A.

PR_65_70_36/48_00.3010C CABLES GLANDS - ARMOURED CABLES
- Cable type
  - Wiring and power; and control and auxiliary.
- Standard - BS EN 50262 metallic, cable retention Class A, protective connection to earth, IP54.
- Type B as BS 6121-5 Annex A for indoors
- Type C as BS 6121-5 Annex A for outdoors

PR_65_70_36/48_00.3110A CABLE DUCTS:
- Standard BS 4660

PR_65_70_36/48_00.3120A CABLE SLEEVES:
- Supply and hand to others for installation non-ferrous cable sleeves for incorporation into the structure where cables pass through fire compartment floors and walls.
- Packing material
  - Weak mix mortar; intumescent, plaster or mastic; solid intumescent material; or intumescent granule filled bags.

PR_65_70_36/48_00.3130A CABLE COVERS AND MARKERS:
- Material - Recovered plastic, integral tape.
- Marking - Electricity or telephone.
- Plastic marker tape
  - Yellow, marked electricity or telephone.

PR_65_70_36/48_00.4010 CABLE INSTALLATION - GENERAL:
- Use and install cables only as directed in the appropriate standard or as directed by the manufacturer in writing. Lay cables in one length unless otherwise indicated. Obtain permission from the consultant for all through joints, and where overall length requirement exceeds practical drum size.
- Handle, install and dispose of cables on wooden drums in accordance with BS 8512.
- Install cables when ambient temperature is 5oC or greater, using cables stored at or above this temperature for not less than 24 hours.
- Use drum stands, drum axles, fair leads, rollers, cable stockings and other equipment as recommended by the cable manufacturer and as appropriate to the method of installation.

PR_65_70_36/48_00.4020 CABLE INSTALLATION IN LOW TEMPERATURES:
- Install cables at lower installation temperatures when authorised by manufacturer in a written statement.

PR_65_70_36/48_00.4030 INSTALLATION OF LSF CABLE:
- Install LSF cables in accordance with manufacturer's instructions. Ensure ambient temperature is above 5oC. Ensure oversheaths are not damaged by abrasion or scuffing.

PR_65_70_36/48_00.4040 INSTALLATION OF UNARMOURED CABLES:
- Install and use unarmoured cable to BS 7540-1, BS 7540-2, BS 7540-3 or the manufacturer's written instructions.

PR_65_70_36/48_00.4060 CABLE INSTALLATION IN TRENCHES:
- Lay cables on newly prepared bedding. Ensure multiple layers of cable are separated vertically by a 50mm layer of hard rammed bedding material.
- When using a power winch ensure tension on the cable is taken by element of the cable designed for that purpose, that is armour or conductor cores as appropriate and not plastic sheath, metal sheath or core insulation.
- When hand pulling cable ensure no kinks are formed and that flaking, when used, is done in the correct direction.
- Do not allow cable to twist during installation. Use swivels to connect pulling bond to cable stocking or equivalent fitting.
- Check drum is suitable for jacking before commencing installation. If drum or reel is unsuitable for jacking, flake cable in correct direction in maximum size turns from drum or reel before commencing installation. Use skilled labour to supervise all unreeling, flaking or running of cable from a drum.
- Lay cables in the formation shown; ensure spacing is not reduced below that indicated.
- Bind trefoil groups at 1m intervals. Bind any associated earth or protective conductor to its cable or trefoil group at 1m intervals.
- Space multiple cables in trenches in accordance with BS 7671.
- Ensure installation radii and permanent bending radii are not less than those recommended by the manufacturer.
- Do not lay cables to BS 7211 or BS EN 50525 direct in the ground.

PR_65_70_36/48_00.4090A CABLE INSTALLATION IN CONDUIT AND TRUNKING:
- Install cables so that they are orderly and capable of being withdrawn.
- Arrange single core wiring generally using the loop-in method.
- Trunking
  - In vertical trunking provide pin racks at 3m intervals. Use ties at 2m intervals for all wires of the same circuit reference. Mark ties with circuit reference number at 10m intervals.
- Conduit
  - Provide cable clamps in conduit boxes at 10m intervals in vertical conduit.
  - Allow for full range of movement at building construction movement joints. Make all joints to wiring at terminal blocks in conduit boxes.

PR_65_70_36/48_00.4110A CABLE INSTALLATION:
- Dress cables flat, free from twists, kinks and strain, and align parallel to building elements. When glands and clamps are not required, take sheathing of cables into accessory boxes and equipment and protect against abrasion using grommets or similar sharp edge protection.

PR_65_70_36/48_00.4120A CABLE EMBEDDED INSTALLATION:
- Ensure plaster or screed over cable is a minimum of 12mm. Protect embedded cables with metal capping or PVC oval conduit.

PR_65_70_36/48_00.4140 CABLE INSTALLATION - FLEXIBLE CORDS:
- Grip cords securely at connections. Where they do not form an integral part of the connected accessory or equipment, provide separate proprietary cord grips.

PR_65_70_36/48_00.4150A CABLE JOINTING AND TERMINATING GENERALLY:
- Ensure all joints and terminations are made by appropriately qualified cable jointers, using jointing materials, components and workmanship recommended by the cable manufacturer and the jointing accessory manufacturer. Install cable glands in accordance with BS 6121-5.

Cold pour resin and heat shrink joints.
- Cut all cable ends immediately prior to jointing or terminating. Seal cables left unconnected for more than 24 hours to prevent the ingress of moisture. Seal plastic sheathed cables using proprietary shrink on end caps. Seal lead sheathed cables by a plumbed dressed lead cap with an airspace to allow conductor movement.
- Strip cables to bring out the cores and expose conductors, for the minimum length required for connection, to leave no exposed length of conductor after termination. Ensure that strands are not damaged when stripping cable cores. Twist strands together. Do not reduce number of strands. Secure all strands at terminations.
- Clean armour thoroughly prior to jointing or terminating.
- At connections to equipment and switchgear without integral cable clamping terminals, use compression or solder type lugs for bolted terminal connections, of correct bore.
- Form all compression connections to components using tools that cannot be released unless the correct degree of compression has been achieved.
  - Install and inspect compression and mechanical connectors on conductors in accordance with BS EN 60228 and BS 7609.
- Bolt core terminations with lugs to equipment using washers or proprietary shakeproof devices.
- Do not bunch more than three cores at clamping terminals or bolted connections.
- Mark cable conductor phasing, or other core identification, at each end of all cables, and at all joints, maintaining consistency of marking with any existing system.
- Connect all cores, including multicore cable spare cores, at all joints and terminations. Bond any unused cores or multicore cables to earth at both ends, unless otherwise indicated.

8.0 PR_65_70_11_00 SUPPORT COMPONENTS - CABLES

PR_65_70_11_00.1000 GENERAL

Install all cables in accordance with manufacturer's recommendations.

PR_65_70_11_00.1010 APPLICATION:
- Cables referred to in this section are only those types that can be installed without further mechanical protection.

PR_65_70_11_00.2010A CABLE SUPPORTS AND FINISHES:
- Support all cables throughout their length using cable tray, cable racking, special support systems; or cleat, clip fixing direct to building fabric as indicated on the drawings/schedules.
- Ensure tray, racking and special support systems are continuous and firmly fixed to building fabric.
- Allow 25% spare capacity space for additional cables.
- Ensure cable support system allows for spacing in accordance with BS 7671 for the design current of the cable.
- Ensure finish for all support components, fixings, hangers and accessories is as cable support system or as specified.

PR_65_70_11_00.2020A CABLE SUPPORT SYSTEM - PERFORATED TRAY:
- Type - Flanged or return flanged.
- Perforations
  - Admiralty pattern for light or medium duty; GDCD pattern standard 23; or manufacturer's standard pattern.
- Fittings
  - Use factory made fittings throughout of same material, type, pattern, finish and thickness as cable tray.
  - Use reducers, inside angles and outside angles as manufacturer's standard.
  - Use flat bends, equal tees, unequal tees and crosses with corners gusseted.
  - Join lengths of tray and fittings using manufacturer's standard shouldered ends, fish plates, or couplers, with galvanized or zinc plated slotted domed head `roofing' bolts, nuts, washers and shakeproof washers.
  - Ensure electrical continuity by fitting earth straps to all joints
- Material
  - Hot rolled steel galvanized after manufacture to BS EN 10327 or BS EN 10143.

PR_65_70_11_00.2025A CABLE SUPPORT SYSTEM - PROPRIETARY CABLE TIES:
- Two piece cable tray pattern, on cable tray only. Wrap round self-locking non releasable pattern on everything except cable trays.

PR_65_70_11_00.2025C CABLE SUPPORT SYSTEM - TWO WAY SADDLES:
- Bright copper for unsheathed mineral insulated cables. PVC covered bright copper for sheathed mineral insulated cables.

PR_65_70_11_00.2025D CABLE SUPPORT SYSTEM - CABLE BASKET:
- Proprietary system of wire basket with compatible jointing and fixing accessories.
- Use factory made fittings throughout of same material finish as basket, for risers, bends, reducers, tees, crosses and drop outs.
- Ensure electrical continuity by fitting earth straps to all joints

PR_65_70_11_00.3010 CABLE TRAY INSTALLATION:
- Support from building fabric with minimum clearance behind of 20mm. Install fixings at regular intervals to prevent visible sagging when loaded, with maximum spacing 1.2m and 230mm from fittings.
- Keep cutting of cable tray to a minimum. Cut along a line of un-perforated metal. Make good finish with zinc rich paint, primer and top coat, or two pack epoxy paste, as appropriate to tray material and finish.
- Fit holes cut in tray for passage of cables with grommets, bushes or other lining.
- Install all bolts, fixings and hangers with threaded portion away from cables. Cable routes to cross at right angles or spacing to BS EN 50374.

PR_65_70_11_00.3020A CABLE CLEATS, TIES, SADDLES AND CLIPS INSTALLATION:
- For cables on horizontal tray use ties for each circuit. Use tie manufacturer's special tensioning tool where available. Crop off tie ends.
- For cables on vertical tray use cleats bolted to tray for paper, plastic or elastomeric insulated cables and saddles or clips for mineral insulated cables. Use cleats sized to grip cables firmly without undue pressure or strain on cable, but preventing slipping.
- For cables on vertical or horizontal rack use proprietary fixings to rack for paper, plastic or elastomeric insulated cables and saddles or clips for mineral insulated cables. On continuous flat surfaces of wood, plaster, brick etc.
  - Use polypropylene surface fixing clips with prefixed hardened steel pin for PVC insulated and sheathed cables and sheathed or bright mineral insulated cables. Use round or flat or flat twin pattern as appropriate, manufactured specifically for cable being fixed.
  - Use one hole 'P' clips or two way saddles of bright copper for unsheathed mineral insulated cable. Use PVC covered for sheathed mineral insulated cables.
- Space cleats, ties, saddles and clips
  - As Appendix G of Guidance Notes `Selection & Erection' published by the IET.

9.0 PR_60_70_48_00 LV SWITCHGEAR AND DISTRIBUTION BOARDS

PR_60_70_48_00.2020B WALL MOUNTED ASSEMBLY CONSTRUCTION:
- Enclosure standard - BS EN 62208.
- Terminals for external conductors, main power circuits
- Accommodate cross-sectional area of copper cables in accordance with BS EN 60439-1.
- Terminals for external conductor, control and auxiliary circuits
- Terminal block. Mounting as manufacturer's standard.
- Size of neutrals on three phase supplies - Full sized.
- Degree of protection to BS EN 60529, IP31 for assembly.
- Accessibility for inspection
  - Arrange for following operations to be performed when assembly is in service and under voltage
  - Visual inspection of switching devices and other apparatus; settings and indicators of relays and releases; conductor connections and markings.
  - Adjusting and re-setting of relays, releases and electronic devices.
  - Replacement of fuse links and indicating lamps.
  - Fault location by voltage and current measuring.
- Accessibility for maintenance
  - Provide space between functional unit or group and adjacent functional units or groups. Provide retainable fastening means for parts likely to be removed for maintenance.
  - Removable parts and withdrawable parts as manufacturers' standard.
- Input voltage variations for electronic equipment supply - BS EN 60439.
- Supply frequency deviation - BS EN 60439.
- Mounting - Wall mounted.

PR_60_70_48_00.2030A ENCLOSURE FINISH:
- Apply high standard finish to enclosure and supporting metalwork. Degrease metal and remove rust prior to applying finish.
- Comply with paint manufacturer's recommendations regarding preparation, stoving times, temperatures, mixing of finishes, application and coat thickness.
- Finish - Manufacturer's standard.
- Colour – To Consultant's specification

PR_60_70_48_00.2090D UTILISATION B, MCCB AIR BREAK CIRCUIT BREAKERS:
- Provide circuit breakers in accordance with BS EN 60947. Ensure that uninterrupted current rating indicated applies when unit is enclosed and in operating environment at rated operational voltage.
- Standard - BS EN 60947-2
- Characteristics of circuit breakers
  - a.c. Interrupting medium - Air.
  - Rated and limiting values for the main circuit.
  - Rated voltage (Volts) - operational, 400.
  - Rated frequency 50 Hertz.
  - Circuit breaker Utilisation category - B.
  - Enclosure degree of protection IP 31.
  - Circuit breakers and switches
  - Provide manual closing air-break circuit breakers, (MCCB).
- Closing mechanism
  - Independent manual spring operated.
- Provide automatic shutters to cover all live contacts when circuit breaker is isolated, withdrawn or removed from housing.
- Provide a padlock to lock circuit breaker in isolated/withdrawn position, and to lock automatic shutters covering live contacts when removed from housing.
- Provide moulded case circuit breakers with provision for safe maintenance

PR_60_70_48_00.2100A SWITCH DISCONNECTORS:
- Supply switch disconnectors in accordance with BS EN 60947.
- Standard - BS EN 60947-3
- Details of equipment - Switch-disconnector.
  - a.c. Interrupting medium - Air.
- Rated and limiting values for the main circuit.
  - Rated voltage (Volts) 230/400.
  - Rated frequency 50 Hertz.
  - Utilisation category - AC 23A.
  - Enclosure degree of protection IP 65.
  - Fit each switch with facility to padlock in OFF position.
  - Provide switches with auxiliary contacts as indicated. Where switches isolate final connections between a starter and its motor, fit one set of contacts to open starter coil circuit when switch is opened.

PR_60_70_48_00.2150A INSTRUMENTS AND METERS:
- Standards
  - Comply with BS 89 and BS EN 60051-1 for voltmeters, ammeters, watt meters, frequency indicators and power factor indicators.
  - Comply with BS 7856, BS EN 62053-11, BS EN 62053-22 or BS EN 62053-21 for kWh meters, kVA and kW maximum demand meters and polyphase reactive kVA meters, and BS EN 62053-23 for KVAhr meters.
- Protect wiring to voltmeters by separate fuses.
- Protect potential coils of watt meters, frequency indicators, power factor indicators and kWh meters, kVA and kW maximum demand meters and polyphase reactive kVA meters by separate fuses.
- Supply instruments and meters suitable for flush mounting and type, size and accuracy as indicated.
- Ensure that indicating scales for all instruments comply with BS 3693.
- Supply so that normal indication is 50% to 75% of full scale deflection.
- Completely segregate all instruments in instrument compartments. Panel mount meters on front of instrument compartment.

PR_60_70_48_00.2160A ELECTRICAL RECORDING INSTRUMENTS:
- Provide electrical recording instruments in accordance with BS EN 61143

PR_60_70_48_00.2210A DISTRIBUTION BOARDS:
- Comply with BS EN 60439-3 as appropriate. Make internal separation Form 1 unless otherwise indicated. Make fuse boards fully shrouded. Fit each distribution board with a 2 or 4 pole isolating switch.
- Install busbars in same position relative to their fuse carriers or miniature circuit-breakers (MCBs) for each pole. In TPN distribution boards supply neutral busbars with one outgoing terminal for each outgoing circuit.
- Provide a multi-terminal earthing bar for circuit protective conductors for both insulated and metal-cased boards, with one terminal for each outgoing circuit. Connect directly to earthing terminal without dependence on exposed conductive parts of enclosure.
- Identify each fuse way and MCB way by numbering. Identify each terminal on neutral busbar and earthing bar with its respective fuse way or MCB way.
- Where specific ratings are indicated incorporate fuses or MCBs, otherwise leave ways blank for future additions.
- Enclosures finish
- Finish - Manufacturer's standard.
- Colour – To Consultant's specification

PR_60_70_48_00.2200A FUSES:
- Supply cartridge fuse links including fuse carrier, bases and associated components that comply with BS EN 60269 (BS 88), fusing factor category gG, unless otherwise indicated.

PR_60_70_48_00.2230A MINIATURE CIRCUIT BREAKERS:
- Standard - BS EN 60898-1.
- Supply miniature circuit-breakers with voltage and current ratings, type according to instantaneous tripping current, energy limiting class, category of duty and frequency in accordance with BS EN 60898-1.

PR_60_70_48_00.2240A RESIDUAL CURRENT DEVICE:
- Comply with BS EN 61008. Supply residual current devices (RCCDs) with rated voltage, rated current, rated tripping current, rated tripping time and rated breaking capacity as indicated.
- DC component
  - Ensure dc component does not affect operation.
- Overcurrent protection
  - Fit RCDs with integral overcurrent protection.

PR_60_70_48_00.2245 COMBINED RESIDUAL CURRENT/OVER CURRENT OPERATED CIRCUIT BREAKERS:
- Supply combined residual current/over current operated circuit breakers (RCBOs) in accordance with BS EN 61009.

PR_60_70_48_00.2250 CABLE TERMINATIONS:
- Ensure that switchgear and distribution boards are provided with facilities to terminate size, number and type of cable indicated. Where necessary use fabricated steel extension boxes (header trunking) for glanding large and multiple cables.
- Provide non-ferrous metal glanding plates for single core cable terminations.

PR_60_70_48_00.3010 FIXING:
- Fix all equipment independently of wiring system. Use cadmium or zinc electroplated bolts, nuts, washers and screws.

PR_60_70_48_00.3020 MOUNTING HEIGHT:
- Mount single items of equipment 1450mm above finished floor level to centre of equipment, unless otherwise indicated.
- Arrange groups of equipment, other than floor mounted assemblies, so that all parts of equipment requiring access for operation or maintenance are at least 500mm and no more than 2000mm above finished floor level, unless otherwise indicated.

PR_60_70_48_00.3030 ACCESS:
- Ensure that clearance in front of switchgear and control-gear is not less than 1m to provide sufficient throwback space.

PR_60_70_48_00.3040A MARKING AND DRAWING:
- Number terminals, cables and component parts to correspond with manufacturer's certified drawings.

PR_60_70_48_00.3050 CABLE TERMINATIONS:
- Terminate paper-insulated cable by means of switchboard manufacturer's standard compound filled cable boxes.
- Terminate PVC SWA PVC and MICS cables inside enclosure by securing cables to switchboard with glanding plates or glanding brackets; and outside enclosure with glanding plates or fabricated steel extension boxes (header trunking).

PR_60_70_48_00.3060A INSTALLATION AND COMMISSIONING:
- Install and commission switchgear and control gear in accordance with the appropriate standard and the manufacturer's recommendations. Include CT Polarity check in commission tests.

10.0 PR_65_70_46_00 LIGHTNING PROTECTION AND EARTHING COMPONENTS

PR_65_70_46.1010 MATERIALS GENERALLY:
- Use materials and installations methods in accordance with BS EN 62305, BS 7671, BS 7430, Electricity Safety, Quality and Continuity Regulations and Local Electricity Supply Authority Requirements as appropriate.

PR_65_70_46.2010A CONDUCTORS FOR LIGHTNING PROTECTION SYSTEMS - HORIZONTAL AIR TERMINATIONS:
- Use - Horizontal air termination or down conductor.
- Minimum dimension - BS EN 62561-2, BS 62305:2011
- Form - Strip.
- Material - Copper, annealed.
- Coverings - None or PVC.
- Accessories - Ridge Saddle; conductor clips - non-metallic; glazing bar holdfast; slate holdfast; back platebackplate holdfast; all accessories sized to suit conductors.

PR_65_70_46.2010B CONDUCTORS FOR LIGHTNING PROTECTION SYSTEMS - SELF SUPPORTING AIR TERMINATIONS:
- Use - Air termination, vertical.
- Minimum dimension - BS EN 62561-2, BS 62305:2011
- Form - Rod.
- Material - Copper, hard drawn.
- Coverings - None.
- Accessories - Terminal base; ridge saddle; rod brackets; rod to tape coupling.

PR_65_70_46.2010C CONDUCTORS TO EARTHING SYSTEMS TO BS 7430:
- Use – Earthing Conductor
- Minimum dimension - BS 7430, current density 50A/mm2.
- Form - Strip.
- Material - Copper, annealed.
- Coverings - None.
- Accessories - Conductor clips, metallic.

PR_65_70_46.2020A LIGHTNING PROTECTION CONDUCTOR JOINTS:
- First Conductor
  - Form - strip; material - copper.
  - Dimensions - To BS EN 62561-2, BS 62305:2011
- Second conductor
  - Form - rod; material - copper.
  - Dimensions - To BS EN 62561-2, BS 62305:2011
- Solid joint - Brazed or welded, thermic.
- Disconnecting test joint
  - Square clamp, oblong clamp, plate clamp or screw-down clamp.

PR_65_70_46.2020B EARTHING SYSTEMS CONDUCTOR JOINTS:
- First Conductor
  - Form - strip; material - copper.
  - Dimensions - For conductor current density 50A/mm2 earthing systems.
- Second conductor
  - Form - rod; material - copper.
  - Dimensions - For conductor current density 50A/mm2 earthing systems.
- Solid joint - Brazed or welded, exothermic.
- Disconnecting test joint
  - Square clamp, oblong clamp, plate clamp or screw-down clamp.

PR_65_70_46.2030A TAPE FIXING DEVICES:
• Secure bare conductor tape to structure with fixing devices which avoid piercing tape and ensure 3mm (minimum) clearance of tape from structure, at 450mm maximum, centres.
• Material for lightning protection systems
o Non-conducting.
• Material for system earthing
o Bronze.

PR_65_70_46.2040B ROD EARTH ELECTRODES FOR SYSTEM EARTHING:
• Standard - BS 7430.
• Form - rod with female thread each end.
• Dimensions
o Rod Diameter - 15 mm - nominal.
o Rod Length - 2.4m (2 x 1.2) minimum.
• Earth electrode couplings
o Use high strength driving cap in contact with driven rod and couplings of compatible material fully enclosing the rod threads.
• Interconnect electrodes using bare copper tape 25mm x 6mm.
• Earth electrodes in drawpits
o Provide concrete cover, permanently labelled, for electrodes installed through cable drawpit bases.
• Main earth conductor connection
o Connect main earth conductor to first electrode using heavy duty purpose made silicon aluminium bronze body conductor clamp and high tensile phosphor bronze bolt.
• Material, minimum size as BS 7430 Table 4 - Copper.
• Accessories
o Rod to tape clamp. Sized to suit earth rod and connector.

PR_65_70_46.2040D BUILDING OR STRUCTURAL ELEMENT EARTH ELECTRODES FOR SYSTEM EARTHING:
• Standard - BS 7430, BS 62305:2011
• Form - Building or structural element, as shown on the drawings.
• Interconnect electrodes using bare copper tape 25mm x 6mm.

PR_65_70_46.2060A EARTH ELECTRODE CLAMPS:
• Connect tape to electrode head using heavy duty purpose made silicon aluminium bronze body connector clamps or leaded gunmetal body connector clamps, and high tensile phosphor bronze bolts to BS EN 12163.

PR_65_70_46.2070A EARTH ELECTRODE INSPECTION FACILITIES:
• Provide enclosure for each connection between earth conductor and associated earth electrode system. Install so that top is flush with finished ground or floor level. Ensure enclosure provides adequate access for testing purposes. Provide pit details for builders work.
• Labelling - Wording, Earth.

PR_65_70_46.2090A MAIN EARTHING CONDUCTOR
• Provide main equipotential bonds in accordance with BS 7671 and any local Distribution Network Operator requirements.
• Armour of SWA cable is not to be use as main earthing conductor
o Material - Insulated cable, single core to BS 6004.
• Use no joints in main earthing conductor.
• Size 70mm2 unless specified.

PR_65_70_46.2090A MAIN EQUIPOTENTIAL BONDS:
• Provide main equipotential bonds in accordance with BS 7671 and any local Distribution Network Operator requirements.
• Armour of SWA cable is not to be use as main equipotential bond.
o Material - Insulated cable, single core to BS 6004.
• Use no joints in main equipotential bonds.
• Size 50mm2 unless specified.

PR_65_70_46.2100A SUPPLEMENTARY EQUIPOTENTIAL BONDS:
• Provide supplementary equipotential bonds to BS 7430, BS 7671 and BS EN 50310. Do not use joints in supplementing bonds.
o Material - Insulated cable, single core to BS 6004.

PR_65_70_46.2110A CIRCUIT PROTECTIVE CONDUCTORS:
• Material
o Insulated cable, single core to BS 6004 as indicated; metallic screwed conduits (excluding flexible); metallic trunking with tinned copper links; armouring and/or metallic sheathing of armoured cables or integral conductor of multi-core cable.
• Size
o Provide protective conductors sized in accordance with BS 7671 (IET Regulations) 543.1.4 and Table 54.7.

PR_65_70_46.2120 EARTHING CLAMPS:
• Use clamps complying with BS 951, for bonding pipes and earthing of conductors. For bonding of lead sheathed cables use soldered or spring clamps.

PR_65_70_46.2130A MAIN EARTH BARS:
• Material
o Manufacture earth busbars from hard drawn, tinned, high conductivity copper bar.
• Substation Earth busbar
o 75 x 13mm cross section 600mm minimum length.
• Main Earth Terminal busbar
o 25 x 6 mm minimum for incoming live conductor not exceeding 50mm and 50 x 6 mm minimum for incoming live conductor over 50mm2.

PR_65_70_46.2140 TEST LINKS:
• Provide two test links, in connections between main earth conductors and earth busbar. Fabricate each from two additional sections of earth busbar. Mount one section on stand-off insulators matching earth busbar; use remaining section as removable test link. Secure high tensile brass studs to fixed sections of busbar and drill corresponding clearance holes in test links and provide brass washers, nuts and locking devices to secure frame/neutral earthing and test links.

PR_65_70_46.2150 LUGS/TAGS:
• Provide lugs or tags to enable connection of bonding conductors to equipment earth terminals.

PR_65_70_46.2160 PROTECTIVE CABLE TERMINATIONS:
• For bolted connections use crimp type lugs compressed by automatic tool to achieve correct pressure and crimp depth.

PR_65_70_46.2170 PROTECTIVE CONDUCTOR WARNING NOTICES/LABELS:
• Provide a permanent label durably marked in letters 4.75mm minimum height "SAFETY ELECTRICAL CONNECTION - DO NOT REMOVE", in visible position, at each bonding conductor connection to extraneous conductive parts.

PR_65_70_46.2180 MAIN EARTH CONDUCTOR - WARNING TAPES:
• Provide green/yellow PVC tapes labelled "EARTHING CONDUCTOR" over complete external lengths of main earth conductors at 300mm depth below finished ground.

PR_65_70_46.2190 EARTH BAR LABEL:
• Label earth bar "SAFETY ELECTRICAL CONNECTION - DO NOT REMOVE" with wall mounted laminated plastic tablet engraved in 10mm high red letters on white ground.

PR_65_70_46.3010 CLEAN EARTH DISTRIBUTION:
• Install clean earth distribution in double insulated cables from earth electrodes to equipment points. Mount all busbars with insulators and separate from other earthing systems.

PR_65_70_46.3020 DISSIMILAR METALS:
• Ensure, where dissimilar metals are used for system, that purpose made jointing materials are used such that corrosion and deterioration of the electrical connection are not caused. Ensure bonding connections to other metal parts of building are electrolytically compatible with those metal parts. Use the guidance given in BS 7430 Table 8 when bonding dissimilar materials.

PR_65_70_46.3030A COPPER TAPE JOINTS:
- Provide waterproof protection at joints subject to moisture.
- Joint copper tapes by brazing, using zinc-free brazing metal with melting point at least 600oC or thermic welding.

PR_65_70_46.3030B ALUMINIUM TAPE JOINTS:
- Provide waterproof protection at joints subject to moisture.
- Joint aluminium tapes by welding to BS EN 1011-4.

PR_65_70_46.3040 STRANDED CONDUCTOR JOINTS:
- Provide waterproof protection at joints subject to moisture.
- Joint copper stranded conductors with compression joints to BS EN 61284.

PR_65_70_46.3050A PROTECTIVE CABLE TERMINATIONS:
- For bolted connections use crimp type lugs compressed by automatic tool to achieve correct pressure and crimp depth.
- Make connections between tape and equipment using high tensile grade brass bolts with brass nuts, washers and locking devices. Use phosphor bronze bolts, nuts and washers where connections are liable to corrosion.

PR_65_70_46.3060A EARTH ELECTRODES:
- Location
  - o Locate electrodes not less than 2m distant from building/structure protected, and away from telecommunication and pilot cables and metallic fences.
- Driving
  - o Drive rods vertically into ground with purpose designed electric hammer. (Where impenetrable strata encountered at shallow depth, drive at 30o to horizontal).
- Depth of rod
  - o 2.4m minimum below finished ground surface.
- Depth of Electrode heads
  - o Locate electrode heads just below ground level.
- Spacing
  - o Where electrodes are installed in a group ensure minimum distance between electrodes is twice depth of rods. Where rods for clean earth are installed ensure distance from any other system rods is six times depth of clean rods.
- Tape Depth
  - o Install interconnecting or electrode tape 750mm below finished ground level, rising vertically at each electrode.
  - o Connect groups of electrodes to main earth conductor via bolted link in inspection pit as BS 7430 for test purposes.

11.0 AC_70_65_00_00 TESTING AND COMMISSIONING OF ELECTRICAL SERVICES

The electrical contractor is responsible for the inspection and testing of the electrical services. All electrical services are to be certified in accordance with the requirements laid out within BS7671 the Wiring Regulations and the NECIEC.

AC_70_65_00_00.2010A INCORPORATED EQUIPMENT CHARACTERISTICS:
- Obtain and use information from manufacturers of equipment provided.
- Use information provided, for equipment supplied by others and incorporated into installation.

AC_70_65_00_00.2020A PROSPECTIVE SHORT CIRCUIT CURRENT:
- Determine values of IP by measurement, unless other means are indicated. Determine IP at all necessary points within installation to confirm correct equipment selections.
- Obtain from supply undertaker written confirmation of maximum and minimum values of IP at origin of installation. Adjust subsequent measured values of IP accordingly.

AC_70_65_00_00.2030A INITIAL VERIFICATION:
- Carry out detailed inspection to verify the requirements of BS 7671, Chapter 64.

AC_70_65_00_00.2040A TEST EQUIPMENT AND CONSUMABLES:
- Provide test equipment and consumables to complete tests satisfactorily, and to retest any failed installations following corrective measures.
  - o Test equipment quality assurance requirements to BS EN ISO 10012.

AC_70_65_00_00.2050A TESTING
- Carry out in the same order as published the tests required by BS 7671, Section 643 for New Installation or Altered or Added Installation as appropriate.

AC_70_65_00_00.2070A EARTH FAULT LOOP IMPEDANCE:
- Use 25 A test current. Measure and record source impedance (ZE).
- If alternative LV supply arrangements are available, measure ZS when using supply with highest impedance.
- Measure ZS with main equipotential bonding conductors connected. Do not summate values of several parts of each loop.

AC_70_65_00_00.2080 SETTINGS AND ADJUSTMENTS:
- Confirm characteristics and settings of protective devices are within maximum and minimum specified tripping times. Check correct operation of devices. Confirm interlocks and sequences operate safely and as indicated.

AC_70_65_00_00.2120A FIRE DETECTION AND ALARM INSTALLATIONS:
- Carry out site testing and inspection and provide test certificates for fire detection and alarm systems in accordance with BS 5839-1.

AC_70_65_00_00.2130 CALIBRATION:
- Provide current certificates of calibration for all instruments used during test procedures. Record particular instrument identity on record sheets.

AC_70_65_00_00.2140A CERTIFICATION AND REPORTING:
- Complete and hand over to the Client a Completion and Inspection Certificate to BS 7671 Appendix 6 for New Installation or Altered or Added Installation as appropriate.

AC_70_65_00_00.2150A INSTALLATION CERTIFICATES:
- Provide installation certificates for electrical installations in accordance with BS 7671 (IET Regulations).
- Record details of departures from BS 7671 (IET Wiring Regulations) on certificate.
- Provide copies of calculations justifying departure from BS 7671 (IET Wiring Regulations) and attach to certificates.
- Signed installation certificated must be in place prior to practical completion.

AC_70_65_00_00.2160 RECORDS:
- Record all results and instrument readings on approved Record Sheets and hand over to the client two copies for each inspection and test.
- Hand over copies of complete Record Sheets to
  - o Client
- Provide copies of Record Sheets
  - o 2

AC_70_65_00_00.3010 CONDUCTIVE PARTS:
- Test conductive parts simultaneously accessible with exposed conductive parts of extraneous conductive parts. Establish that they are either not an extraneous conductive part, or that they are reliably connected by metal to main equipotential bonding.
- Confirm conductive parts which are not extraneous conductive parts are separated from earth by an impedance greater than 50,000 ohms. Confirm other conductive parts are bonded to equipotential zone earth bar by an impedance not exceeding 0.1 ohms.

AC_70_65_00_00.3040A LV BURIED CABLES:
- Test continuity and insulation of buried cables immediately after back-filling. Test continuity and insulation of buried cables prior to handover.

12.0 PR_20_29_00_00 FIXING TO BUILDING FABRIC

PR_20_29_00_00.1010 PREPARATION:
- Mark-out, set-out and firmly fix all equipment, components and necessary brackets and supports.

PR_20_29_00_00.1020 MANUFACTURER'S DRAWINGS:
- Use manufacturer's drawings and templates for purposes of marking and setting out.

PR_20_29_00_00.1030 FIXINGS:
- Ensure structure and fixings are suitable for items to be fixed.

PR_20_29_00_00.1040 LOADING DETAILS:
- Provide loading details for all fixing types.

PR_20_29_00_00.1050 BUILDING-IN BY OTHERS:
- Provide all necessary assistance to enable any item of building-in type to be built in by others.

PR_20_29_00_00.1060 SIZE OF FIXING:
- Use largest size of bolt, screw or other fixing permitted by diameter of hole in item to be fixed.

PR_20_29_00_00.1070 GREASING OF FIXINGS:
- Ensure all bolts, screws or other fixings used are greased or lubricated in accordance with manufacturer's instructions.

PR_20_29_00_00.2010 STANDARDS:
- Ensure that fixings such as expanding anchors are tested for tensile loading in accordance with BS 5080-1.

PR_20_29_00_00.2020 PLUGS:
- Use plugs of suitable size and length for fixings. Use plastic, fibrous or soft metal non-deteriorating plugs to suit application. Do not use wood plugs.
- Ensure that when screw is in place, threaded length is in plug. Ensure plugs used for screw fixing are set-in to correct depth prior to final tightening.

PR_20_29_00_00.2030 SCREWS:
- Use screws to BS 1210. Generally use sherardized steel wood screws for fixing to concrete, brickwork or blockwork.
- In damp or exposed situations use greased brass wood screws.

PR_20_29_00_00.2080 NON-PENETRATIVE SUPPORT SYSTEMS FOR ROOF MOUNTED EQUIPMENT:
- Obtain approval prior to using non-penetrative support systems for roof mounted equipment.

PR_20_29_00_00.3010 DRILLING:
- Drill holes squarely. Use drills of requisite size and depth, and appropriate to fabric. Do not flame-cut holes in metal work.

PR_20_29_00_00.3050 FIXING TO TIMBER RAILS:
- Fix equipment, brackets and supports by drilling hole through timber rail and fixing with bolt, back plate, washer and loose nut.

PR_20_29_00_00.3060A FIXING TO HOLLOW STUD/TILE/BLOCK WALLS:
- Fix equipment, brackets and supports where there is access at rear of wall, by drilling hole through wall and fixing with bolt, back-plate, washer and loose nut.
- Fix equipment, brackets and supports where there is no access at rear of wall, drill hole and use screw anchor type fixing or gravity type toggle fixing.

PR_20_29_00_00.3070A FIXING TO CONCRETE, BRICKWORK OR BLOCKWORK:
- Fix equipment, brackets and supports using wood screws in plugs or, as appropriate, drill holes and fix using steel bolts of grouted bolt type or expanding bolt type fixing.

PR_20_29_00_00.3080A FIXING TO METALWORK:
- Fix equipment, brackets and supports by drilling holes and fixing using set screws or bolts complete with washers, shakeproof washers and loose nuts.

PR_20_29_00_00.3090A FIXING TO STRUCTURAL STEELWORK AND CONCRETE STRUCTURES:
- Provide manufacturer's information on recommended fixing. Obtain approval for any fixing to structure steel work and concrete structures.
- Generally use proprietary fixings to structural steelwork and concrete structures.
- Obtain approval to cut holes in structural steelwork or concrete structures or weld to structural steelwork.

PR_20_29_00_00.3100 NON-PENETRATIVE SUPPORT SYSTEMS FOR ROOF MOUNTED EQUIPMENT:
- Provide manufacturer's information on recommended support systems.
- Obtain the necessary approvals to use non-penetrative support systems as follows:
  - Ensure that the roof build-up is suitable for non-penetrative supports.
  - Ensure that necessary approval is given by
    - The Structural Engineer
    - The Architect
- Mounting positions
- Roof load management parameters (if known)
  - UDL deck loading kN/m2
  - Maximum Point Loads kN
  - Maximum Base Pressures kN/m2
- Components
  - Provide support manufacturer's information on recommended free-standing systems
    - Support leg type
    - Support frame type
- Roof maintenance building clearance
  - Ensure that future roof maintenance access to roof finish is provided under each support system
  - Minimum building clearance
- Documentation required for Project Team approval:
  - CAD drawings of supports
  - Roof load management calculations
  - O&M documentation
  - Warranty information
- Manufacturer

MAX FORDHAM

nationalgrid

Beacon Tower
Colston Street
Bristol
BS1 4XE

Venture Way
Priorswood Industrial Estate
Taunton
Somerset
TA2 8DE
01823 348593
smtaylor@nationalgrid.co.uk

NGED Reference: 5264603

17/09/2024

Budget Estimate

Scheme No:	1944144
Scheme Version:	1

Dear Mr B Ashby Max Fordham Llp,

Budget Estimate for electricity connection works by National Grid Electricity Distribution (South West) plc ("NGED") for a 69kVA Connection at St Mary Magdalene'S, Stockland Bristol Stockland Bristol, Bridgwater Somerset, TA5 2PZ

Thank you for your recent enquiry. I am pleased to provide an indication of NGED's likely costs to carry out the connection works for you ("the Budget Estimate"). Our estimate for this work is based upon the information you have provided and is shown below.

Estimated Connection Charge

Contestable Works	£3,492.00
Non-Contestable Works	£15,294.00
VAT @ 20%	£3,757.00
Total	£22,543.00

Non-Contestable works are those works that only NGED can undertake. It is possible for you to get someone else to quote for the contestable part of the works. For further information please visit our website:
https://connections.nationalgrid.co.uk/competition-in-connections/

Your supply will have the following electrical characteristics

Voltage	230 / 400 Volts
Phase	Three Phase
Agreed Import Capacity	69kVA
Agreed Export Capacity	0kVA

Please note that the proposed works and estimated connection charge is for **guidance purposes** only and has been derived from a desk-top design exercise. It is non-binding and subject, in particular, to any legal permission, wayleaves and any other consents being successfully obtained. It is based on present day prices. It does not include the cost of any necessary on-site civil works, which should be provided by you at your expense.

Enclosures

Please also find enclosed:

- Our summary document entitled "Budget Estimates - Your Budget Estimate Explained"
- A drawing showing the indicative point of connection (POC) of the new assets to our existing distribution system, in relation to the proposed development.

Competition in Connections

The Budget Estimate is based upon NGED undertaking both the contestable and non-contestable connection works. You are able to seek competitive prices for some or all of the contestable elements.

You have the option to appoint an Independent Connection Provider (ICP) or Independent Distribution Network Operator (IDNO) to carry out some of the connection works, referred to as the Contestable Connection Works. Any connection works that can only be undertaken by NGED are referred to as Non-contestable Connection Works. See our enclosed Budget Estimate guide for more information.

Proposed Connection Works

Our estimate of the connection charge is for providing the following works:

Proposed Works:
3ph supply upgrade. Meter position assumed to be staying the same. High voltage and low voltage overhead line upgrades required.

Please note that these proposals are based upon a desk top provisional investigation and no site visit or detailed study has been carried out.

The estimate does not include costs for any reinforcement or diversionary work that may be required, or for any environmental, or stability studies which may also be necessary, although these are generally only required for larger capacity connections.

Progression to Connection Offer stage

This Budget Estimate is not a legally binding contract, but sets out the amount we reasonably estimate we would require you to pay for the connection works under a formal Connection offer.

If you would like us to undertake a more detailed analysis, including an assessment of any network reinforcement required we can provide a formal Connection Offer. Further information regarding how to apply is provided in our enclosed summary guide.

Upon receipt of your application we will carry out detailed network studies to finalise the design of the connection works (and any associated reinforcement works), and provide a Connection Offer detailing the works required, the associated costs, timescales, payment terms and conditions for the connection.

If you have any queries regarding this Budget Estimate please do not hesitate to contact me via the contact details at the top of this letter.

Yours Sincerely,

Steve Taylor

Planner