1. SCOPE

This Specification outlines SP Energy Networks (SPEN) technical requirements for the construction of SPT pre-fabricated modular buildings.

This is a generic technical specification and it is not designed to cover every eventuality or site-specific situation; however, prior agreement must be obtained by the relevant party in writing from SPEN Engineering Design and Standards for any proposed variations to the guidelines provided in this Specification.

2. ISSUE RECORD

This is a Reference document. The current version is held on the EN Document Library.

It is your responsibility to ensure you work to the current version.

Issue Date	Issue No.	Author	Amendment Details
March 2022	1	Colin Ritchie	First issue of document

3. ISSUE AUTHORITY

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4. REVIEW

This is a Reference document which has a 5 year retention period after which a reminder will be issued to review and extend retention or archive.

5. DISTRIBUTION

This document is not part of a Manual maintained by Document Control and does not have a maintained distribution list but is published to the SPEN internet site.

6. CONTENTS

7. GLOSSARY

Adopt		Transfer of title, ownership, operation and maintenance responsibilities as defined in the adoption agreement
AIS		Air insulated Switchgear
Approved		Equipment which is Approved in accordance with SPEN documents for use or installation on the Company network
ARC		Alarm Receiving Centre operated by Corporate Security or 3rd party
CDM Regulations		Construction (Design and Management) Regulations
Civil		Reference to civil or similar shall mean civil, structural and building engineering and shall apply to the design, manufacture, installation and demolition of all related permanent works
Company		Refers to SP Distribution plc (SPD) /SP Transmission plc (SPT) /SP Manweb plc (SPM)
Equipment		Switchgear, transformers, cables, overhead lines, surge arresters, voltage transformers, current transformers, protection & control, telecommunications, unit substations
High Voltage (HV)		An AC voltage exceeding 1000 volts measured between the phase conductors
Indoor Equipment		Equipment designed solely for installation within a building or other housing where the Equipment is protected against wind, rain, snow, abnormal dirt deposits, abnormal condensation and frost
LED		Light Emitting Diode
LPS		Loss Prevention Standards
Low Voltage (LV)		An alternating current (AC) voltage not exceeding 1000 volts measured between the phase conductors
NGTS		National Grid Technical Specification
Outdoor Equipment		Equipment designed to be suitable for installation out with a building or other housing where the Equipment is not protected against wind, rain, snow, abnormal dirt/salt deposits, abnormal condensation and frost
Pre-Fabricated Modular Building		A building that consists of repeated sections called modules. These are manufactured away from site and then delivering to site and the the prefabricated sections connected together on site to create the modular building
SCADA		Supervisory Control and Data Acquisition

8. RELATED DOCUMENTS

The design and construction of the works shall be in accordance with the relevant Eurocodes and British Standards specific to that design element. This is detailed further in Section 11 'Standards'.

8.1 Specific SPEN Documents

ASSET-01-023		Substation Security Policy
EART-03-002		Technical Specification for Earthing 132kV S/S and above
SUB-01-012		Substation Fire Protection Policy
SUB-01-018		Substation Flood Resilience Policy
SUB-03-025		General Specification for the Civil Engineering and Building Design and Construction of Primary Substations
SUB-03-026		General Specification for the Civil Engineering and Building Design and Construction of 132kV Substations
SUB-03-034		General Specification for the Civil Engineering and Building Design and Construction of 275kV and 400kV Substations

8.2 National Grid (NG) Documents

NGTS 2.10 Series		Generic Electricity Substation Design Manual Civil, Structural and Building Engineering
NGTS 3.10 Series		Generic Technical Specification (Construction) for Civil, Structural and Building Engineering

9. INTRODUCTION

This document outlines SPEN's technical requirements for the design, manufacture, delivery, installation, testing and commissioning of all the elements of work associated with modular control buildings housing indoor electrical plant.

Project specific deviations from the design and build principles and construction details within this Specification will be considered by SPEN where it can be demonstrated that they offer an equivalent or better technical and/or lower risk solution. It is the responsibility of the Contractor to ensure that all such deviations are fully discussed and approved by SPEN Engineering Design and Standards within timescales that do not adversely affect project objectives.

This specification should be read in conjunction with the relevant Civil Engineering Specification documents listed below:

- Construction of Primary Substations SUB-03-025
- Construction of 132kV Substations SUB-03-026
- Construction of 275/400 kV Substations SUB-03-034

9.1 Feasibility

It is important that during the detailed design stage any SPEN or statutory authority requirements highlighted during the feasibility phase and detailed in other referenced documents are given due consideration and are factored into the detailed design.

In order to avoid possible abortive effort and subsequent delay, confirmation should be provided, at the earliest opportunity, of how these requirements are to be met. This should be undertaken by discussing the principles at a Scheme Team meeting in order that any particular site specific issues can be factored into the design proposal. This should ensure that the design principles being adopted are acceptable to SPEN.

10. GENERAL REQUIREMENTS

The Contractor shall be entirely responsible for all aspects of the detailed design, design interface management, manufacture, fit out, delivery and installation of the modular control building.

Where detailed in the contract suitable space and facilities shall be made available by the Contractor to facilitate access for 3rd party contractors to fit out specialist equipment within the modular building.

The detailed design shall be developed in accordance with this specification as well as interface meetings with SPEN. The project should be undertaken in accordance with SPEN's Building Information Modelling (BIM) requirements and a detailed design submission shall be made to SPEN, which includes the following:

- 2D drawings for both the modular building and the building services elements including consideration of Plant, Telecoms and mess facilities;
- A report detailing all relevant design calculations;
- A Technical Specification Document supporting the detailed design drawings;
- A 3D model of the building, in an agreed BIM format,
- Details of any exceptional inspection and maintenance requirements over and above those typically expected with the operation and management of this type of building over its design life.

The Contractor shall make proper provision in the programme for the design, interface management, construction, delivery and erection of the building and shall allow a minimum of 28 days for SPEN to comment on each design and drawing submission, including any proposed site-specific variation to this Specification.

The Contractor shall ensure that cognisance is taken of all such SPEN comments, however, acknowledgment of the Contractor's design submissions by SPEN shall not relieve the Contractor of any design responsibility or any generic functional obligation of this Specification, nor shall it imply any liability on the part of SPEN.

10.1 Consents

Consents matters are outside the scope of this document, but the the SPEN Projects team are responsible for ensuring that all necessary legislation is followed, that all statutory consents and permissions are in place and that any associated applicable conditions are discharged prior to commencement of construction.

Over and above the minimum legislation and statutory consent requirements the following should be considered:

- Land Acquisition or Lease Arrangements;
- Planning Approval;
- Building Control or Building Warrant Approval;
- Fire Authority Approval;
- Party Wall Etc Act, or where this is not applicable, prior formal notification of proposals to adjacent third-parties who potentially may be affected by the works;
- Any other statutory or landowner consents that may apply.

10.2 Functional Design Requirements

The building shall be designed to meet the functional requirements of this specification for a minimum of 40 years. The design and construction detail shall be such that future inspection and maintenance is minimised, with the expected first life major maintenance to most elements at 25 years.

The external painted finish of the building shall be such that an assessment to determine if repainting of the building is required shall be undertaken after a minimum of 15 years.

The building shall be of such material as to provide a consistent finished surface colour throughout its working life and offer an acceptable appearance when viewed from a distance.

The building design shall be such that no water storage tank or water and drainage pipes, are run through the building.

Indicative layout drawings for 3 and 4 module buildings are provided in Section 15.

The detailed design should be undertaken such that, if required, SPEN can expand the building in the future. The modular building design should therefore be flexible such that any future expansion can be carried out with minimal impact on the existing building and electrical infrastructure.

Typically, only one Telecoms room will be required however where a substation is deemed to be a strategic Telecoms site then 2 separate Telecoms rooms with a 1hr fire separation between each room shall be required. This requirement will be identified on a project specific basis and the layout should be agreed with the SPEN Projects team.

The Contractor shall adopt a design methodology that identifies all significant factors in the design and ensures proper attention is given to each factor at every stage in the process. In tendering the Contractor shall prepare a Design Intent Document which shall describe the high-level design philosophy and any assumptions to be adopted, and shall include but shall not be limited to:

- Design and Inter-disciplinary responsibilities;
- Geotechnical and Foundation Design Assumptions;
- Identifying all the load cases that will be considered during design e.g. all dead, imposed, plant, wind and any short circuit forces considered appropriate;
- Load Case Combinations;
- Strategy for delivery to site;

- The design and construction shall ensure that all inspection and maintenance tasks can be carried out safely;
- Design Statement shall identify applicable BS/BSEN documents.

The detailed design submission must be in the English language and shall be prepared in terms of SI units in accordance with the recommendations of applicable BS/BSEN documents. All dimensions shall be in millimetres.

10.3 Structural Design

The structural design of the building is entirely the Contractor's responsibility and shall be prepared, checked and approved to professionally recognised design Quality Assurance procedures by appropriately qualified Chartered Civil or Chartered Structural Engineer. Design calculations shall be included within the CDM Health & Safety File.

10.4 Transport and Delivery

The Contractor shall be responsible for the transportation and laydown of the modular building as detailed in the contract and shall make all necessary arrangements to ensure delivery is as per the programme requirements.

The Contractor shall be responsible for undertaking a Transportation Study to ensure that the modular building can be successfully delivered. The study should also ensure that the units can be safely offloaded and positioned. This study should include relevant method statements and identify any necessary permits that will be required and should identify any temporary works that will be needed to allow delivery of the building.

Erection, installation, decommissioning and dismantling details (i.e. Risk Assessments and Method statements detailing lifting equipment, vehicles used, acceptable weather conditions, etc.) shall be provided to the SPEN project team for comment.

10.5 Site Installation

The standard of workmanship shall be in keeping with industry best practices and shall not be less than that specified by BS 8000.

The Contractor will be required to prepare and submit all construction related safety documentation for review and approval by the SPEN project team prior to commencement of delivery and installation activities.

The Contractor shall be obliged to identify site management and supervision resources to be engaged in the delivery and installation phases of the work. Documentation submittals shall include Construction Phase Plans, Emergency Response Plans, Traffic Management Plans, Lifting Plans and relevant Method statement/Risk assessments for all aspects of works to be undertaken.

The Contractor shall ensure that any sub-contractors engaged to carry out works under this Specification take all reasonable precautions to ensure the safety of all parties concerned with or affected by operations associated with substation construction works.

The Contractor shall be responsible for rectifying, at their own expense, any defective workmanship or any workmanship which does not comply with the specifications or drawings. Should programme be affected by such defective and/or non-compliant work, then the Contractor shall, at their own expense, accelerate the works to ensure that the key delivery dates are met. In addition, the Contractor shall be responsible for repairing and making good any damage to the existing infrastructure resulting from the construction of the new building.

Where required the SPEN Site Manager shall be consulted on the setting up of vehicle access routes and safe working areas as well as methods of work to be adopted, prior to any works starting within the substation. All plant and equipment shall be considered live unless explicitly proven otherwise.

Any works to be carried out underneath overhead lines shall meet all the requirements of Guidance Note GS6 (Avoidance of danger from overhead electric power lines).

Any works to be carried out close to underground services shall meet all the requirements of HSG47 - Avoiding danger from underground services.

10.6 As-Built Information

To allow SPEN to manage their assets, a CDM Health & Safety File, including a Building Asset Management Plan, shall be submitted to SPEN in an agreed electronic format for each project. This file should include As-Built drawings, Operating Manuals and proposed Inspection and Maintenance Schedules covering the design life of the building.

Unless specified elsewhere in this document future inspection and maintenance shall be minimised, with expected first major maintenance works at not less than 25 years.

10.7 Maintenance

The building shall be maintenance free as far as practicable. Within the Building Asset Management Plan the Contractor shall provide details of recommended inspection and maintenance requirements and frequencies for all elements. Specific details of exceptional inspection and maintenance requirements over and above those typically expected should be highlighted within this document.

The external painted finish of the building shall be such that an assessment to determine if repainting of the building is required shall be undertaken after a minimum of 15 years and details of these requirements shall be covered within the Building Asset Management Plan.

The Contractor will be required to return to site at the end of the contract defects liability period to touch up and repair any paint defects and/or areas showing signs of corrosion.

Full details of the materials from which the building is constructed shall be submitted with the as-built information. The materials, fittings, components and other manufactured products or parts thereof whose suitability depends upon proper maintenance or periodic renewal must be readily accessible or positioned so that replacement is reasonably practicable. All recommendations for maintenance and renewal requirements must be specified within the Building Asset Management Plan.

10.8 Quality Assurance

All materials shall be of good quality, suitable for purpose, designed and manufactured such that they provide safe and continuous service and are capable of withstanding the various stresses and onerous conditions to which they may be subjected to on the site of installation without suffering any undue deterioration.

The Contractor shall adhere to the agreed project Environmental & Quality Management plan to ensure that the scope of the project is carried out in accordance with all specified standards, specifications, current legislation, drawings and documents and to ensure that a high standard of workmanship and quality is maintained throughout the project. SPEN shall have the right to inspect any aspect of the construction process.

11. STANDARDS

Building infrastructure in its entirety shall be designed and constructed to comply with the following documents, unless expressly varied by this Specification:

- SPEN Policy documents;
- SPEN Specification documents;
- NGTS 3.10 document suite - Generic Technical Specification for Civil, Structural and Building Engineering;
- European Standards;
- British Standards;
- Codes of Practice;
- Relevant Industry Guidance.

Where associated Standards do not explicitly relate building engineering but nonetheless contain requirements that may impact upon these aspects it shall be the Contractors responsibility to ensure a holistic and compliant overall design solution (e.g. in relation to earthing).

Building Regulations requirements shall apply unless stated or expressly implied otherwise within this Specification. Where literal compliance is not possible the work shall be to a standard agreed with SPEN that takes the Building Regulations as its basis.

12. TECHNICAL REQUIREMENTS

12.1 Building Foundations

The Contractor shall provide SPEN with all the information necessary to design the foundations of the building. This shall include dead and imposed loads along with any other forces considered appropriate. The design shall also indicate the required location of the foundations below the building and provide details of any connections arrangements necessary to fix the building to the foundations.

Unloading and installation of the building at site will be the responsibility of the Contractor as well as securing the building to the foundations provided. Connecting the substation earth mat to the earth connections provided on the building will be carried out by others unless advised otherwise within the contract.

12.2 Access and Egress to the Building

The building shall be designed to take account of the access requirements for the on-site installation of the electrical equipment associated with the operation of the substation, as well as the safe access/egress arrangements for personnel during the normal operation of the site.

The main access/egress to the building will be through the welfare facilities module.

12.3 Cable Entry

Cable entries shall be provided for entry of outdoor cables into the building. These apertures will be distributed as follows: Module 2, Control and Telecoms – 1 x 300mm wide; Module 3, LVAC/Protection - 2 x 600mm wide; Module 4, LVAC/Protection - 2 x 600mm wide.

The preference is for cable entries into the building to be from below ground. Actual positions should be co-ordinated and agreed with the SPEN project team and cowls should be fitted where necessary. Where this cannot be achieved then agreement on alternative proposals, which consider network security should be agreed with SPEN Engineering Design on a project specific basis.

Cables and pipes passing through external walls shall be suitably sealed to prevent the ingress of manufactured or natural gas and shall have a fire resistance appropriate to the building. The cable sealing system shall be approved and listed on the SPEN Approved Equipment Register.

12.4 Plant and Equipment Cable Containments System

Heavy duty cable tray/ladder/racking will be required in each room to facilitate cabling between individual items of plant or equipment. The cable containment system shall run at a high level.

Indicative layout drawings for the internal cable ladder routes are provided in Section 15.

The Contractor shall provide a complete system of cantilever arms and cable ladder system within the Control room, Telecom room and LVAC/Protection room. The detailed design of this should be co-ordinated and agreed with SPEN project team. Additional cable ladder systems shall be provided for vertical cable runs from wall mounted equipment to the high-level cable ladders. The location and type of cable ladder system will be agreed with the SPEN project team.

The minimum dimensions for high level cable ladders within the LVAC/Protection room shall be 600mm wide. In the Telecoms room the minimum width of the cable ladder shall be 300mm.

This cable containment system will not be utilised for installation and connection of building services supplied by the Contractor. A separate trunking system shall be designed and installed for this purpose.

All internal and external cable containment systems entering or exiting Telecoms rooms shall be designed and installed such that they can be sealed using an approved cable sealing system that is listed on the SPEN Approved Equipment Register to provide a 1hr fire separation.

12.5 Equipment loads

The building shall be designed to support the equipment panels without undue deflection/distortion during installation and operation. The floor shall be detailed to incorporate the fixing arrangement necessary for the panels.

The maximum unfactored imposed floor loads may be assumed as:

- Telecoms/LVAC/Protection Rooms – 12kN/m^2
- Welfare and Storage Areas (Mess Room, Toilets, Stores) - 5kN/m^2

The Contractor shall design the building floors based on the loads stated above and factor all loads in accordance with the requirements of BS EN 1991 - Actions on Structures. As detailed in Section 12.1 all reactions shall be provided to the SPEN project team in the form of basic unfactored load cases to allow the building foundations to be designed.

12.6 Drainage

12.6.1 Rainwater

Guttering and down pipes shall be fitted external to the building. No internal downpipes are permitted.

Connections from the building rainwater drainage system to the site surface water drainage system or to a rainwater harvesting system will be co-ordinated and agreed with the SPEN project team.

12.6.2 Foul Water Drainage

Connections from the building foul water drainage system to the site foul water drainage system will be co-ordinated and agreed with the SPEN project team.

12.7 Fire

The building shall be designed to prevent the propagation of fire from either external sources (e.g. outdoor power transformers) or from internal equipment faults.

Internal travel distances within the building to a reasonable place of safety shall not exceed those stated in Table 1.

Room Type Containing	**Building Regulations Purpose Group**	**Travel Distance** One Direction Only (m)	**Travel Distance** More than One Direction (m)
Rooms with Oil filled plant, generators, batteries.	Purpose Group 7 – Place of special fire hazard.	9	18
Other rooms	Plant Room	18	45

Table 1 – *Maximum travel distances to a reasonable place of safety*

A reasonable place of safety shall be:

- A protected stairway enclosure (a storey exit);
- A separate fire compartment from which there is a final exit to a place of total safety;
- The nearest available final exit.

Escape route passages shall have a minimum clearance width of 900mm and the clear opening width and height of doors forming part of this escape route shall not be less than 750mm and 2000mm respectively. Emergency exit doors shall open outwards, external doors by means of panic bars without the use of a key, which shall be clearly marked with a suitable notice explaining the operation of the opening device.

Signage indicating escape routes and self-contained emergency lighting shall be installed.

The use of readily combustible materials within buildings shall not be acceptable; all internal lining and structural surfaces shall be non-flammable material of limited combustibility such that they adequately resist the spread of flame over their surfaces. In addition, but with the exception of external doors, civil fabric finishes internal to the substation building shall meet the requirements of the national building regulations for low surface spread of flame (Class 1) and low fire propagation index. (Class O).

Where required, fire protection to buildings shall be by means of proprietary intumescent paint or Vermiculite-type fireboard which cannot be displaced in the event of a disruptive failure.

Buildings shall be fully compartmented construction with a minimum 1 hour fire segregation, including below floor trenches and ducts passing between rooms, such that spread of fire to other internal areas shall not occur for a minimum period of 1 hour in the event of a fire initiating.

Where required ducts, cables and apertures shall be sealed with an approved cable sealing system that is listed on the SPEN Approved Equipment Register to prevent the spread of fire to adjacent compartments.

Where wall vents are considered essential they shall be the intumescent fire block type that will operate automatically in the event of fire to ensure that there is no spread of smoke or fumes.

Risk assessment with respect to fire and smoke spread to property surrounding substations is entirely the Contractor's responsibility.

Portable fire extinguishers shall not be provided however fire blankets shall be provided to Mess Room areas.

12.8 Security

Substation security is of prime importance and buildings shall be designed and detailed to minimise the potential for vandalism and unauthorised entry. There shall be no windows within the building and the lock mechanisms to doors shall be suited to SPEN site-specific requirements.

Where substation locations are identified as being at risk from vandalism or unauthorised entry the security requirements shall take precedence over considerations of appearance, cost and local environment.

Any additional security measures for the building will be determined by ScottishPower Corporate Security, who shall be consulted on a project specific basis.

Where required the security cabinets for the site shall be located within the Telecoms room.

12.9 Earthing Systems

The earthing system shall be designed in accordance with EART-03-002 and the Contractor shall ensure that the building earthing is co-ordinated and integrated with the compound earthing system and is agreed with SPEN.

All metalwork e.g. panels, cubicles, kiosks etc including the steelwork of buildings, shall be bonded to the main earthing system by a conductor of no less than 70 mm2 cross section. Strip conductor shall be no less than 3mm thick. Doors will be earthed by flexible 70 mm2 braid bonds.

Inside each room an earthing tape ring shall be installed at 300mm below the ceiling fixed to the wall at least every 1.5m. The rings will be connected between each other at two separate points.

Connections from the inner earthing tape ring to the main substation earthing system will be done by others via two separate vertically dropping earthing tapes from each room. Additional vertical drops should be added to connect wall mounted equipment to the rings.

The Contractor shall allow for earthing bonds to the incoming water service mains together with the steel frame structure of the building, ductwork, pipework, telecoms services and lightning protection installations. All bonding shall be no less than 10 mm^2 cross section and green/yellow in colour.

12.10 Building Structure

12.10.1 General

The building in its entirety shall be constructed of materials such that it will have a minimum 40-year design life.

The building shall be:

- Of modular construction with appropriate lifting points such that it can be transported separately and then connected together on site;
- A fully framed freestanding structure of galvanised steel welded construction;
- Fully weatherproofed to protect all sensitive plant and equipment installed within the building, paying particular attention to design and construction details with respect to wind driven rain and surface water run-off;
- Capable of withstanding the effects of any corrosive substance present within or outside the building;
- Sufficiently robust to withstand the effects of all loading combinations that may occur throughout the operational life of the substation, including expected mechanical loadings;
- Capable of achieving sufficient thermal insulation to provide an appropriate internal environment and minimize condensation;
- Where buildings have cables exposed below floor level these shall incorporate galvanised steel mesh or other acceptable anti-vermin barrier between sub-frame and ground level;

- Designed to withstand fire as detailed in this Specification;
- Designed to allow future expansion with minimal impact on the existing building and electrical infrastructure;
- Designed to allow future decommissioning and removal from site, complete with installed equipment. Where the proposed installed equipment exceeds the allowable transport loads this shall be clearly stated in the decommissioning plan, which should also indicate what equipment needs to be removed prior to lifting and transport.

12.10.2 Building and Equipment Layout

Sufficient space shall be provided within buildings to facilitate access for all necessary construction, testing and commissioning, inspection, as well as maintenance and removal activities. The building design shall make allowance for future expansion of the building.

A clear passage of not less than 750mm wide shall be provided behind and around floor-mounted equipment where access for operation, maintenance or replacement of equipment is required and where access for maintenance or redecoration of the building fabric is required.

Where two rows of equipment face each other (control panels and/or switchgear) the clear distance between front faces shall not be less than 1.8m, increased as necessary to facilitate access for test gear and for removal for replacement of equipment.

The clear distance in front of equipment shall provide operators with a full view of instruments and indications to the unit under consideration and to the units immediately to either side and shall not be less than 1.2m.

When clear passage and operating distance are being considered, these shall be clear of obstructions such as wall-mounted equipment or tools, radiators, services, structural projections and the like as well as equipment door openings unless these are either removable or will open through approximately 180°.

12.10.3 Exposed External Surfaces

All exposed external wall surfaces shall be reinforced galvanised steel and be finished with a heavy duty coating that achieves a minimum atmospheric-corrosion category of C5 (very high), as defined in BS EN 12944-2, with a durability performance greater than 15 years. The design and construction details shall be such that future inspection and maintenance is minimised, with the expected first life major maintenance at 25 years.

The finished colour shall be agreed on a project specific basis to align with any planning conditions.

12.10.4 Metalwork

All steelwork shall be hot dip galvanised and where required shall facilitate fixings for earthing tape.

A minimum hot dip galvanised coating thickness of 85 microns is required. Where the galvanised steelwork is exposed the thickness should be increased to ensure it is resistant to a minimum atmospheric-corrosion category of C5 (very high) as defined in BS EN 12944-2.

As required by the National Structural Steelwork Specification for Building Construction, nuts to galvanised bolt systems shall be of a higher grade than the bolts.

Exposed metalwork shall be bonded to the substation earth system with adequately sized insulated conductor.

12.10.5 Floors

The floor and its loading performance characteristics shall be designed and constructed to withstand the manufacturer's loading requirements for electrical plant/equipment installation, operation and

removal as detailed in Section 12.5 'Equipment Loads'. Deflection limitations shall also be taken into consideration.

The exposed external face shall be a galvanised steel sheet with an insulated void space and will be finished as detailed in Section 12.10.3 – Exposed External Surfaces.

Internal floor construction shall be 18mm WBP plywood or flat steel plate supported on a galvanised steel welded beam substructure. This shall be covered with a fully bonded and seam welded 2mm anti-static anti slip PVCu floor covering with silicone beaded seal around the perimeter.

Floors shall be capable of achieving sufficient thermal insulation as necessary to provide an appropriate internal environment and avoid moisture ingress via condensation. As a minimum, floors shall be capable of achieving an overall thermal transmittance 'U' Value as detailed in Table 3. The construction shall allow for equipment to be secured to the floor via coach screws direct through the floor surface.

12.10.6 Walls

All walls shall be designed and constructed such that they present a smooth plumb even surface and are suitable for accepting wall-mounted equipment where necessary. Where required walls shall incorporate joints and additional measures necessary to accommodate and/or resist post-construction movement, internal and external, such that they withstand all loading combinations without undue deflection or distortion.

External walls shall be reinforced galvanised steel with vertical stiffening channels. The internal face should be lined with galvanised steel sheets with an insulated void space.

Walls shall be capable of achieving sufficient thermal insulation as necessary to provide an appropriate internal environment and avoid moisture ingress via condensation. As a minimum, walls shall be capable of achieving an overall thermal transmittance U Value as detailed in Table 3. The construction shall allow for equipment to be secured to the walls via coach screws direct through the floor surface.

All exposed external wall surfaces will be finished as detailed in Section 12.10.3 – Exposed External Surfaces.

Internal partition walls shall be finished both sides in flat galvanised steel sheet. They shall present a smooth plumb even surface suitable for accepting wall-mounted equipment.

Internal wall colour finish is to be typically white.

12.10.7 Roof

The roof shall be dual or mono pitch and designed such that it sheds rainwater in a controlled manner to a land drainage system appropriate to the site. Positive collection of rainwater by guttering and downpipe rainwater goods systems shall not be utilised except where part of storm water harvesting.

The roof shall have a fully capped and sealed standing seam zinc coated steel outer skin construction with stiffening members as required.

The roof shall be designed and constructed such that the roof loading capacity has provision for maintenance access and inspection activities.

The exposed external face shall be a galvanised steel sheet with an insulated void space and will be finished as detailed in Section 12.10.3 – Exposed External Surfaces.

Roofs shall be capable of achieving sufficient thermal insulation as necessary to provide an appropriate internal environment and avoid moisture ingress via condensation. As a minimum, roof shall be capable of achieving an overall thermal transmittance U Value as detailed in Table 3. The construction shall allow for internal cable ladder to be secured as necessary to comply with design criteria.

Internal roof colour finish is to be typically white.

There is no specific requirement for suspended ceilings within the building.

Any waterproofing systems shall include an independent insurance backed guarantee to warranty both materials and workmanship for a minimum period of 25 years. Roofs shall be designed such that they eliminate or protect against the risk of failure due to vandalism or theft; in order to reduce the associated risk that this could lead to a disruptive failure.

12.10.8 Doors

It is essential that SPEN personnel can access and properly secure, on egress, all doors at all times. Any door material/construction type that may bind, shrink, warp, wind, corrode or distort will not be acceptable.

With the exception of bespoke Store Rooms, all doors shall be emergency escape doors, including doors providing access internally, and shall open outwards.

Entry to the building shall be by a personnel door only and the number of doors having external locking to access buildings shall be kept to a minimum consistent with adequate safe operational use (to limit opportunities for unauthorised entry).

Subject to site layout, other external doors may be required to open through 180° and/or incorporate removable panels over to facilitate the installation of plant.

Doors shall be fully weather proofed including appropriate seals to the external perimeter of frames, cover plate to meeting stiles and weathering to lintels over and to thresholds below. Weather bars shall be corrosion resistant construction. Proprietary threshold weather bars shall not exceed 15mm up-stand height to avoid presenting a trip hazard.

Wherever practicable design layouts shall avoid locating emergency escape doors such that they open into high risk areas such as HV switch rooms and AIS compounds with exposed live equipment or into areas where different types of Safety Rules Authorisation may apply.

12.10.9 External Metal Security Doors

External access doors shall be metal security doors, with security locks. These should have a minimum fire resistance rating of 1 hour and have a minimum security rating of C5 as defined in LPS 1175. They shall be finished in a heavy duty coating to provide a system compliant to atmospheric-corrosion category C5 (very high) as detailed in Section 12.10.3 – Exposed External Surfaces.

Manufacture shall take cognisance of the size of any items of plant that will be delivered through the entrance and shall be such that the doors are sealed against water entry but allow discharge of condensation where it is possible for this to occur within.

Plant entry doors and doors only used for emergency escape shall open outwards and have no external entry system, but shall be fitted with a multi point locking system.

12.10.10 Internal Doors

Internal doors shall be proprietary steel fire doors, but these are not required to have locks. Internal doors, including the frames and fittings, to operational areas and to mess rooms shall be certified as having a minimum fire resistance rating of 1 hour and provide a means of emergency egress.

12.10.11 Door furniture

The Contractor is responsible for the supply and installation of all fixed door furniture, which shall be robust heavy-duty construction and corrosion resistant. The Contractor shall agree the type and designated category of user access for locking mechanisms with the SPEN project team.

The project team will provide approved locksmith contact details for the supply of SPT suite locking mechanisms which should be installed prior to delivery to site.

Mechanisms for emergency egress shall be high-security multi-point locking mechanisms operated by means of full width panic bars. Panic bars should not be fitted to doors that give direct access into live compounds. If emergency escape mechanisms are fitted to access doors with external locking then the panic bars must operate when the doors are locked.

If bolts are fitted to fixed leafs they shall be solid heavy-duty 16mm square section bow handle galvanised steel or other similar robust corrosion resistant construction.

Doors shall be fitted with appropriate proprietary garage type restraint stays to fix doors open at 90°; in addition, where access for plant installation is restricted, doors shall be fitted with heavy duty galvanised or stainless-steel cabin hooks systems to restrain doors open at approximately 180°.

Door closers to external doors shall not be acceptable as doors will remain in the open position whilst personnel are working inside.

Hinges shall be stainless steel construction.

Where provided as essential, external pull handles shall be appropriately designed heavy-duty galvanised or similar corrosion resistant construction. Pull handles shall be avoided where these have the potential to assist forced unauthorised entry.

Cognisance shall be given to the physical size of the equipment to be located in each compartment of the building in order that this can be safely transported within the building without undue manhandling of the Equipment. Any double leaf doors shall not have a central pillar.

12.10.12 Signage

Wherever possible, internal and external signage should be fitted to the building modules prior to delivery to site. This shall typically include, but may not be limited to, warning signs, external room identification, emergency exit signs, keep clear signs, door operation signs, information signs and signage relating to lifting points and earth connections as well as any other health and safety signage deemed necessary.

Room identification signs will be manufactured from Traffolyte or similar approved materials. Safety signage shall comply with the appropriate parts of BS5499 or as otherwise agreed with SPEN.

12.10.13 Internal Fixtures and Fittings

All fixtures and fittings shall be factory fitted or delivered along with the modular building components and fitted during installation at site. They shall as a minimum include:

- Mess Room - Table and 4 chairs, sink, soap dispenser, instantaneous water heater, wall mounted fire blanket, cupboards and worktop;
- Toilet - WC, hand wash basin, instantaneous water heater, wall mounted mirror, toilet paper dispenser, soap dispenser and hand drier;
- Control Room - Twin pedestal desk, suitable for A1 layout drawings, ergonomic chair and lockable filing cabinet;
- Telecoms Room - Pedestal desk, suitable for A1 layout drawings, ergonomic chair and lockable filing cabinet;
- Store Room
    - 5 No heavy duty wall mounted angle brackets capable of storing portable earth connections. These should protrude 400mm from the wall and be manufactured with holes at either end to facilitate locking of the portable earths using a padlock and chain;
    - 1 No lockable storage wall bracket to house portable earth rods.

All fittings and fixtures shall be approved by SPEN prior to installation.

13. BUILDING SERVICES

13.1 Building Heating, Humidity and Ventilation

13.1.1 General

Buildings shall be designed to control ventilation, humidity and heating within the following limits for a daily average ambient external temperature range of -10°C and +26°C.

In order to maintain internal room temperatures between the ranges defined in Table 2, heating and ventilation systems shall only operate during periods when the internal room temperature is a direct function of the ambient external temperatures being outside the 'daily average ambient temperature range' as stated above and allowance shall be made for 'thermal lag'. This performance should be proved through modelling and calculation as part of the detailed design stage.

Heat outputs from the free issue equipment, to be housed within the building, shall be provided to the Contractor by the SPEN Projects Team to allow the design of the ventilation, humidity and heating systems.

The internal design conditions for the various items of plant and their associated rooms are stated in Table 2. Where plant is co-located in a shared space then the more onerous of the conditions listed in Table 2 should be used.

Internal Design Conditions:		
Location	**Max Temp**	**Min Temp**
Control Room/LVAC Room/Telecoms Room/Battery Room	30ºC (35 ºC)	15ºC ± 2ºC
Switchgear	40ºC	5ºC ± 2ºC
Workshop/Store Room/WC/Mess Room/Corridors	Uncontrolled	15ºC ± 2ºC

Table 2 – *Internal Design Temperature Limitations*.

It is recognised and accept that it is not economically viable to limit internal temperatures to 30°C in all circumstances. In extreme weather situations where the external ambient temperature range is between -25°C and +35°C as a short-term and infrequent occurrence, the above limits on internal temperatures may be relaxed to those indicated in brackets in Table 2.

Air conditioning systems shall not be used to meet the requirements detailed in this specification.

13.1.2 Heating

Rooms within the buildings shall be heated to achieve the minimum temperatures specified in Table 2. This shall be via electrical heaters installed and controlled by thermo-switches.

In each room the thermostat controlling the heaters shall be set to deliver minimum winter temperatures detailed in Table 2 and locked off against tampering. A manual override switch with a 2-hour maximum timer shall be fitted to allow an increase in ambient temperature to 21°C during occupation.

13.1.3 Ventilation

Ventilation shall be provided to achieve the maximum temperatures specified in Table 2 and to ensure a minimum of four complete air changes per day within rooms in the building. Mechanical extract ventilation should be provided in the Mess Room and WC, in accordance with Building Regulations and the preference is for natural ventilation to be used throughout the rest of the building.

Ventilation of batteries shall be in accordance with BS EN 50272-2.

All fans shall be provided with speed controllers and thermo switches, where twin fans are utilised, auto-change over panels and controls should be provided. The WC shall have a through-the-wall extract fan which will run when the lights are turned on. The fan should be supplied complete with a run on timer.

All weather louvers specification shall meet the following minimum requirements:

- Loss coefficient Class 2
- Water repellent Class A
- Class A3 up to 0.5m/s

A battery location or enclosure shall maintain the hydrogen concentration below the 4% Lower Explosion Limit threshold. Battery locations are considered as safe from explosions when by natural or forced ventilation the concentration of hydrogen is kept below this safe limit. SPEN will provide the Contractor with the relevant ventilation requirements for each room containing batteries.

13.1.4 Humidity

Humidity must be controlled to prevent any undue deterioration of the equipment or fabric of the building, in particular to prevent problems associated with condensation. Typically, this shall be achieved by providing natural air flow across the room from low to high-level through outside walls or via dehumidification.

Relative humidity shall be maintained between 20% and 75% with four complete air changes per day within rooms in the building. Control of relative humidity and temperature is to be done by means of natural ventilation unless otherwise agreed.

13.1.5 Humidity Control by Dehumidification

Where utilised, dehumidifiers shall be high-level wall-mounted units capable of efficient operation between the temperature range of +5°C and +30°C. Discharge pipes shall be taken directly through walls at high-level to drop externally within robust vandal and corrosion resistant protective downpipes to safely condensate and discharge at ground level. Low loss trace heating shall be provided on the dehumidifier drain.

Rooms utilising dehumidification shall be draught-sealed and shall not incorporate ventilation units.

The dehumidifier drying cycle shall be controlled by a humidistat, suitably located away from the dehumidifier airflow but forming an integral part of the unit. The switching point shall be capable of being set over the range of 40% to 80%, but factory set at 50%.

A second humidistat shall be provided in a similar position for use as a high relative humidity (RH) level alarm, which shall be pre-set at 70% and factory sealed. The auxiliary contacts of this humidistat shall be set to open at 70% RH and above, such that when the level is below 70% RH the auxiliary contacts are closed, giving a constant healthy signal to the SCADA system. The contact ratings shall be suitable to meet the rating of the dehumidifier.

Both humidistats shall be clearly labelled to indicate their function and RH level setting range.

The refrigerant shall be CFC free.

The defrosting cycle shall be controlled primarily by an auto-defrost device of the temperature sensing type.

13.1.6 Dehumidifier Design Note

Dehumidification shall be capable of extracting at least 75ml/hr of moisture from the sealed room environment at 10$_{o}$C / 50% (RH) – more than one unit may be required per room. The following conditions shall be assumed:

- Ambient humidity 80%RH;

- Ambient temperature +20°C;
- Design humidity 50%RH;

13.1.7 Insulation

Buildings shall be capable of achieving sufficient thermal insulation as necessary to provide an appropriate internal environment and avoid moisture ingress via condensation. Buildings shall provide, as a minimum standard, thermal transmittance U Values as detailed in Table 3.

Region	Roof U (W/m²K)	Walls U (W/m²K)	Floor U (W/m²K)
Scotland	0.2	0.27	0.22
England and Wales	0.25	0.35	0.25

Table 3 – *Thermal Insulation Requirements*

13.2 Building Electrical Systems

13.2.1 General

Electrical installation schemes shall be entirely suitable to the intended purpose of each room within buildings, including LV AC supply distribution board and if applicable design to satisfy requirements for use in potentially explosive environments in Battery Rooms with vented unsealed batteries. These schemes shall conform in all respects to the requirements of the relevant BS/BSEN Standards and the Regulations for the Electrical Equipment of Buildings issued by the Institution of Electrical Engineers (IEE) or its successor organisation. In addition, lighting design shall be in accordance with BS EN 12464-1.

The Contractor shall submit his proposals to the SPEN project team for acceptance prior to commencing work, including loading calculations to verify the design for all aspects of the works.

The Contractor shall make available for inspection a valid electrical test certificate for the works in accordance with the current IEE regulations. These should be included, where applicable, within the CDM H&S File that is handed over to SPEN.

The Contractor shall provide SPEN with ‘As-Built’ schematic and layout drawings showing the installed LV AC distribution system.

Internal cabling shall be run through galvanised surface-mounted conduit or trunking.

13.2.2 Power Connection

The Contractor will be responsible for the design and installation of metering panel for incoming power connection to the control building prior to manufacturing phase.

During the installation phase, the Contractor will be required to interface with Scottish Power Distribution and their delivery partners for the completion of a metered connection into the control building and further connection to building distribution board for commissioning of small power, lighting and ancillary services throughout the building.

13.2.3 Small Power

Buildings shall incorporate complete electrical installations for lighting and small power schemes including 400V, 230V and 110V outlet sockets as required by SPEN. Low Voltage systems shall be designed for the requirements of plant commissioning, operation and maintenance.

General purpose sockets shall be fitted in all rooms within the building with a minimum of 2 points in each room. 110V sockets shall be fitted in all areas to power electrically operated hand-tools, aside from the mess room and toilets.

Outlets shall be metallic with a minimum IP-54 for interior and IP-65 for exterior applications.

13.2.4 Electro-mechanical heating and ventilation systems

Where provided, electrical installations for heating and ventilation schemes to buildings shall incorporate control and instrumentation, interlocking and cabling systems necessary to maintain appropriate operational conditions.

13.2.5 Internal lighting

Internal lighting levels shall, where practicable, be LED type and as a minimum be in accordance with Table 4 and BS EN 12464-1. It shall be operated by wall switches positioned adjacent to doorways, including outside at the entrance to rooms and/or at more than one doorway if appropriate. It shall also incorporate a 4 hour timer manual override switch. Where plant is co-located in a shared space then the more onerous of the conditions listed in Table 4 should be used.

Internal lighting shall allow safe movement of personnel and safe operation of equipment and generally shall be designed such that the positions of all light fittings and associated switches etc. take due cognisance of the locations of and access to all equipment within the building.

All fittings shall be provided with covers or diffusers, with a minimum IP-54 for indoors in accordance with BS EN 60598-1

Emergency lighting shall be provided in accordance with BS 5266: Part 1. Emergency luminaires shall comply with the “F mark” requirements of BS 4533 Part 102.22 and recommendations of ICEL 1001. A key test wall switch shall be installed adjacent to the entrance door.

The Contractor shall design and install a complete set of emergency signalling for escape routes in accordance with BS 5266 and European Signs Directive format ISO 3864.

For lighting calculations purposes, a maintenance plan method with a maintenance factor of 0.67, corresponding to a clean room 3 years maintenance cycle, shall be used. Room surfaces reflections are considered as follows: Ceiling 0.7, Walls 0.5, Floor 0.2. The Contractor’s internal lighting calculations shall also show the luminaire mounting heights.

Location	Maintained Illuminance (lux)	Minimum Uniformity (U_o)	Workplane
Control Room/LVAC Room/Telecoms Room	400	0.6	@ 0.75 m above floor level
Workshop/Store Room/WC/Mess Room/Corridors	200	0.4	at floor level
Building Access Doors	20 (6 min)	0.3	at floor level

Table 4 – *Internal Lighting Levels*

13.2.6 Exterior Lighting

Exterior lighting shall allow safe access and emergency egress for personnel (including from buildings) and safe operation of equipment, subject to the following minimum requirements:

- Maintained average illuminance 6.0 lux at ground level
- Minimum maintained point illuminance 2.5 lux at ground level

As part of the detailed design the Contractor shall provide an external lighting calculation report for the project team to review in advance of the construction works.

Exterior lighting shall be fixed to the building and shall incorporate IP65 wall mounted LED luminaires to illuminate all pathways surrounding the building. They shall be controlled by a combination of photocells, for automatic dawn to dusk operation, and integral PIR detectors (minimum detection range of 12m and minimum detection angle of 110 degrees).

An internal wall mounted override switch shall be fitted adjacent to the main entrance door of the building to enable constant operation of these luminaires. Note that a non-maintained IP 65 emergency bulkhead LED luminaire shall be mounted above each emergency exit doors.

An internal wall mounted control box and switch shall be fitted adjacent to the main entrance door of the building to enable operation of the live compound lighting system. Connection of this compound lighting will be done by others.

13.2.7 Security Alarm Systems

The building fit out shall take cognisance of the requirement of a substation security system as specified and installed by ScottishPower Corporate Security.

ScottishPower Corporate Security shall place a security contract through internal framework agreements, for the design and installation of an intruder alarm system that will cover both the modular control building and the wider substation compound.

The installation of the security system into the control room modules will be carried out by the appointed security contractor at an agreed stage in the programme for the fabrication and fit out of the building, or as otherwise agreed with the SPEN project team.

On completion of the site works the security contractor will return to finalise the installation and carry out the commissioning and testing of the full system to ensure connection to the SP Alarm Receiving Centre (ARC).

The security system operating panel shall be located adjacent to the main access door.

13.2.8 Fire Alarm Systems

A fire detection system shall be installed in accordance with the requirements of ScottishPower's Corporate Specification. The building fit out shall therefore take cognisance of the requirement of any fire detection system proposed.

The installation of the fire detection system into the control room modules will be carried out by an appointed contractor at an agreed stage in the programme for the fabrication and fit out of the building, or as otherwise agreed with the SPEN project team.

On completion of the site works the fire detection system installer shall return to finalise the installation and carry out the commissioning and testing of the system.

The security system operating panel shall be located adjacent to the main access door.

13.2.9 Communications Systems

External walls shall have a minimum of 3 brackets installed to facilitate the connection of hardware (aerials, CCTV cameras etc.), as specified by the SPEN project team, to the building façade.

These aerials shall be fitted on site by others.

13.2.10 Voice and Data

The Contractor shall install a Voice and Data system. Both data and phone outlets are to be connected to the EGN router and to the Patch Panel (by others). In the telecoms room this will be by means of FTP Cat 5e Ext LSOH cable.

All outlets shall be wired to the final position of the EGN router / Patch Panel in segregated cable trunking so that the cables can be connected to them (by others).

The Contractor shall allow for liaising with the IT Data Voice Specialists as necessary to ensure all data/ voice containment systems and outlets comply with the requirements.

One telephone point shall be provided inside each room. A minimum of four additional telephone points shall be provided in the Control room.

13.2.11 Lighting and Power Cables

All works to the final circuit installation, unless otherwise indicated, shall be completed using annealed, electrolytic stranded Cu flexible conductor, 0.6/1kV XLPE insulated LSOH type, flame retardant and fire resistant, low smoke emission and low corrosive gases, BASEC approved, single core or multi core cables, and shall conform to the appropriate British Standards BS 6724, BS 7846 and BS 8573. All cables shall be contained within galvanised metal cable containment systems.

All circuits shall be provided with a protective yellow/green cable, same features and size as phase conductors.

All circuits are to be identified by means of plastic labels (Self-laminating / Traffolyte) plastic labels.

The Contractor shall provide cable sizing calculations to SPEN for review prior to constrution

13.2.12 Building Services Cable Containment System

The Contractor shall design, supply and install a system of suitable inner and outer hot dip galvanized seamless conduits, trunking, cable tray and cable ladder system in order to protect, segregate and support all cables installed under this contract. The Contractor shall provide SPEN with details of supports and fixings for approval prior to installation.

All cable containment and conduits are to be heavy duty steel galvanized class 2 when installed inside building and class 4 when installed outside the building.

Conduits are to be seamless extruded steel conduit, measures and features as per BS EN 61386-21 and BS 4568, Metric threaded as per BS EN 60423, inner and outer galvanized, and steel galvanized couplers.

The trunking system shall provide a minimum degree of protection IP-4x.

The conduit system shall have an IP-44 for indoor and IP-65 for outdoors.

Final connection from the containments to the fixtures, sockets, isolators etc, shall be made by means of steel galvanized conduits. Connections from the main branch shall be allocated in steel galvanized or aluminium alloy junction boxes. Adaptable boxes shall be heavy gauge pattern, IP-44 indoor or IP-65 outdoor.

Standard circular boxes to BS 31 or BS EN 50086 shall be used at lighting points.

Transition between adjacent rooms shall be done by means of steel galvanized letter box (transit block frames for the battery room), and properly sealed with intumescent fireproofing material.

13.2.13 Lighting and Heating Distribution Boards

Installation of a number of distribution boards for power supply to electrical and mechanical building services equipment of the substation building shall be allowed for within the LVAC room. These dedicated distribution boards shall be located in a strategic position within the LVAC room to allow servicing of the respective lighting and small power services throughout the control building, in the locations identified on the drawings.

Secondary Distribution Panels shall be rated 400/230 V (3P+N), 50 Hz, 10 kA, TN-S distribution

Secondary Distribution Boards shall be made from hot dipped galvanized mild steel sheet, formed to clean lines and complete with lockable hinged covers with gaskets, with a minimum ingress protection IP-44. Removable plates with conduit knock-out shall be provided for cable entry

All exterior surfaces shall be true and smooth. The enclosures shall be painted with one rust preventive painting, a coat of undercoat, and a coat of stove enamelled finishing paint.

The Secondary Distribution Boards shall be provided with integral isolators with neutrals bars having separate terminals for each fuse way within the distribution board. Each terminal shall be properly identified with the circuit and phase, neutral or earth, as appropriates, it is connected to.

Distribution boards shall be fitted with appropriately rated MCB's. Each shall be totally enclosed, suitable for wall mounting and shall comply with BS EN 61439: Part 3. As part of the detailed design the Contractor shall provide Distribution Board loading calculations and MCB or fuse sizing and grading reports for the project team to review in advance of the construction works.

The distribution panels and distribution boards shall be provided with an integral control section in the form of a Service Control Module (SCM) containing the contactors and terminal blocks necessary for controls where required.

The electrical distribution equipment shall be fixed back to the structure via a channel support bracketing arrangement.

Wiring within enclosures shall be so that devices can be removed without removing wiring. Identify each internal wire at each end on a heat shrink soft plastic sleeve, or self-laminating plastic label. Cables shall be annealed, electrolytic stranded Cu flexible conductor, 0.6/1 kV XLPE insulated LS0H type, flame retardant and fire resistant, low smoke emission and low corrosive gases. Cross section shall be suitable for the rated current of each circuit. All wiring shall be laid inside covered cable ducts

All circuits are to be identified by means of Traffolyte labels.

All circuits shall be protected by means of MCB. MCBs shall be type 'B' or 'C' and shall be double/four poles, disconnecting the phases and neutral when operated. They shall have a maximum of 10 kA breaking capacity

All circuits shall be protected against current leakage by means of 30 mA RCD or RCBO

Distribution boards shall be provided with anti-condensation space heater in those unheated areas.

From the Secondary Power & Lighting Distribution Board the following loads are to be fed:

- Lighting Circuits
- Small Power System
- Extract Fans
- Fire Alarm Panel and Security Alarm Panel (SIS, in the telecoms room)
- Break Tank of the Water Services (where required)
- Rainwater Harvesting System (where required)
- UV Filtration System (where required)
- Roller Shutter (where required)

The Secondary Power & Lighting Distribution Board power busbars shall be divided into three sections: First section for indoor lighting and loads, the second for outdoor lighting, and the third section for small power socket outlets and fans. The second section shall be interconnected with the mains by a contactor, which is energized by a twilight switch relay or by a manual selector. The third section shall be interconnected with the mains by means of a contactor. Such a contactor shall be de-energized in the event of a fire alarm, so that fans and sockets are de-energized. A Normally Closed contact from the Fire Alarm panel shall be interfaced to control the contactor.

From the Secondary Heating and Water Services Distribution Boards are to be fed:

- Electrical Heaters

- Water Heaters
- Dehumidifier units
- Heat Recovery Units (where required)
- Crane Provisional Supply (where required)
- Apart from the Secondary Distribution Boards, a Fan Control Box, of similar features as Distribution Boards is to be supplied. This control box is to be arranged with contactors so that the fans within the Switchgear and Relay room can be switched on manually from a separate fire compartment (e.g. corridor) and the smoke can be removed once the Fire Alarm is cleared.

All electrical distribution boards and control boxes shall be provided with the appropriate health and safety signage, including, but not necessarily limited to, the following:

- Warning notices on the outer and inner side of the access doors.
- Resuscitation notices on the inside of the access doors.
- Distribution board charts (framed) mounted adjacent the relevant distribution boards.
- Electrical schematic drawing (framed) mounted adjacent to the main LV

13.2.14 Testing

The Electrical Services shall be tested in accordance with BS 7671.

14. FINAL RECORDS

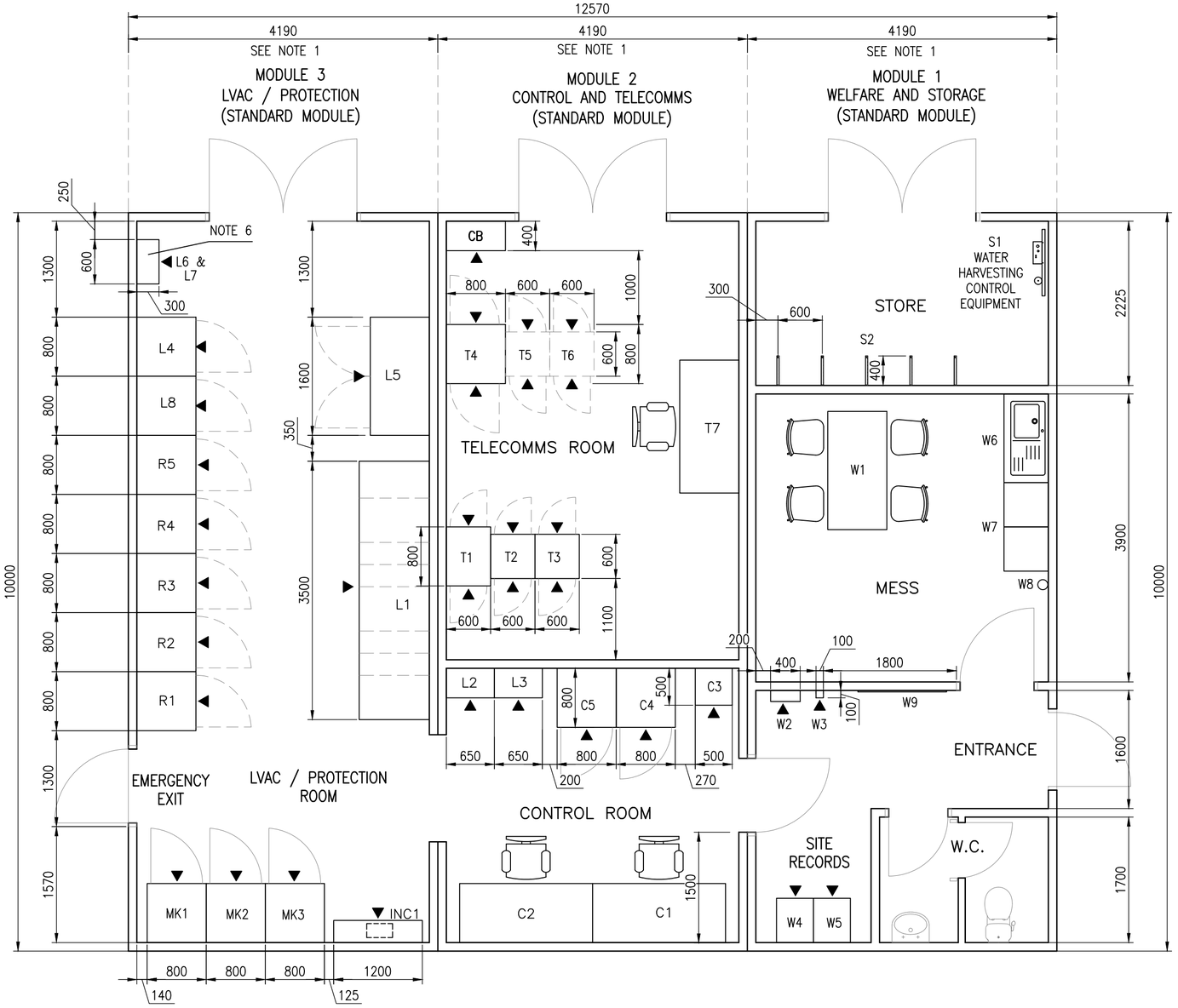
The Contractor shall verify by way of ‘as-built’ records, the final positions, locations and details of all services as well as the final construction details of the building. These shall be submitted to SP Energy Networks prior to the completion of the project as outlined below:

Records of all ‘as-built’ assets shall be issued in both electronic (AutoCAD .DWG and .PDF format, or as otherwise agreed with SPEN) and hard copy format. The Contractor shall ensure that the as-built drawings provide a consistent and accurate record of the completed installation. Any alterations made during the installation of the building shall be made clear in the final drawing submission.

The Contractor shall also provide input to the final Health and Safety File in conjunction with the Principal Designer and in compliance with current CDM Regulations. This shall include an operation and maintenance manual in both electronic and hard copy format.

15. INDICATIVE LAYOUT DRAWINGS

- Typical 3 Module Building Equipment Layout
- Typical 3 Module Building Internal Cable Ladder Layout
- Typical 4 Module Building Equipment Layout
- Typical 4 Module Building Internal Cable Ladder Layout



MODULE 1: WELFARE AND STORAGE

UNIT	DESCRIPTION	DIMENSIONS	ACCESS
S1	STORMSAVER WATER HARVESTING CONTROL UNIT SUPPORT RAILS	TBC	F
S2	5 No HEAVY DUTY PORTABLE EARTH STORAGE 'L' BRACKETS	–	L
W1	MESS TABLE AND 4 CHAIRS	800 x 1600	–
W2	COMPOUND LIGHTING CONTROL BOX	400 x 150	F
W3	LIGHTING SWITCH FOR SUBSTATION LIGHTING (SIZE TBC)	100 x 100	F
W4	FILING CABINET	600 x 500	F
W5	FILING CABINET	600 x 500	F
W6	SS SINK UNIT WITH INSTANTANEOUS WATER HEATER BELOW	–	–
W7	WORKTOP WITH CUPBOARD BELOW	600 x 1200	–
W8	WALL MOUNTED FIRE BLANKET	–	–
W9	FELT BACKED ALUMINIUM FRAMED NOTICE BOARD	900 x 1200	–

MODULE 2: TELECOMMS & CONTROL

UNIT	DESCRIPTION	DIMENSIONS	ACCESS
T1	48V DC BATTERY AND BATTERY CHARGER CUBICLE	800 x 600	F+R
T2	FIBRE TERMINATION CUBICLE 1	600 x 600	F+R
T3	TELECOM MUX / CISCO CUBICLE	600 x 600	F+R
T4	SECURITY CONTROL CABINET	800 x 800	F+R
T5	FUTURE / SPARE	600 x 600	F+R
T6	FUTURE / SPARE	600 x 600	F+R
T7	DESK	1800 x 800	F
CB	CABLE BOX	400 x 400	–
C1	DESK	1800 x 800	F
C2	DESK – HMI	1800 x 800	F
C3	PRINTER	500 x 500	F
C4	SCIS CTC CUBICLE	800 x 800	F
C5	SCIS RTU CUBICLE	800 x 800	F
L2	BUILDING SERVICES DISTRIBUTION BOARD No1	650 x 400	F
L3	BUILDING SERVICES DISTRIBUTION BOARD No2	650 x 400	F

MODULE 3: LVAC/PROTECTION

UNIT	DESCRIPTION	DIMENSIONS	ACCESS
L1	LVAC BOARD	3500 x 950	F
L4	110V DC DISTRIBUTION BOARD	800 x 800	F
L5	110V BATTERY (VRLA)	1600 x 800	F
L6	230/110V AC TRANSFORMER	500 x 250	F
L7	110V AC DISTRIBUTION BOARD	600 x 300	F
L8	110V DC BATTERY CHARGERS	800 x 800	F
INC1	DNO METERING UNIT FUSED SWITCH	1200 x 300	F
R1	PROTECTION/CONTROL PANEL	800 x 800	F
R2	PROTECTION/CONTROL PANEL	800 x 800	F
R3	PROTECTION/CONTROL PANEL	800 x 800	F
R4	PROTECTION/CONTROL PANEL	800 x 800	F
R5	PROTECTION/CONTROL PANEL	800 x 800	F
MK1	MARSHALLING CUBICLE	800 x 800	F
MK2	MARSHALLING CUBICLE (AS REQUIRED)	800 x 800	F
MK3	MARSHALLING CUBICLE (AS REQUIRED)	800 x 800	F

STANDARD MODULAR ARRANGEMENT:

THIS IS A GENERIC LAYOUT ARRANGEMENT WHICH CAN BE MODIFIED TO SUIT SITE SPECIFIC ORIENTATION AND PLANT REQUIREMENTS
MODULE 1 – WELFARE FACILITIES AND STORE ROOM STANDARD LAYOUT
MODULE 2 – CONTROL ROOM AND TELECOMMS ROOM STANDARD LAYOUT
MODULE 3 – LVAC/PROTECTION ROOM STANDARD LAYOUT

NOTES:

1.– DIMENSION OF TYPICAL WIDTH OF PREFABRICATED MODULAR BUILDING SECTIONS.
2.– WORK AREA REQUIREMENTS:–
2.1.– WORK ABOVE WAIST HEIGHT – MINIMUM HEIGHT 2100mm
MINIMUM PASSAGEWAY WIDTH 750mm
2.2.– WORK ABOVE BELOW HEIGHT – MINIMUM HEIGHT 2100mm
MINIMUM PASSAGEWAY WIDTH 1100mm
3.– MINIMUM DISTANCE BETWEEN TWO CUBICLES FACING EACH OTHER IS 1800mm
4.– ESCAPE ROUTE PASSAGES SHALL HAVE A MINIMUM CLEAR WIDTH OF 900mm.
5.– ALL DIMENSIONS IN MILLIMETRES
6.– L7 IS PLACED ABOVE L6

ASSOCIATED DRAWINGS:

MCB22–2–17HS–DO–SPENEC–0004 – CONTROL BUILDING INTERNAL CABLE LADDER LAYOUT

(*) L – Lockable
F – Front
R – Rear
◀ PANEL ACCESS

Rev.	Date	Drawn	Reviewed	Approved	Reason / Description of changes.
0A	15/03/2022	AJB	CF	PK	ISSUED FOR TENDER

SP ENERGY NETWORKS

Status Stamp: FOR INFORMATION

Project: STANDARD 3 MODULE CONTAINERISED CONTROL BUILDING

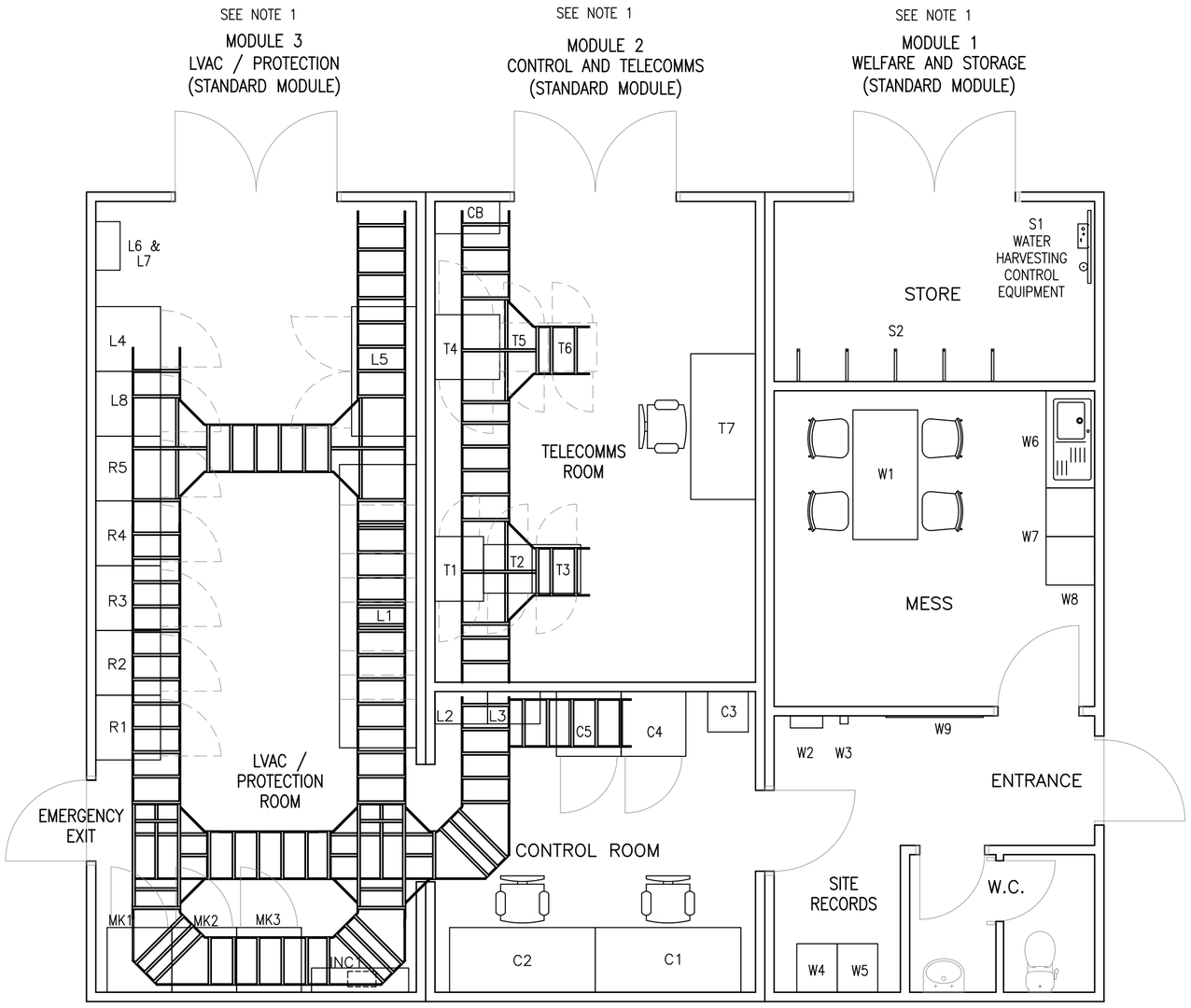
Location: N/A

Status Stamp:

Drg. Title: CONTROL BUILDING - TYPICAL EQUIPMENT LAYOUT

Drawn	Rev'd	App'd

Drg. No.: MCB22-2-17HS-DO-SPENEC-0002
Sheet: -
Next: -
Rev: 0A
SPEN Ref. No. : ----
Scale: 1:50
Size: A2



MODULE 1: WELFARE AND STORAGE

UNIT	DESCRIPTION	DIMENSIONS	ACCESS
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W1	MESS TABLE AND 4 CHAIRS	800 x 1600	–
W2	COMPOUND LIGHTING CONTROL BOX	400 x 150	F
W3	LIGHTING SWITCH FOR SUBSTATION LIGHTING (SIZE TBC)	100 x 100	F
W4	FILING CABINET	600 x 500	F
W5	FILING CABINET	600 x 500	F
W6	SS SINK UNIT WITH INSTANTANEOUS WATER HEATER BELOW	–	–
W7	WORKTOP WITH CUPBOARD BELOW	600 x 1200	–
W8	WALL MOUNTED FIRE BLANKET	–	–
W9	FELT BACKED ALUMINIUM FRAMED NOTICE BOARD	900 x 1200	–

MODULE 2: TELECOMMS & CONTROL

UNIT	DESCRIPTION	DIMENSIONS	ACCESS
T1	48V DC BATTERY AND BATTERY CHARGER CUBICLE	800 x 600	F+R
T2	FIBRE TERMINATION CUBICLE 1	600 x 600	F+R
T3	TELECOM MUX / CISCO CUBICLE	600 x 600	F+R
T4	SECURITY CONTROL CABINET	800 x 800	F+R
T5	FUTURE / SPARE	600 x 600	F+R
T6	FUTURE / SPARE	600 x 600	F+R
T7	DESK	1800 x 800	F
CB	CABLE BOX	400 x 400	–
C1	DESK	1800 x 800	F
C2	DESK – HMI	1800 x 800	F
C3	PRINTER	500 x 500	F
C4	SCIS CTC CUBICLE	800 x 800	F
C5	SCIS RTU CUBICLE	800 x 800	F
L2	BUILDING SERVICES DISTRIBUTION BOARD No1	650 x 400	F
L3	BUILDING SERVICES DISTRIBUTION BOARD No2	650 x 400	F

MODULE 3: LVAC/PROTECTION

UNIT	DESCRIPTION	DIMENSIONS	ACCESS
L1	LVAC BOARD	3500 x 950	F
L4	110V DC DISTRIBUTION BOARD	800 x 800	F
L5	110V BATTERY (VRLA)	1600 x 800	F
L6	230/110V AC TRANSFORMER	500 x 250	F
L7	110V AC DISTRIBUTION BOARD	600 x 300	F
L8	110V DC BATTERY CHARGERS	800 x 800	F
INC1	DNO METERING UNIT FUSED SWITCH	1200 x 300	F
R1	PROTECTION/CONTROL PANEL	800 x 800	F
R2	PROTECTION/CONTROL PANEL	800 x 800	F
R3	PROTECTION/CONTROL PANEL	800 x 800	F
R4	PROTECTION/CONTROL PANEL	800 x 800	F
R5	PROTECTION/CONTROL PANEL	800 x 800	F
MK1	MARSHALLING CUBICLE	800 x 800	F
MK2	MARSHALLING CUBICLE (AS REQUIRED)	800 x 800	F
MK3	MARSHALLING CUBICLE (AS REQUIRED)	800 x 800	F

STANDARD MODULAR ARRANGEMENT.–

THIS IS A GENERIC LAYOUT ARRANGEMENT WHICH CAN BE MODIFIED TO SUIT SITE SPECIFIC ORIENTATION AND PLANT REQUIREMENTS
MODULE 1 – WELFARE FACILITIES AND STORE ROOM STANDARD LAYOUT
MODULE 2 – CONTROL ROOM AND TELECOMMS ROOM STANDARD LAYOUT
MODULE 3 – LVAC/PROTECTION ROOM STANDARD LAYOUT

ASSOCIATED DRAWINGS:

MCB22–2–17HS–DO–SPENEC–0002 – STANDARD 3 MODULE CONTROL BUILDING TYPICAL EQUIPMENT LAYOUT

Rev.	Date	Drawn	Reviewed	Approved	Reason / Description of changes.
0A	15/03/2022	AJB	CF	PK	ISSUED FOR TENDER

SP ENERGY NETWORKS

Status Stamp: FOR INFORMATION

Project: STANDARD 3 MODULE CONTAINERISED CONTROL BUILDING

Location: N/A

Status Stamp:

Drg. Title: CONTROL BUILDING - TYPICAL INTERNAL CABLE LADDER LAYOUT

Drawn	Rev'd	App'd

Drg. No.: MCB22-2-17HS-DO-SPENEC-0004

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Rev: 0A

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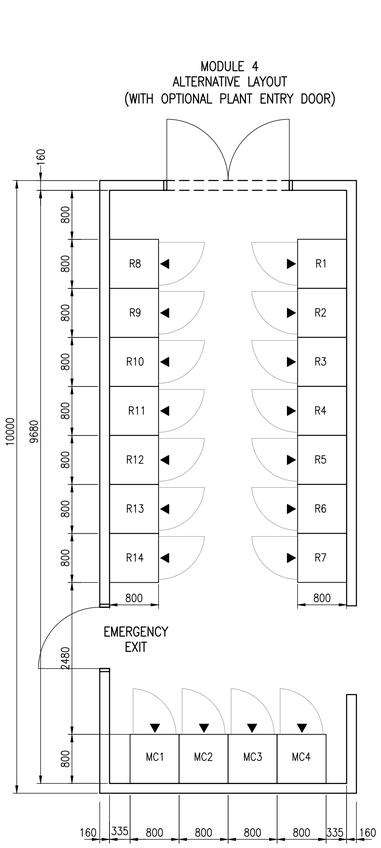

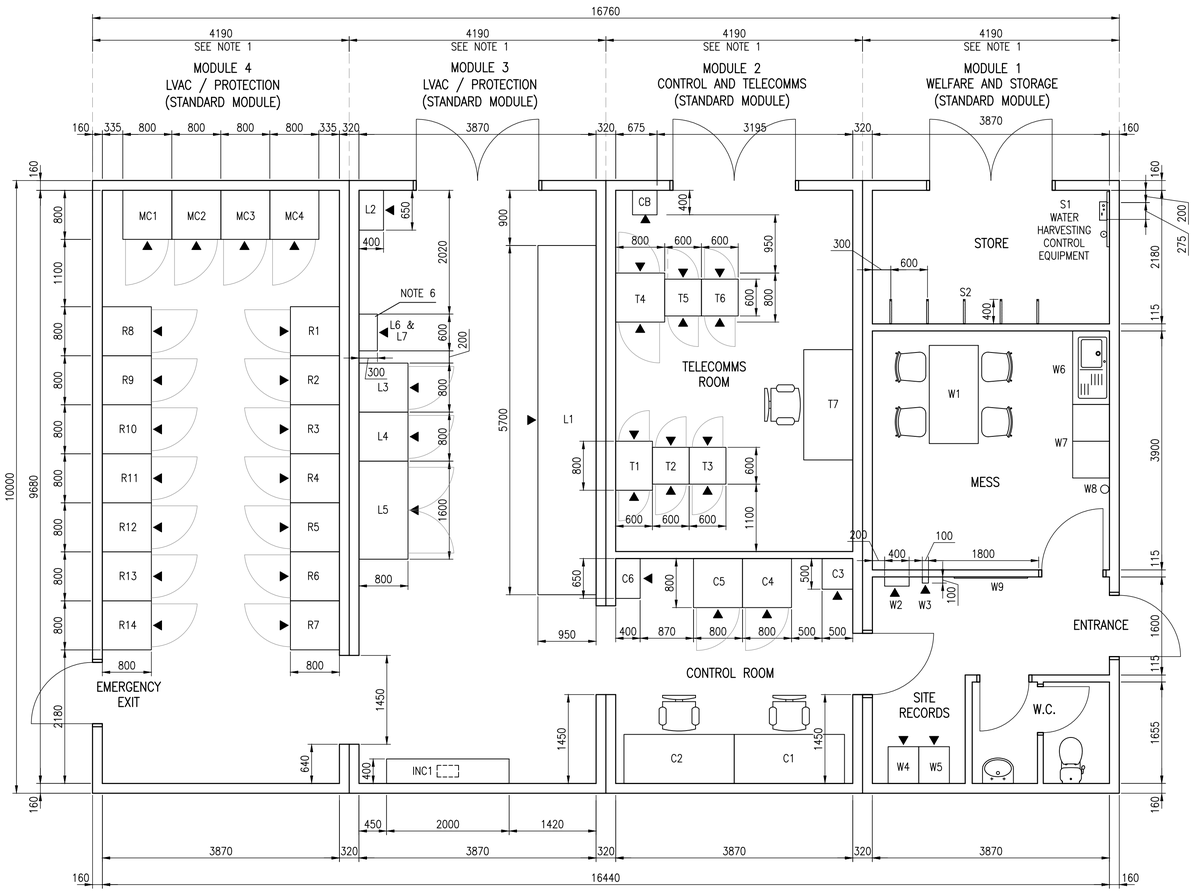

MODULE 1: WELFARE AND STORAGE

UNIT	DESCRIPTION	DIMENSIONS	ACCESS
S1	STORMSAVER WATER HARVESTING CONTROL UNIT SUPPORT RAILS	TBC	F
S2	5 No HEAVY DUTY PORTABLE EARTH STORAGE 'L' BRACKETS	–	L
W1	MESS TABLE AND 4 CHAIRS	800 x 1600	–
W2	COMPOUND LIGHTING CONTROL BOX	400 x 150	F
W3	LIGHTING SWITCH FOR SUBSTATION LIGHTING (SIZE TBC)	100 x 100	F
W4	FILING CABINET	600 x 500	F
W5	FILING CABINET	600 x 500	F
W6	SS SINK UNIT WITH INSTANTANEOUS WATER HEATER BELOW	–	–
W7	WORKTOP WITH CUPBOARD BELOW	600 x 1200	F
W8	WALL MOUNTED FIRE BLANKET	–	–
W9	FELT BACKED ALUMINIUM FRAMED NOTICE BOARD	900 x 1200	–

MODULE 2: TELECOMMS & CONTROL

UNIT	DESCRIPTION	DIMENSIONS	ACCESS
T1	48V DC BATTERY AND BATTERY CHARGER CUBICLE	800 x 600	F+R
T2	FIBRE TERMINATION CUBICLE 1	600 x 600	F+R
T3	TELECOM MUX / CISCO CUBICLE	600 x 600	F+R
T4	SECURITY CONTROL CABINET	800 x 800	F+R
T5	FUTURE / SPARE	600 x 600	F+R
T6	FUTURE / SPARE	600 x 600	F+R
T7	DESK	1800 x 800	F
CB	CABLE BOX	400 x 400	–
C1	DESK	1800 x 800	F
C2	DESK – HMI	1800 x 800	F
C3	PRINTER	500 x 500	F
C4	SCIS CTC CUBICLE	800 x 800	F
C5	SCIS RTU CUBICLE	800 x 800	F
C6	BUILDING SERVICES DISTRIBUTION BOARD No2	650 x 400	F

MODULE 3: LVAC / PROTECTION

UNIT	DESCRIPTION	DIMENSIONS	ACCESS
L1	LVAC BOARD	4000 x 950	F
L2	BUILDING SERVICES DISTRIBUTION BOARD No1	650 x 400	F
L3	110V DC BATTERY SYSTEM No 1 – CHARGERS	800 x 800	F
L4	110V DC DISTRIBUTION BOARD	800 x 800	F
L5	110V BATTERY SYSTEM No1 – BATTERY (VRLA)	1600 x 800	F
L6	230/110V AC TRANSFORMER	500 x 250	F
L7	110V AC DISTRIBUTION BOARD	600 x 300	F
INC1	INCOMING SUPPLY METER PANEL	2000 x 400	F

MODULE 4: PROTECTION

UNIT	DESCRIPTION	DIMENSIONS	ACCESS
MC1	MARSHALLING CUBICLE	800 x 800	F
MC2	MARSHALLING CUBICLE (AS REQUIRED)	800 x 800	F
MC3	MARSHALLING CUBICLE (AS REQUIRED)	800 x 800	F
MC4	MARSHALLING CUBICLE (AS REQUIRED)	800 x 800	F
R1	PROTECTION/CONTROL PANEL	800 x 800	F
R2	PROTECTION/CONTROL PANEL	800 x 800	F
R3	PROTECTION/CONTROL PANEL	800 x 800	F
R4	PROTECTION/CONTROL PANEL	800 x 800	F
R5	PROTECTION/CONTROL PANEL	800 x 800	F
R6	PROTECTION/CONTROL PANEL	800 x 800	F
R7	PROTECTION/CONTROL PANEL	800 x 800	F
R8	PROTECTION/CONTROL PANEL	800 x 800	F
R9	PROTECTION/CONTROL PANEL	800 x 800	F
R10	PROTECTION/CONTROL PANEL	800 x 800	F
R11	PROTECTION/CONTROL PANEL	800 x 800	F
R12	PROTECTION/CONTROL PANEL	800 x 800	F
R13	PROTECTION/CONTROL PANEL	800 x 800	F
R14	PROTECTION/CONTROL PANEL	800 x 800	F
R15	PROTECTION/CONTROL PANEL	800 x 800	F

STANDARD MODULAR ARRANGEMENT.–

THIS IS A GENERIC LAYOUT ARRANGEMENT WHICH CAN BE MODIFIED TO SUIT SITE SPECIFIC ORIENTATION AND PLANT REQUIREMENTS

MODULE 1 – WELFARE FACILITIES AND STORE ROOM STANDARD LAYOUT
MODULE 2 – CONTROL ROOM AND TELECOMMS ROOM STANDARD LAYOUT
MODULE 3 – LVAC/PROTECTION ROOM STANDARD LAYOUT
MODULE 4 – LVAC/PROTECTION ROOM STANDARD LAYOUT

NOTES.–

1.– DIMENSION OF TYPICAL WIDTH OF PREFABRICATED MODULAR BUILDING SECTIONS.
2.– WORK AREA REQUIREMENTS:–
2.1.– WORK ABOVE WAIST HEIGHT – MINIMUM HEIGHT 2100mm
MINIMUM PASSAGEWAY WIDTH 750mm
2.2.– WORK ABOVE BELOW HEIGHT – MINIMUM HEIGHT 2100mm
MINIMUM PASSAGEWAY WIDTH 1100mm
3.– MINIMUM DISTANCE BETWEEN TWO CUBICLES FACING EACH OTHER IS 1800mm
4.– ESCAPE ROUTE PASSAGES SHALL HAVE A MINIMUM CLEAR WIDTH OF 900mm.
5.– ALL DIMENSIONS IN MILLIMETRES
6.– L7 IS PLACED ABOVE L6

(*) L – Lockable
F – Front
R – Rear
◀ PANEL ACCESS

ASSOCIATED DRAWINGS.–

MCB22–2–17HS–DO–SPENEC–0003 – CONTROL BUILDING TYPICAL INTERNAL CABLE LADDER LAYOUT

Rev.	Date	Drawn	Reviewed	Approved	Reason / Description of changes.
0A	15/03/2022	AJB	CF	PK	ISSUE FOR TENDER

SP ENERGY NETWORKS

Status Status: FOR INFORMATION

Project: STANDARD 4 MODULE CONTAINERISED CONTROL BUILDING

Location: N/A

Contractor:

Status Stamp:

Drg. Title: CONTROL BUILDING - TYPICAL EQUIPMENT LAYOUT

Drawn	Rev'd	App'd

Drg. No.: MCB22-2-17HS-DO-SPENEC-0001
SPEN Ref. No. :
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Rev: 0A
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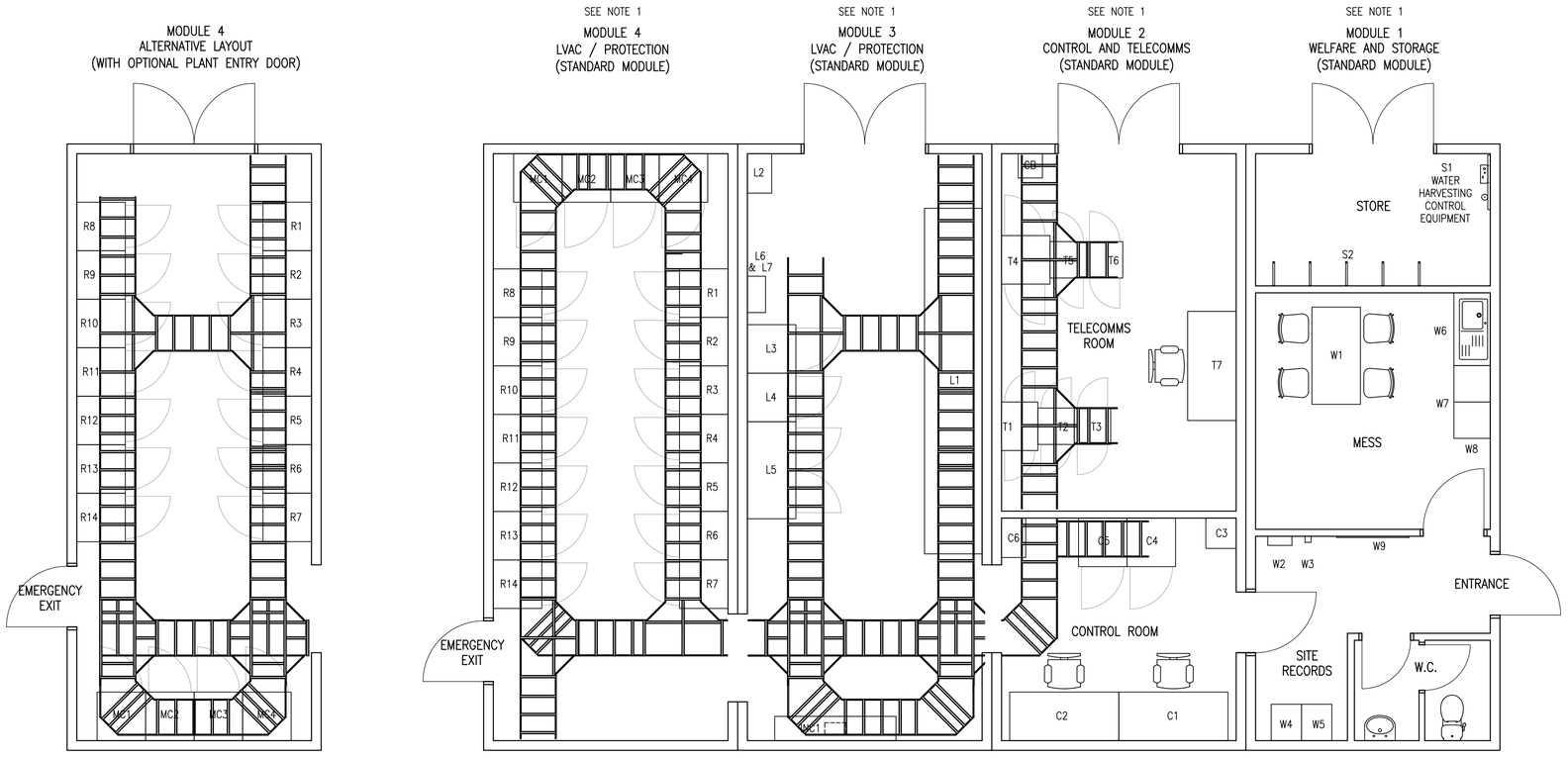

MODULE 1: WELFARE AND STORAGE

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W4	FILING CABINET	600 x 500	F
W5	FILING CABINET	600 x 500	F
W6	SS SINK UNIT WITH INSTANTANEOUS WATER HEATER BELOW	–	–
W7	WORKTOP WITH CUPBOARD BELOW	600 x 1200	F
W8	WALL MOUNTED FIRE BLANKET	–	–
W9	FELT BACKED ALUMINIUM FRAMED NOTICE BOARD	900 x 1200	–

MODULE 2: TELECOMMS & CONTROL

UNIT	DESCRIPTION	DIMENSIONS	ACCESS
T1	48V DC BATTERY AND BATTERY CHARGER CUBICLE	800 x 600	F+R
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T4	SECURITY CONTROL CABINET	800 x 800	F+R
T5	FUTURE / SPARE	600 x 600	F+R
T6	FUTURE / SPARE	600 x 600	F+R
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C1	DESK	1800 x 800	F
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L7	110V AC DISTRIBUTION BOARD	600 x 300	F
INC1	INCOMING SUPPLY METER PANEL	2000 x 400	F

MODULE 4: PROTECTION

UNIT	DESCRIPTION	DIMENSIONS	ACCESS
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MC2	MARSHALLING CUBICLE (AS REQUIRED)	800 x 800	F
MC3	MARSHALLING CUBICLE (AS REQUIRED)	800 x 800	F
MC4	MARSHALLING CUBICLE (AS REQUIRED)	800 x 800	F
R1	PROTECTION/CONTROL PANEL	800 x 800	F
R2	PROTECTION/CONTROL PANEL	800 x 800	F
R3	PROTECTION/CONTROL PANEL	800 x 800	F
R4	PROTECTION/CONTROL PANEL	800 x 800	F
R5	PROTECTION/CONTROL PANEL	800 x 800	F
R6	PROTECTION/CONTROL PANEL	800 x 800	F
R7	PROTECTION/CONTROL PANEL	800 x 800	F
R8	PROTECTION/CONTROL PANEL	800 x 800	F
R9	PROTECTION/CONTROL PANEL	800 x 800	F
R10	PROTECTION/CONTROL PANEL	800 x 800	F
R11	PROTECTION/CONTROL PANEL	800 x 800	F
R12	PROTECTION/CONTROL PANEL	800 x 800	F
R13	PROTECTION/CONTROL PANEL	800 x 800	F
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R15	PROTECTION/CONTROL PANEL	800 x 800	F

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ASSOCIATED DRAWINGS.–

MCB22-2-17HS-DO-SPENEC-0001 – STANDARD 4 MODULE CONTROL BUILDING TYPICAL EQUIPMENT LAYOUT

Rev.	Date	Drawn	Reviewed	Approved	Reason / Description of changes.
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SP ENERGY NETWORKS

Status Stamp: FOR INFORMATION

Project: STANDARD 4 MODULE CONTAINERISED CONTROL BUILDING

Location: N/A

Contractor:

Status Stamp:

Drg. Title: CONTROL BUILDING - TYPICAL INTERNAL CABLE LADDER LAYOUT

Drawn	Rev'd	App'd

Drg. No.: MCB22-2-17HS-DO-SPENEC-0003 | Sheet: - | Next: - | Rev: 0A

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