MECHANICAL & ELECTRICAL ENGINEERING SERVICES SPECIFICATION

for the

MARSIC SYNTHETIC ENVIRONMENT

at

NATIONAL OCEANOGRAPHY CENTRE, SOUTHAMPTON

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WHEN THE TENDERER RECEIVES THIS SPECIFICATION, THEY ARE TO IMMEDIATELY CHECK THAT IT CONTAINS ALL THE PAGES IN NUMERICAL ORDER. IF ANY PAGES ARE MISSING OR DUPLICATED, OR IF ANY TYPING IS INDISTINCT, THEY ARE TO INFORM THE CONTRACT ADMINISTRATOR.

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00-05-10 Project Definition

101 Project description

Project reference: *J2171109*

Project title: *NOCS MARSIC Synthetic Environment*

Project description: *Research Laboratory*

NOC is seeking interest from qualified Principle Contractors to undertake the professional services associated with the above project. This contract will be awarded subject to NEC3 Engineering and Construction Contract (ECSC) Terms and Conditions.

INTRODUCTION

The National Oceanography Centre is wholly owned by the Natural Environment Research Council. The Southampton site was opened in 1995 and constructed with a design life of 125 years. The campus is an international centre of excellence, primarily in ocean and earth science, and marine technology. A significant level of scientific research is undertaken throughout the campus. Approximately 2000 persons are based at the site, employed by the Natural Environment Research Council, the University of Southampton and a number of associated tenants.

The centre was purpose-built between 1992 and 1995 and occupies a quayside site within the Associated British Ports operational port area in Southampton. The site was previously used as a dock facility and generally the ground is reclaimed. The mainly six-storey building houses offices, research laboratories, engineering workshops and associated facilities. The heavily serviced building uses vertical service risers internally with horizontal mechanical and electrical distribution areas (intermediate 'MEDA' plant room floors) to service occupied areas. A number of separate single storey buildings are also constructed on the site mainly housing stores, workshops and support facilities.

A project has been identified in the Marine Robotics Innovation Centre (MARSIC) an extension of the main building, for creating a synthetic working environment for research purposes. The existing ops room will be upgraded to include 6 high performance graphics workstations, a 6 screen video wall, as well as supporting infrastructure. The environment will accommodate 6 personnel in a single Synthetic Environment session and 12+ personnel for operations, meetings, etc. Additional capacity in terms of networking and power will be required to extend connectivity to the neighbouring room as and when needed.

102 Project overview

General: *Conversion of an existing meeting room to an IT workroom, meeting room and presentation space including:*

- Provision of new mechanical supply and extract ventilation.
- Provision of cooling served from the existing chilled water infrastructure.
- Controls modifications.
- Lighting modifications.
- Lowering of existing dado and provision of supplies to new media wall.
- Containment alterations to allow new communications cabling installation by others.
- Provision of supplies to new mechanical services.

Hazardous substances information

150 Asbestos survey report

Details: *Refer to NOCS building asbestos register.*

Design information

165 Drawings

Details: *NOCS MARSIC*

Status: *Tender*

Format: *AUTOCAD. Electronic.*

Provision: *Issued by NOCS.*

Contract drawings:

- Generally: *The same as the tender drawings.*

170 Preconstruction information

Scope: *Integral with the project specification, including but not restricted to the following: Information to follow Appendix D.*

00-05-15 Works Terminology

110 Terminology

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

210 Description terminology

Attendance: *Includes*
The use of the Main Contractor's temporary roads, pavings and paths, standing scaffolding, standing power operated hoisting plant,
The provision of temporary lighting of an equivalent brightness to the finished lighting brightness,
The provision of water,
The clearing away of rubbish and paying all charges in connection with its disposal, the provision of secure hard standing space for the sub-contractor's own offices, plant and material storage,
The use of standing mess rooms, sanitary accommodation and welfare facilities and
The provision of all Health and Safety facilities and all Fire Safety precautions, services, equipment, signage, facilities, Marshalls and the like necessary to comply with the relevant parts of the Joint Fire Code.
Additional requirements should be described as 'Special attendance'.

Building Manual: *A document containing information of use to subsequent building owners, occupiers and users about the requirements and procedures for effective operation, maintenance, decommissioning and demolition of the building.*

Construction Work: *Permanent work together with temporary work.*

Contractor: *The party who undertakes to perform the services, supply goods or carry out work defined in a contract. Includes Main Contractor, Prime Contractor, Supplier, Service provider, Builder, Subcontractor, etc. as the context dictates, which may be defined terms in certain standard contract forms.*

Contractor's choice: *Selection delegated to the Contractor, but liability to remain with the specifier.*

Contractor's design: *Design to be carried out or completed by the Contractor, supported by appropriate contractual arrangements, to correspond with specified requirements.*

Cost: *The amount paid or given by one party to another in exchange for goods, work or services.*

Designer: *A person carrying out design on a project.*

Deviation: *Difference between a specified dimension or position and the actual dimension or position.*

Employer: *The party to the Contract for whom the goods, work or services are provided. Includes Client (in consultancy contracts and CDM Regulations), the Employer, Building owner or Purchaser (in construction contracts), the Developer (in development agreements and funding agreements), or the 'Main' contractor in contractor/ subcontractor agreements - which may be defined terms in certain standard contract forms*

Estimate: *An approximate evaluation of either time or cost of part or the whole of a project.*

Execute: *To complete a task fully and put into effect. To fix, apply, install or lay products securely, accurately, plumb and in alignment.*

Existing: *Items retained in place to receive new work.*

Fastener: *Device for mechanically attaching something to something else.*

Manufacturer and Product reference: *Manufacturer - the body under whose name the particular product, component or system is marketed.*
Product reference - the proprietary brand name and/ or reference by which the particular product, component or system is identified.
References are as specified in the manufacturer's technical literature current on the date specified.

Manufacturer's standard: *Where used in conjunction with a specified proprietary product, accessories to be those recommended by the product manufacturer.*

Permanent Work: *Work to be constructed and completed in accordance with the Contract.*

Price: *An indication of the amount required to be paid by one party to another in exchange for goods, work or services.*

Product: *Material, both manufactured and naturally occurring, goods and accessories for permanent incorporation into the Works.*

Requirements: *A description in outline or detailed form of the development, or a part of it, which one party requires another to design and/or build.*

Schedule of rates: *The subdivision of product and execution prices by a pre-determined unit basis.*

Schedule of Work: *The subdivision of work items by a pre-determined classification. Can form the basis of a pricing document where Bills of Quantities are not used.*

Schematic: *A drawing of a system showing components, products, systems and their interconnections.*

Site equipment: *The Contractor's apparatus, appliances, machinery, vehicles or things of whatsoever nature required in or about the construction for the execution and completion of the Works and the remedying of defects.*
Includes Appliances, vehicles, consumables, tools, temporary work, scaffolding, cabins and other site facilities.
Excludes: Temporary work, Employer's products and equipment or anything intended to form or forming part of the permanent Works.

Specification: *Written description of requirements.*

System: *Products, components, equipment, accessories, controls, supports and ancillary items, including installation, necessary for that section of the work to function.*

Temporary work: *Incidental work to undertaken during construction but not intended to form part of the completed work.*

310 Activity terminology

Advise: *See 'Communicate'.*

Agree: *See 'Communicate'.*

Approve: *Record conformance of work to specified criteria by giving formal or official sanction.*

Communicate: *Includes advise, inform, agree, confirm, notify, seek or obtain information, consent or instructions, or make arrangements.*

Confirm: *See 'Communicate'.*

Ease: *Adjust moving parts of designated products, systems or work to achieve free movement and good fit in open and closed positions.*

Fix: *Receive, unload, handle, store, protect, place and fasten in position; dispose of waste and surplus packaging; to include labour, materials and site equipment for that purpose.*

Give notice: *Communicate in writing to the person administering the Contract at the address listed therein.*

Inform: *See 'Communicate'.*

Keep for recycling: *As 'keep for use' but relates to a naturally occurring material rather than a manufactured product.*

Keep for reuse: *Do not damage designated products, systems or work. Clean off bedding and jointing materials. Stack neatly, adequately protect and store until required by the Employer or Purchaser, or for use in the Works as instructed.*

Make good: *Execute local remedial work to designated work. Make secure, sound and neat.*

Match existing: *Provide products and work of the same appearance and features as the original, excluding ageing and weathering. Make joints between existing and new work as inconspicuous as possible.*

Notify: *See 'Communicate'.*

Quote: *Use 'Estimate'.*

Recycle: *Collect, sort, process and convert discarded or recovered components into raw materials for use in the creation of new products.*

Refix: *Fix previously removed products.*

Remove: *Disconnect, dismantle as necessary and take out the designated products or work, together with associated accessories, fixings, supports, linings and bedding materials. Dispose of unwanted materials.*
Removal of a system includes this work.

Remediate: *Action or measures taken to lessen, clean-up, remove or mitigate the existence of hazardous materials existing on a property; in accordance with standards, specifications or requirements as may be required by statutes, rules, regulations or specification.*

Repair: *Execute remedial work to designated products. Make secure, sound and neat. Excludes redecoration and replacement.*

Replace: *Supply and fix new products matching those removed. Execute work to match the original new state of that removed.*

Reuse: *Recover components to be fixed or used in the project or other buildings without the requirement for recycling.*

Submit: *Deliver an item in a specified format to a specified person within a specified timeframe.*

Submit proposals: *Submit information in response to specified requirements.*

Supply and fix: *Supply of products, components or systems to be fixed, together with their fixing.*

00-05-20 Project Participants

Management and delivery roles

120 Client

Statutory roles

205 Principal Designer

Design roles

265 Civil engineer

270 Electrical services engineer

280 Mechanical services engineer

00-05-70 Project Location

110 Project location

Details: *National Oceanography Centre*

Address:

- Street: *European Way*
- City: *Southampton*
- Post code: *SO14 3ZH*

150 Surrounding land and building uses

Surrounding land uses or activities: *Southampton docks and industrial units.*

170 Access

Details: *Dock Gate 4.*

Limitations: *Secure manned access.*

221 Site visit

Nature of the site: *Ascertain before Tendering, including access thereto and local conditions and restrictions likely to affect the execution of the Work.*

Arrangements for visit: *During the Tender period, the proposed site will be available for on-site viewing by appointment with the Employer's Agent. The Contractor shall be deemed to have visited site, to have acquainted himself as to the nature and extent of the works, to inspect local conditions, means of access and other matters that may affect the Tender price and to have examined the Specification, Drawings and Conditions of Contract.*

60-45-10/110 Chilled water system

System outline

60-45-10/110 Chilled water system

Description: *The new Synthetic Environment laboratory will be cooled via connection into the existing chilled water infrastructure.*

Cooling will be provided by wall and floor mounted cooling only fan coil units with integral controls which will provide local on/off, fan speed and temperature setpoint adjustment. The fan coil unit cooling output shall be controlled by 2 port pressure independent control valves (PICV) and a return air sensor supplied free issue by the control specialist (Matrix) for factory fitting by the fan coil manufacturer.

Chilled water connections shall be extended from connections made in the existing chilled water infrastructure in MEDA122.

Prior to any works the Contractor shall carry out chilled water flowrate and pressure validation measurements at the proposed point of connection to ensure that there is sufficient flow capacity and pump head for the proposed new works.

The new chilled water pipework shall be routed via the existing service corridor between MEDA122 and the MARSIC/Workshop building.

The existing chilled water pipework routed in the service corridor serving the Glider Workshop is not large enough to provide sufficient spare capacity for the new Synthetic Environment laboratory.

There is also not sufficient space to run dedicated pipework connections so the existing mains will be replace with new larger bore pipework to accommodate the additional load.

Prior to any works the Contractor shall carry out flowrate validation measurements on the existing chilled water connections to cooling equipment in the Glider workshop served from the existing main. The figures shall be used to re-commission the flowrates subsequent to the works.

(N.B. The Contractor shall be aware of the Provisional Sum allowance that has been included within the Tender Summary for the installation of a new chilled water heat exchanger and pumpset to provide chilled water to the synthetic environment room and Glider Workshop if the existing circulation pump pressure head is not sufficient at the point of connection).

Builders work in connection

The Contractor shall provide all necessary builders work in connection with the new installation as necessary for the successful completion of the works. This shall include but not be limited to the following:-

•Removal and reinstatement of the existing ceiling grid and tiles within the services cupboard adjacent to the synthetic environment.

•Making good/repair works and painting of surfaces/finishes disturbed.
•Boxing in of all vertical pipework risers including painting and making good.
•Making good any redundant building apertures following services removal or identified on the tender drawings.
•Alteration, modification, enabling works and any removals required to facilitate the new installation.
•All painting, finishing, coating, fixing, removal and replacement as necessary of ceiling tiles, ceiling/walls, fixed equipment and any furniture. The Contractor shall make allowance for the removal of sections of the solid suspended ceiling within W2/13 to provide fixings for the new services (i.e. ductwork and fabric ducts) where necessary including all subsequent making good.
•Provision of access and all necessary safety equipment including edge protection and suitable protection for existing roof mounted PV equipment.
•The Contractor shall prepare all necessary holes, chases, covers and supports for services, plant and equipment as deemed necessary for the completion of the works.
•Access equipment to work at high level and on the flat roof area.
•Provision of equipment to deliver services onto the flat roof.
•All fire stopping.
•Trimming/support steelwork around any structural openings as necessary.
•Secondary steelwork for support of mechanical equipment i.e. pipework etc.

Making good shall be carried out as necessary in order to seal and weatherproof any existing/new holes in the existing structure and to repair existing elements disturbed by the new works.

Design Parameters

All works shall be undertaken in accordance with the following:-
•Building Regulations (current editions).
•BESA (HVCA) Standard Specification for Ductwork DW144.
•The Construction (Design & Management) Regulations 2015
• CIBSE Design Guides Current Practice
• CIBSE Commissioning Codes Series 'A' and 'W'
• BSRIA BG 29/2012 'Pre-commissioning Cleaning of Pipework Systems.
• HVCS TR19 - Internal Cleanliness of Ventilation Systems.
•All relevant Health Technical Memorandums
•BS 7671 17th Edition Wiring Regulations

Phasing of the Works

The Contractor shall prepare a programme of works which offers the minimum down time for NOCS.

Considerations shall include, but not be limited to the following:-

•The initial supply installation, pressure testing, thermal insulation of new chilled water pipework connections, complete with valved tappings ready for connection into the site chilled water infrastructure within MEDA 122. The Contractor shall make allowance within their tender for the draining down of the chilled water circuit to allow for the new connections to be made but to include as an option 'hot tapping' into a live service.

Strip out Works

The Contractor shall isolate, drain and remove the chilled water pipework as identified

on the design drawings.

For the purposes of tender, the Contractor shall assume that areas may contain asbestos materials and shall make due allowance for works to be undertaken in accordance with the Control of Asbestos Regulation 2012.

Prior to the commencement of works the Contractor shall request a copy of the building asbestos register detailing all areas of the building including services. This report shall be provided to all employees/contractors working on the project. Until all areas, items and materials are proven free of asbestos, no works shall be undertaken.
Should the Contractor suspect any materials of containing asbestos they shall notify the principal designer/contractor and project manager who will commission an approved asbestos contractor to test and as necessary remove the suspect material.

New Works

The Contractor shall provide, install, test and commission the chilled water system as described within this specification and as indicated on the tender drawings. This shall include for off-loading, positioning on site all pipework, fittings and equipment to provide a complete working system.

Prior to the works the Contractor shall carry out validation flowrate and pressure measurements where possible on the existing chilled water system at full load in order to check that there is sufficient pressure in the existing system.

Specific works include but are not limited to the following:

• Supply and installation of new chilled water pipework connections to the new fan coil units.
• Supply and installation of new condensate drainage pipework from the new fan coil units and heat recovery ventilation unit to connect to the existing waste drainage system via a waterless Hepvo trap.
• Thermal insulation of all chilled water pipework and application of ID labelling.

The Contractor shall supply and install a valve chart in a protective laminated format and installed within each of the plantrooms ensuring they detail every pipe size and valve in the new chilled water installation.

All equipment shall be installed to allow the item of equipment to be readily maintained, inspected and replaced.

The Contractor shall submit proposed layouts and manufacturer's details to the project manager for approval prior to the commencement of work.

The Contractor shall visit site to review the works. No discussions will be entered into with the Contractor regarding additional claims arising from such issues as:-

•Restricted site access particularly the confined space of the MEDA and service corridor.
•Restricted movement of materials within the boundaries of the site.
•Material handling and storage.
•Storage of materials/tools and equipment.
•Conditions that would have been deemed apparent to the Contractor following a visit to site.
•Provision of safety equipment.

All valves shall be located to be readily accessible.

Prior to the ordering of materials, the Contractor shall conduct all site measurements and checks to ensure that the materials specified are suitable. No discussions will be entered into with the Contractor due to the ordering of materials without the Contractor having first carried out site measurement, which as a result has either caused additional unplanned works or required the return of previously ordered materials.

The Contractor shall note that a Practical Completion Certificate will not be issued until the first draft of the O&M manuals have been received with no outstanding comments or actions remaining.

System performance: *60-45-10/210 Design of chilled water systems; 60-45-10/260 Cooling system capacity for chilled water systems; and 60-45-10/270 Water treatment for chilled water systems.*

System:

- Arrangement: *Two pipe.*
- Pipeline circuits: *Variable flow.*

Cooling source: *Existing.*

Pumps: *Existing.*

Pipelines: *90-10-65/415 Steel pipelines.*

Pipelines accessories:

- Venting devices: *90-10-60/310 Automatic air vents.*
- Expansion devices: *To be defined.*
- Gauges: *90-10-60/380 Temperature gauges and 90-10-60/375 Pressure and altitude gauges.*
- Accessories: *90-10-60/405 Pipe sleeves; 90-10-60/395 Masking plates; 90-10-60/400 Pipeline strainers; and 90-10-60/420 Tundishes.*

Valves:

- Isolating valves: *90-10-90/330 Ball valves.*
- Regulating valves: *90-10-90/356 Double regulating valves and 90-10-90/358 Flow measuring devices.*
- Draining and venting devices: *90-10-90/374 Draining taps.*
- Accessories: *90-10-90/360 Test points type B and 90-10-90/360 Test points type C.*

Thermal insulation: *90-90-40/360 Phenolic foam insulation and 90-90-40/330 Mineral wool pipe section insulation.*

Emitters: *90-45-05/320 Fan coil units.*

Controls: *75-75-50/125 Cooling systems control.*

System accessories: *90-90-60/390 Services supports.*

Plant and equipment identification: *90-90-55/490 Valve charts and schematics; 90-90-55/495 Valve identification labels; 90-90-55/480 Mechanical plant and equipment identification labels; and 90-90-55/430 Identifying pipework.*

Execution: *To be defined.*

System completion: *To be defined.*

Products Recommendations to be met or matched with equivalent or better specifications

90-10-60/310 Automatic air vents

Arrangement: *Vertical inlet with integral lockshield isolating valve.*

Product: *To be defined.*

- Manufacturer: *Spirax and Oventrop.*
- Product Reference: *Spirax - AESSOSY SG Iron and Oventrop - Fig 1088203.*

Material: *Gunmetal.*

Connections: *Threaded.*

90-10-60/375 Pressure and altitude gauges

Manufacturer: *To be defined.*

- Product Reference: *Contractor's choice.*

Standard:

- Bourdon: *To BS EN 837-1.*
- Diaphragm: *To BS EN 837-3.*

Diameter: *100 mm.*

Case: *Black steel.*

Connections: *'U' pattern siphon and gauge cock.*

Execution: *90-10-60/630 Installing pressure gauges.*

90-10-60/380 Temperature gauges

Standard: *To BS EN 13190.*

Format: *Bi-metallic.*

Manufacturer: *Contractor's choice.*

Diameter: *100.* Case: *Black steel.* Connections: *Straight stem.*

Integral accessories: *100 mm immersion length pocket.*

90-10-60/395 Masking plates

Manufacturer: *Contractor's choice.*

Material:

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

90-10-60/400 Pipeline strainers

Pattern: *Y pattern.*

Manufacturer: *To be defined.*

- Product Reference: *Refer to STR.*

Material: *Dezincification resistant brass (DZR).*

Connections: *Flanged.*

Integral accessories: *Plugged connections for drain, air vent and differential pressure monitoring.*

Execution: *To be defined.*

90-10-60/405 Pipe sleeves

Material: *Manufacturer's standard.*

Form: *Manufacturer's standard.*

90-10-60/420 Tundishes

Manufacturer: *To be defined.*

- Product Reference: *Contractor's choice.*

Material: *Mild steel sheet, hot dip galvanized.*

Connections: *Diameter to suit drain line.*

90-10-65/415 Steel pipelines

General requirements: *90-10-65/425 Steel pipeline jointing materials and 90-10-65/420 Steel pipeline fittings.*

Standard:

- Up to 150mm: *To BS EN 10255, heavy weight.*
- 150mm and above: *To BS EN 10216-1, designation TR1 and To BS EN 10217-1, designation TR1.*

Execution: *To be defined.*

90-10-65/420 Steel pipeline fittings

Standards:

- Malleable: *To BS 143 and 1256.*
- Flanged: *To BS EN 1092-1.*
- Welded: *To BS EN 10253-1 and BS EN 10253-2.*
- Wrought: *To be defined.*
- Press fit fittings: *To be defined.*
- Mechanical couplings: *To be defined.*

90-10-65/425 Steel pipeline jointing materials

Standards:

- Jointing compound: *To BS 6956-5.*
- PTFE tape: *To BS EN 751-3.*
- Flange jointing rings: *To BS EN 1514-4.*
- Elastomeric gaskets: *To BS EN 681-1.*
- Welding rods:

  Gas welding: *To BS EN 12536.*

  Arc welding: *To BS EN ISO 636.*

90-10-90/305 Connections for accessories type A

Threaded:

- Where pressure-tight joints are made on the threads: *To BS 21 or BS EN 10226-1.*
- Where pressure-tight joints are not made on the threads: *To BS EN ISO 228-1.*

90-10-90/305 Connections for accessories type B

Threaded:

- Where pressure-tight joints are made on the threads: *To BS 21 or BS EN 10226-1.*
- Where pressure-tight joints are not made on the threads: *To BS EN ISO 228-1.*

90-10-90/330 Ball valves

General requirements: *90-10-90/305 Connections for accessories type A.*

Material: *Brass copper alloy.*

Manufacturer: *To be defined.*

- Product Reference: *Refer to STR*

Connections: *Threaded.*

Finish: *Natural.*

90-10-90/356 Double regulating valves

General requirements: *90-10-90/360 Test points type A and 90-10-90/305 Connections for accessories type B.*

Type: *Globe.*

Manufacturer: *To be defined.*

- Product Reference: *Refer to STR.*

Standard: *To BS 7350.*

Arrangement: *Globe.*

Material: *Steel.*

Connections: *Threaded joints to BS EN ISO 228-1.*

90-10-90/358 Flow measuring devices

Standard: *To BS 7350.*

General requirements: *90-10-90/360 Test points type A and Connections for accessories.*

Type: *Globe.*

Manufacturer: *To be defined.*

- Product Reference: *Refer to STR.*

Material: *Steel.*

Connections: *Threaded joints to BS EN ISO 228-1.*

Execution: *90-10-90/610 Installation of valves generally.*

90-10-90/360 Test points type A

Shared by: *90-10-90/356 Double regulating valves; and 90-10-90/358 Flow measuring devices.*

Arrangement: *Manufacturer's standard.*

Material: *Manufacturer's standard.*

Connections: *Manufacturer's standard.*

90-10-90/360 Test points type B

Manufacturer: *Refer to STR*

Arrangement: *Self-sealing.*

Material: *Manufacturer's standard.*

Connections: *Manufacturer's standard.*

90-10-90/360 Test points type C

Arrangement: *Self sealing.*

Manufacturer: *To be defined.*

- Product Reference: *Refer to STR.*

Material: *Brass.*

Connections: *12.5 mm (½ inch) standard length.*

90-10-90/374 Draining taps

General requirements: *Manufacturer's standard.*

Standard: *To BS 2879.*

Arrangement: *1.*

Product: *To be defined.*

- Product Reference: *Contractor's choice.*

Material: *Bronze.*

Connections: *Threaded.*

90-45-05/320 Fan coil units

Manufacturer: *Refer to STR*

Standard: *To BS 4856-1, BS 4856-2, BS 4856-3 and BS 4856-4.*

Duty:

- Air volume: *Refer to STR*
- Cooling output: *Refer to STR*
- Noise levels: *Refer to STR*

Water temperature:

- Chilled water flow: *6 deg C*
- Chilled water return: *12 deg C*

Fan speed: *Refer to STR*

Noise levels: *Refer to STR*

Electrical supply type: *Refer to STR*

Casings: *Refer to STR*

Mounting: *Vertical. Wall mounted.*

Finish: *Manufacturer's standard.*

Access: *Provide access to filter, fan and motor, valves and controls.*

Drip tray:

- Position: *Under coil, and under control valve where fitted.*
- Material: *Corrosion resistant.*
- Finish: *Insulate external faces to prevent.*

Controls: *Manufacturer's standard.*

Accessories: *Manufacturer's standard.*

Execution: *90-45-05/610 Installing drain lines*.

90-90-40/330 Mineral wool pipe section insulation

Manufacturer: *ROCKWOOL Ltd*

Product reference: *Submit proposals.*

Standard: *To BS 3958-4.*

Recycled content: *Manufacturer's standard.*

Thermal conductivity: *0.032 W/m·K at 0°C.*
0.034 W/m·K at 10°C.
0.037 W/m·K at 50°C.
0.040 W/m·K at 75°C.
0.044 W/m·K at 100°C.

Finish: *Aluminium foil faced.*

Insulation thickness (minimum): *To BS 5422.*

Accessories: *90-90-40/480 Insulation for valves and flanges;*
90-90-40/485 Insulation at loadbearing pipeline supports;
and 90-90-40/390 Protection.

Execution: *90-90-40/625 Installing foil faced mineral wool insulation on pipelines.*

90-90-40/360 Phenolic foam insulation

Standard: *To BS EN 13166.*

Manufacturer: *To be defined.*

- Product Reference: *Contractor's choice.*

Form: *Duct slab and Pipe section.*

Thermal conductivity: *0.025 W/m·K.*

Finish: *Aluminium.*

Execution: *90-90-40/780 Installing vapour barriers and 90-90-40/640 Installing phenolic foam insulation on pipelines.*

90-90-40/480 Insulation for valves and flanges

Material: *Submit proposals.*

Form: *Removable and reusable pads.*

Finish: *Manufacturer's standard.*

Execution: *90-90-40/740 Installing at valves and flanges.*

90-90-40/485 Insulation at loadbearing pipeline supports

Pipelines carrying cold fluids: *Submit proposals.*

Execution: *90-90-40/750 Installing at loadbearing pipelines supports.*

90-90-55/430 Identifying pipework

Standards: *To BS 1710.*

Type: *Black bands, with arrows to indicate direction of flow*

Wording: *White lettering "CHILLED WATER" on black background*

Identification type: *Adhesive colour bands.*

Locations: *At 3000mm centres, junctions and both sides of slabs, valves, appliances, bulkheads and wall penetrations*

90-90-55/480 Mechanical plant and equipment identification labels

Standard: *To BS 1710.*

Type: *Traffolyte Labels.*

Manufacturer: *To be defined.*

- Product Reference: *Contractor's choice.*

Colour: *White.*

Size: *150x25mm.*

Colour and size of lettering: *8mm high.*

Wording: *As described on contract drawings and agreed with engineer.*

Fixing: *Brass round head screws.*

Execution: *90-90-55/610 Installing mechanical plant and equipment identification.*

90-90-55/490 Valve charts and schematics

Material: *Paper print, glazed frame.*

Information to be included: *Location and identification of pipework regulating, isolating and control valves.*

Execution: *90-90-55/620 Installing valve charts and schematics.*

90-90-55/495 Valve identification labels

Standard: *To BS 1710.* Type:

Traffolyte Labels.

Manufacturer: *To be defined.*

- Product Reference: *Contractor's choice.*

Colour: *White.*

Size: *25mm Diameter.*

Colour and sizing of lettering: *Black 10mm high.*

Wording: *A number and service designation e.g. HWS-F, which is reproduced on the as-fitted drawings and on separate valve chart.*

Fixing: *Brass ring fitted around spindle.*

90-90-60/390 Services supports

Manufacturer: *Contractor's choice.*

Support type: *Beam clips;*
Cantilever hanger;
Proprietary support channels and fixings;
and All ductwork shall be supported by steel drop rods. Wire suspensions shall not be used..

Positioning: *All ductwork shall be independently supported within 500mm both sides of any partition.*

Execution

90-10-60/630 Installing pressure gauges

Position: *Between the supply pipe stop valve and the check valve on a town main connection;*
Downstream of outlet check valve and upstream of outlet stop valve on pump supply;
Immediately downstream of the alarm valve;
Immediately downstream of the tail end valve but upstream of any subsidiary stop valve;
and Immediately upstream of the main control stop valve.

90-10-90/610 Installation of valves generally

Installation: *In accordance with BS 6683.*

Position: *As valve schedule*

Sanitary Appliance Isolation: *1/4 turn type isolation valves on domestic services*

Isolation and regulation valves: *Provide at equipment and on sub-circuits.*

Access: *Locate valves so they can be readily operated and maintained. Locate next to equipment which is to be isolated.*

Connection to pipework: *Fit with joints that suit the pipe material.*

90-45-05/610 Installing drain lines

Drain connections: *Connect drainline flush with bottom of drip tray.*

Drain line material: *To be defined.*

90-90-40/610 Installing insulation and protection products generally type A

Standard: *In accordance with BS 5970.*

Timing: *Insulate after installed system has been fully tested and joints proved sound.*

Insulation: *Do not enclose adjacent units together.*

Clearance: *Maintain between pipes.*

Finish: *Neatly finish joints, corners, edges and overlaps.*

90-90-40/610 Installing insulation and protection products generally type B

Standard: *In accordance with BS 5970.*

Timing: *Insulate after installed system has been fully tested and joints proved sound.*

Insulation: *Do not enclose adjacent units together.*

Clearance: *Maintain between pipes.*

Finish: *Neatly finish joints, corners, edges and overlaps.*

90-90-40/625 Installing foil faced mineral wool insulation on pipelines

General requirements: *90-90-40/610 Installing insulation and protection products generally type A.*

Joints: *Close butt; seal with 50 mm wide class 0 tape on both longitudinal and circumferential joints.*

At fittings: *Mitre. Secure with tape.*

Vapour seal: *Tape exposed insulation membrane. Seal vapour barrier at pipe support with class 0 tape.*

90-90-40/640 Installing phenolic foam insulation on pipelines

General requirements: *90-90-40/610 Installing insulation and protection products generally type B.*

Joints: *Close butt, seal with 50 mm wide class 0 tape on both longitudinal and circumferential joints.*

At fittings: *Mitre. Secure with tape.*

Vapour seal: *Tape exposed insulation membrane. Seal vapour barrier at pipe support with class 0 tape.*

90-90-40/740 Installing at valves and flanges

Application: *Do not obstruct removal of nuts and bolts, or operation of valves.*

90-90-40/750 Installing at loadbearing pipelines supports

Application: *Close butt to insulation.*

Joints: *Seal with 100 mm wide class 0 foil tape.*

Sleeve: *Provide sheet metal protection sleeve.*

90-90-40/780 Installing vapour barriers

Integrity: *Seal to maintain throughout.*

90-90-55/610 Installing mechanical plant and equipment identification

Fixing: *Fix with adhesive to equipment and Plug and screw to wall.*

Position: *On equipment base.*

90-90-55/620 Installing valve charts and schematics

Fixing: *Submit proposals.*

Position: *Plant room.*

Ω End of system

65-10-95/130 Mechanical supply ventilation system

System outline

65-10-95/130 Mechanical supply ventilation system

Description: *There is currently no mechanical ventilation within the proposed Synthetic Environment room other than an existing extract ventilation system which shall be removed.*

The new room will be designed to accommodate up to 25 occupants for presentations and a new mechanical ventilation system shall be provided for fresh air for ventilation.

The ventilation unit shall be a self contained heat recovery ventilation unit (HRVU) which incorporates speed controlled supply and extract fans, supply and extract filters, heat exchanger and integral controls.

Control of the ventilation unit will be determined by occupancy and the fan speed shall be automatically controlled based on a CO2 sensor located in the return duct.

The HRVU shall be installed at high level within the service cupboard.

To provide sufficient room for the HRVU the existing high level heating pipework shall be re-routed.

Intake and exhaust air connections shall be via vertical duct connections through the roof to a suitable terminal unit.. The exhaust connection shall utilise the location of the existing roof penetration which will be modified to suit.

The Contractor shall provide all required new and modified penetrations and weathering details.

There is insufficient space within the existing ceiling void to route new ductwork so the ventilation ductwork shall be supported from the ceiling and exposed within the room.

The Contractor shall make allowance for the removal of sections of the solid suspended ceiling within W2/13 to provide fixings for the new services (i.e. ductwork and fabric ducts) where necessary including all subsequent making good etc.

Supply ventilation shall be provided via 'D-shaped' fabric ducts arranged between the existing lighting rows.

Return air shall be extracted via a bellmouth.

Duct mounted attenuators shall be installed to minimise air generated noise from the ventilation unit to NR35 within the room.

Please refer to Appendix F for structural related information.

Location of plant: *High level in service cupboard*

Type of system: *Constant volume.*

External air intake: *Via roof terminal*

Air filters: *Manufacturers standards*

Heat recovery: *Manufacturers standards*

Acoustic treatment: *90-45-75/320 Circular silencers*.

Air ductwork and accessories:

- Ductwork: *90-45-25/315 Circular sheet metal ductwork and fittings*.
- Accessories: *90-45-25/420 Fire and smoke dampers* and *90-45-25/480 Shut off dampers*.

Vibration isolation mountings: *90-90-95/370 Isolation hangers*.

Room supply air terminal devices: *Fabric ducts*

Controls: *Manufacturers standards*

Identification of ductwork and equipment: *90-90-55/420 Identifying ductwork*.

Execution: *65-10-95/610 Removing ventilation system* and *65-10-95/640 Ductwork systems cleaning*.

System completion: *65-10-95/830 Inspection and test records;*
65-10-95/840 Demonstrations;
65-10-95/850 Documentation for ventilation systems;
and 65-10-95/810 Commissioning of air distribution systems.

Products Recommendations to be met or matched with equivalent or better specifications

90-45-25/315 Circular sheet metal ductwork and fittings

Standards: *To HVCA DW/144;*
BS EN 1506;
and BS EN 12237.

Classification: *To DW/144: Class A Low Pressure.*

Air leakage testing: *Required where system flow rate >0.2m3/s and Maximum permissible air leakage rates shall be as DW144 Table 2 - Low Pressure Class A or Medium Pressure Class B as dictated by specified AHU or fan external static pressure, with tests carried out in accordance with DW143.*

Material: *Mild steel.*

Construction: *Spirally wound.*

Regulating dampers:

- Balancing type: *Double skin single-blade damper.*
- Operation: *Manual.*
- Material: *To match ductwork.*

Hangers and supports: *To be defined.*

- Strength requirements: *To BS EN 12236.*
- Notes: *All ductwork shall be independently supported within 500mm either side of any partition and All ductwork shall be supported via drop rods. The use of gripper wire shall not be acceptable.*

Access openings: *Function: As HVCS TR19 Table 2;*
Inspection;
Cleaning;
and Maintenance.

Sizes: *As DW 144 Appendix D;*
Unless otherwise detailed medium radius bends shall be used as standard. Where square

bends are used turning vanes shall be provided;
and Self piercing drill screws shall not be used on ducting, only blind rivets shall be accepted.

90-45-25/480 Shut off dampers

Standard: *To BS EN 1751.*

Manufacturer: *To be defined.*

- Product Reference: *Contractor's choice.*

Leakage through closed blades: *As DW 144.*

Casing leakage: *To suit system i.e. A,B.C.*

Setting: *After commissioning, the setting of each damper shall be recorded on the damper itself and logged in the O&M manual/As Fitted drawings.*

Material: *Galvanized sheet steel.*

Control method: *Manual/Motorised.*

90-45-75/320 Circular silencers

Manufacturer:

- Product reference: *As STR.*

Application: *As STR.*

Performance standards: *To BS EN ISO 7235 and BS EN ISO 11691.*

Duty:

- Insertion loss: *See Silencer Schedule.*
- Air volume: *See Silencer Schedule.*
- Permissible pressure loss: *See Silencer Schedule.*

Casing material: *Metal.*

Lining material: *Inert, fire proof, inorganic and non- hygroscopic.*

Duct connections: *Manufacturer's Standard.*

Markings: *Show direction of air flow on silencer.*

90-90-55/420 Identifying ductwork Manufacturer:

Contractor's choice. Standard: *To BS 1710*

and To BS EN 13779.

Identification type: *Self-adhesive plastics or transfers.*

Colour: *Submit proposals.*

Lettering: *Submit proposals.*

Execution: *90-90-55/650 Installing ductwork identification*.

90-90-95/370 Isolation hangers

Isolation hangers type: *Spring and neoprene rubber.*

Manufacturer: *To be defined.*

- Product Reference: *Contractor's choice.*

Colour code: *Submit proposals.*

Load: *Submit proposals.*

Deflection: *Submit proposals.*

Drop rod misalignment capability: *35%.*

Execution

65-10-95/610 Removing ventilation system

Scope: *Remove existing ventilation systems, including ductwork and controls as detailed on the drawings.*

65-10-95/640 Ductwork systems cleaning

Standards: *In accordance with BESATechnical Report TR/19 and to BS EN 15780.*

90-45-25/750 Access to dampers for resetting and maintenance

Position: *Provide access to damper mechanisms on fire dampers; smoke dampers; combined smoke and fire dampers, and volume control dampers through access doors, suspended ceilings, etc. Where more than one fire damper is installed in a frame provide access to all fire dampers.*

Fire links: *Provide access for replacement.*

90-90-55/650 Installing ductwork identification

Standard: *In accordance with BESADW/144.*

Position: *Locate where visible.*

Direction of flow: *Equilateral triangle, 150 mm length of side, with one apex pointing in the direction of flow.*

Information: *Space served by the duct and associated plant*

System completion

65-10-95/810 Commissioning of air distribution systems

Pre-commissioning: *In accordance with BSRIABG 49/2015 and CIBSECommissioning code A.*

Commissioning: *In accordance with BSRIABG 49/2015 and CIBSECommissioning code A.*

Notice (minimum): *48 h.*

65-10-95/830 Inspection and test records

Records for air systems: *In accordance with BSRIABG 49/2015.*

65-10-95/840 Demonstrations

Running of plant:

- Operation: *Run, maintain and supervise the installations under normal working conditions.*
- Duration: *One week.*

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

65-10-95/850 Documentation for ventilation systems

Operating and maintenance instructions:

- Scope: *Submit for the system as a whole giving optimum settings for controls.*
- Product information: *Include product description, date of purchase, performance characteristics, application (suitability for use), method of operation and control, and cleaning and maintenance requirements.*
- Format: *Paper copy.*

Record drawings:

- Content: *Location and arrangement of plant in plant rooms;*
  Location, size and route of ductwork;
  Location and identification of regulating dampers and fire dampers;
  and Location of outlets.
- Format: *Electronic.*

Submittal date: *At handover.*

Ω End of system

70-70-45/110 Low voltage distribution system

System outline

70-70-45/110 Low voltage distribution system

Description: *The Electrical Contractor shall allow for modifications to the existing dado trunking to allow the installation of the new media wall. The dado installed to this wall shall be lowered from the existing height of 1290mm AFFL (to top) to the new height of 1000mm AFFL (to top).*

The Electrical Contractor shall install 4 No. new 13A switched fused connection units in the locations shown on the design drawing. These switched fused connection units will feed 1 No. new Heat Recovery Ventilation Unit and 3No. new fan coil units. 1 No. new radial circuit will be provided to supply these new mechanical services, this supply will be obtained from way 9L3 of existing distribution board 'LVS10/N29P' utilising 4.0 mm² LSZH single core cables protected by a 20A Type C MCB. This new cabling will be routed within the existing steel trunking contained within the existing low level boxing, see the design drawing for more information.
Locally the new LSZH singles cabling will be contained within new high impact PVC conduit, supported by steel saddles.

The Electrical Contractor shall remove 5 No. double socket outlets (fed from DB LVS10/N29P/2/L3) from the existing dado in the location indicated on the drawing, providing new trunking lid to cover these existing holes. 4 No. new double sockets will be provided above the existing Dado trunking to supply the new media wall screens. Extend the existing 4.0 mm² ring circuit supplied by DB LVS10/N29P/2/L3 within surface mounted high impact PVC conduit from the top of the existing (relocated) dado trunking.

The Electrical Contractor shall install a 13A switched fused connection unit to feed the heat meter within the Glider Workshop. Provide a new 2.5 mm² radial circuit from way 12L1 of DB LVS10/N29P utilising LSZH single core cables protected by a 16A type B MCB. This new cabling will be routed within surface mounted high impact PVC conduit.

Connection to low voltage supply: *Existing.*

Switchgear: *Existing.*

Distribution circuit cabling: *90-55-15/334 Single core non-sheathed cables with LSHF insulation.*

Containment: *90-55-10/380 Rigid conduit.*

Containment accessories: *90-55-10/460 Conduit fittings.*

Rewireable installation: *Required.*

Concealed installation: *Required, where possible.*

Execution: *70-70-45/630 Electrical property measurement of low voltage systems.*

System completion: *70-70-45/810 Inspecting, testing and commissioning of switchgear generally.*

Products Recommendations to be met or matched with equivalent or better specifications

90-55-10/380 Rigid conduit

Shared by: *70-70-45/110 Low voltage distribution system; and 70-80-35/110 Hard wired general lighting system.*

Manufacturer: *Contractor's choice.*

Standard: *To BS EN 61386-21.*

Material: *High Impact PVC.*

Mechanical properties:

- Resistance to compression: *Heavy.*
- Resistance to impact: *Heavy.*
- Resistance to bending: *Rigid.*
- Tensile strength: *Heavy.*
- Suspended load capacity: *Heavy.*

Resistance against flame propagation: *Required.*

Sizes (OD): *20 mm;*
25 mm;
and 32 mm.

Execution: *90-55-10/735 Installing conduit connections to equipment and 90-55-10/765 Conduit, trunking and ducting zones.*

90-55-10/460 Conduit fittings

Shared by: *70-70-45/110 Low voltage distribution system; and 70-80-35/110 Hard wired general lighting system.*

Manufacturer: *Match conduit.*

Standards: *To BS EN 61386-1 and to BS EN 61386-21, BS EN 61386-22, or BS EN 61386-23 as appropriate; or to BS 4607-1.*

Material:

- Type: *PVC-U.*
- Finish: *Match conduit.*

Conduit boxes: *Fit covers of same material and finish as boxes. Include brass earthing terminals in PVC-U boxes.*

Plugs:

- For non-metallic boxes: *Hexagon screwed PVC-U.*

Locknuts:

- For non-metallic boxes: *Knurled circular PVC-U.*

Execution: *90-55-10/700 Installing conduit, trunking and ducting.*

90-55-15/334 Single core non-sheathed cables with LSHF insulation

Shared by: *70-70-45/110 Low voltage distribution system; and 70-80-35/110 Hard wired general lighting system.*

Manufacturer: *Contractor's choice.*

Standards: *To BS EN 50525-1 and BS EN 50525-3-41.*

Third party certification: *British Approvals Service for Cables (BASEC) certified.*

Cable type: *H07Z-R.*

Size: *Submit proposals.*

Execution: *90-55-15/635 Installing low voltage cables and 90-55-15/660 Installing low voltage cables in conduit and trunking.*

Execution

70-70-45/630 Electrical property measurement of low voltage systems

Objectives: *To determine the integrity of the existing installation, prior to carrying out new works.*

Property values to be recorded: *Carry out a full Periodic Test and Inspection; including identification and verification of existing retained distribution board circuits.*

Results:

- Format: *Electronic Certificated results, with one hard copy.*

90-55-10/700 Installing conduit, trunking and ducting

Shared by: *90-55-10/460 Conduit fittings; 90-55-10/735 Installing conduit connections to equipment; and 90-55-10/765 Conduit, trunking and ducting zones.*

Standards: *In accordance with BS 7671 and IET Guidance Note 1.*

Preparation: *Cut square. Remove burrs and sharp edges to make smooth.*

Protection of metallic conduit, trunking and ducting: *To be defined.*

Cross-sectional area: *Maintain throughout the conduit, trunking and ducting length.*

Arrangement: *Position vertically and horizontally in line with equipment served, and parallel with building lines.*

Spare containment: *To be defined.*

Draw wires: *Install nylon tapes galvanized soft iron wires within spare conduit, trunking and ducting.*

Distance from other services running parallel (minimum):

- Generally: *150 mm.*
- Above radiators: *600 mm.*
- Steam services: *600 mm.*

Drainage of conduit, trunking and ducting: *Locate drainage outlets at lowest points in conduit, trunking and ducting installed externally, and where condensation may occur.*

Fire barriers: *Provide to maintain integrity of fire compartments.*

Rewireable installations: *Enable rewiring from accessible boxes or accessories only.*

Support: *Independently fix and support conduit, trunking and ducting from building structure.*

Cleaning: *Clean insides of conduit, trunking and ducting before installing cables.*

Cabling: *Install when conduit, trunking and ducting enclosure is complete.*

Submittals: *Submit manufacturer's technical information. Submit drawings showing the proposed routes of conduit, trunking and ducting and the location of service outlets.*

90-55-10/735 Installing conduit connections to equipment

General requirements: *90-55-10/700 Installing conduit, trunking and ducting.*

Surface mounted equipment:

- Concealed conduit: *Conceal the final connection.*

Connections to external equipment: *90-55-10/360 Flexible conduit*.

90-55-10/765 Conduit, trunking and ducting zones

General requirements: *90-55-10/700 Installing conduit, trunking and ducting*.

Ceiling voids: *Provide clear distance of 150 mm (minimum) between underside of any conduit or trunking and the topside of ceiling.*

90-55-15/635 Installing low voltage cables

Standard: *In accordance with BS 7671.*

Timing: *Do not start internal cabling until building enclosure provides permanently dry conditions.*

Preparation: *Store cables above 5°C for 24 hours before installation.*
Clear cable path of debris.

Installation temperature (minimum): *5°C.*

Cables: *Install in one length. Dress cables flat, free from twists, kinks and strain.*

Cable pulling: *Do not overstress. Prevent kinks and twisting of the cable.*

Cable protection: *Cables passing through walls and floors to be sleeved with conduit or pipeduct to a minimum of 300 mm. Bush at both ends. Ensure that appropriate fire stopping materials are used to maintain the original fire integrity of the wall or floor around the penetration.*

Concealed cable runs to wall accessories: *Run vertically from the accessory.*

Exposed cable runs: *Direct to surface.*

Distance from other services running parallel (minimum): *150 mm. Position cables below heating pipes.*

Jointing and termination:

- Final circuit cables: *At electrical accessories only.*
- Core connections: *Using compression lugs to equipment without integral clamping terminals.*
- Terminating cables when not using glands: *Take sheathing of cables into accessory boxes and equipment and protect against abrasion with grommets.*

90-55-15/660 Installing low voltage cables in conduit and trunking

Cable installation: *Orderly and capable of being withdrawn.*

Single core wiring: *Arrange using the loop-in method.*

Cables within trunking: *Tie at 2 m intervals for cables of the same circuit reference. Label ties with circuit reference number at 10 m intervals.*

Cables in vertical conduit: *Provide cable clamps in accessible conduit boxes at 5 m intervals.*

Extra low voltage cables: *Install within a separate partition from low voltage cables where installed in multi compartment trunking.*

System completion

70-70-45/810 Inspecting, testing and commissioning of switchgear generally

Standard: *In accordance with BS 7671.*

Notice before testing and commissioning: *7 days.*

Switches and circuit breakers: *Clean to remove all visible traces of dust.*

Protective devices settings: *Configure to match the grading study.*

Switchboard monitoring: *Continuous for 30 minutes following first energizing.*

Additional inspecting and testing: *Check levelling and alignment of assembly.*
Check operation of instruments and metering devices.
Check and adjust tightness of busbar connections and supports.
Check tightness of bolted connections.
Check busbar joints with duct or resistance measurements.
Check earth connections at compartments, switches and earth electrodes.
Check clearance of live parts from direct contact.
Check polarity and phase sequence of protective devices.
Check operation of protective devices using secondary and primary current injection.
Manually operate protective devices.
Carry out earth fault protection simulation tests.
Check functional operation of circuit breakers.
Check operation of switch tripping devices.

Testing and commissioning results: *Submit one copy.*

Certificates of calibration for meters and instruments: *Submit.*

Ω End of system

70-80-35/110 Hard wired general lighting system

System outline

70-80-35/110 Hard wired general lighting system

Description: *All existing lighting within the works areas will be retained. Within room W2/13 the switching of the existing LED luminaires shall be modified by the Contractor so that the luminaires switch in rows from left to right (parallel to the new media wall).*

Record drawings indicate that the existing luminaires are connected to a DALI lighting control module located above the ceiling. It should therefore be possible to carry out this modification purely through reprogramming without the need for any cabling alterations.

Final circuit cabling: *90-55-15/334 Single core non-sheathed cables with LSHF insulation.*

Containment: *90-55-10/380 Rigid conduit.*

Containment accessories: *90-55-10/460 Conduit fittings.*

Rewireable installation: *Required.*

Concealed installation: *Required.*

Luminaire types: *90-60-50/405 General purpose luminaires.*

Lamp types: *As per luminaire schedule on drawing.*

Connections to luminaires: *90-60-25/425 Ceiling roses.*

Lighting controls: *90-60-25/325 Light switches and 90-60-25/330 Dimmer switches and controls.*

Accessories: *Submit proposals.*

Electrical identification: *Submit proposals.*

Execution: *70-80-35/610 Removing lighting systems and 70-80-35/620 Modifying existing lighting systems.*

System completion: *70-80-35/812 Testing and commissioning emergency lighting systems.*

Products Recommendations to be met or matched with equivalent or better specifications

90-55-10/380 Rigid conduit

Shared by: *70-70-45/110 Low voltage distribution system; and 70-80-35/110 Hard wired general lighting system.*

Manufacturer: *Contractor's choice.*

Standard: *To BS EN 61386-21.*

Material: *High Impact PVC.*

Mechanical properties:

- Resistance to compression: *Heavy.*
- Resistance to impact: *Heavy.*
- Resistance to bending: *Rigid.*
- Tensile strength: *Heavy.*
- Suspended load capacity: *Heavy.*

Resistance against flame propagation: *Required.*

Sizes (OD): *20 mm;*
25 mm;
and 32 mm.

Execution: *90-55-10/735 Installing conduit connections to equipment* and *90-55-10/765 Conduit, trunking and ducting zones*.

90-55-10/460 Conduit fittings

Shared by: *70-70-45/110 Low voltage distribution system; and 70-80-35/110 Hard wired general lighting system*.

Manufacturer: *Match conduit.*

Standards: *To BS EN 61386-1 and to BS EN 61386-21, BS EN 61386-22, or BS EN 61386-23 as appropriate; or to BS 4607-1.*

Material:

- Type: *PVC-U.*
- Finish: *Match conduit.*

Conduit boxes: *Fit covers of same material and finish as boxes. Include brass earthing terminals in PVC-U boxes.*

Plugs:

- For non-metallic boxes: *Hexagon screwed PVC-U.*

Locknuts:

- For non-metallic boxes: *Knurled circular PVC-U.*

Execution: *90-55-10/700 Installing conduit, trunking and ducting*.

90-55-15/334 Single core non-sheathed cables with LSHF insulation

Shared by: *70-70-45/110 Low voltage distribution system; and 70-80-35/110 Hard wired general lighting system*.

Manufacturer: *Contractor's choice.*

Standards: *To BS EN 50525-1 and BS EN 50525-3-41.*

Third party certification: *British Approvals Service for Cables (BASEC) certified.*

Cable type: *H07Z-R.*

Size: *Submit proposals.*

Execution: *90-55-15/635 Installing low voltage cables* and *90-55-15/660 Installing low voltage cables in conduit and trunking*.

90-60-25/325 Light switches

General requirements: *Manufacturer's standard.*

Manufacturer: *As electrical accessories manufacturer.*

Application: *Internal.*

Degree of ingress protection (minimum): *Manufacturer's standard.*

Rating: *20 A.*

Actuating method: *Standard rocker bar.*

Mounting: *Flush and Surface according to installation requirements.*

Poles: *Single pole.*

Execution: *90-60-25/640 Installing light switches*.

90-60-25/330 Dimmer switches and controls

Manufacturer: *As electrical accessories manufacturer.*
Standards: *To BS EN 60669-2-1 and BS EN 55015.*
Ingress protection (minimum): *Manufacturer's standard.*
Mounting: *Flush and Surface according to installation requirements.*
Format: *Soft start.*
Rating: *250 W.*
Suitable for the following loads: *Match to LED requirements.*
Control: *Momentary.*

90-60-25/425 Ceiling roses

Manufacturer: *As electrical accessories manufacturer.*
Standard: *To BS 67.*
Rating: *6 A.*
Mounting type: *Surface.*
Colour: *White.*

90-60-50/405 General purpose luminaires

General requirements: *90-60-50/440 Control gear generally*.
Manufacturer: *As per luminaire schedule.*
Standards: *Manufacturer's standard.*
Electric shock classification: *Manufacturer's standard.*
Rating (W): *As per luminaire schedule.*
Quantity: *202 22 05.*
Photometric performance: *To BS EN 13032-1.*
Supply circuit conductor connections: *Manufacturer's standard.*
Internal fuse: *Manufacturer's standard.*
Input voltage: *230 V a.c.*
Luminaire power factor: *Correct to minimum 0.9 lagging.*
Luminaire type: *As per luminaire schedule.*
Features: *Manufacturer's standard.*
Ballasts CELMA energy efficiency index (minimum): *A1 and A2.*
Control gear position: *Integral within luminaire.*
Lamps: *Submit proposals.*
Execution: *90-60-50/620 Installing luminaires and lamps generally*.

90-60-50/440 Control gear generally

Third party certification: *ENEC.*
Ballasts:

- For fluorescent lamps: *To BS EN 60921, BS EN 61347-1 and BS EN 61347-2-8.*
- For discharge lamps: *To BS EN 60923, BS EN 61347-1 and BS EN 61347-2-9.*

Lamp starters generally: *To BS EN 60927, BS EN 61347-1 and BS EN 61347-2-1.*
Electronic control gear:

- For fluorescent lamps: *To BS EN 60929, BS EN 61347-1 and BS EN 61347-2-3.*
- For battery supplied self-contained emergency lighting: *To BS EN 61347-1 and BS EN 61347-2-7.*
- For discharge lamps: *To BS EN 61347-1 and BS EN 61347-2-12.*
- For LED modules: *To BS EN 61347-1 and BS EN 61347-2-13 and BS EN 62384.*

Digital addressable control gear:

- For digital addressable fluorescent lamps: *To BS EN 62386-102 and BS EN 62386-201.*
- For digital addressable self-contained emergency lighting: *To BS EN 62386-102 and BS EN 62386-202.*
- For digital addressable high intensity discharge lamps: *To BS EN 62386-102 and BS EN 62386-203.*
- For digital addressable low voltage halogen lamps: *To BS EN 62386-102 and BS EN 62386-204.*
- For digital addressable incandescent lamps: *To BS EN 62386-102 and BS EN 62386-205.*
- For digital addressable LED modules: *To BS EN 62386-102 and BS EN 62386-207.*

Execution

70-80-35/610 Removing lighting systems

Scope: *As indicated on drawing.*

Disposal of batteries: *In accordance with manufacturer's recommended procedures.*

70-80-35/620 Modifying existing lighting systems

Existing luminaires: *Clean.*

Existing lamps: *Replace.*

90-55-10/700 Installing conduit, trunking and ducting

Shared by: *90-55-10/460 Conduit fittings; 90-55-10/735 Installing conduit connections to equipment; and 90-55-10/765 Conduit, trunking and ducting zones.*

Standards: *In accordance with BS 7671 and IET Guidance Note 1.*

Preparation: *Cut square. Remove burrs and sharp edges to make smooth.*

Protection of metallic conduit, trunking and ducting: *To be defined.*

Cross-sectional area: *Maintain throughout the conduit, trunking and ducting length.*

Arrangement: *Position vertically and horizontally in line with equipment served, and parallel with building lines.*

Spare containment: *To be defined.*

Draw wires: *Install nylon tapes galvanized soft iron wires within spare conduit, trunking and ducting.*

Distance from other services running parallel (minimum):

- Generally: *150 mm.*
- Above radiators: *600 mm.*
- Steam services: *600 mm.*

Drainage of conduit, trunking and ducting: *Locate drainage outlets at lowest points in conduit, trunking and ducting installed externally, and where condensation may occur.*

Fire barriers: *Provide to maintain integrity of fire compartments.*

Rewireable installations: *Enable rewiring from accessible boxes or accessories only.*

Support: *Independently fix and support conduit, trunking and ducting from building structure.*

Cleaning: *Clean insides of conduit, trunking and ducting before installing cables.*

Cabling: *Install when conduit, trunking and ducting enclosure is complete.*

Submittals: *Submit manufacturer's technical information. Submit drawings showing the proposed routes of conduit, trunking and ducting and the location of service outlets.*

90-55-10/735 Installing conduit connections to equipment

General requirements: *90-55-10/700 Installing conduit, trunking and ducting.*

Surface mounted equipment:

- Concealed conduit: *Conceal the final connection.*

Connections to external equipment: *90-55-10/360 Flexible conduit.*

90-55-10/765 Conduit, trunking and ducting zones

General requirements: *90-55-10/700 Installing conduit, trunking and ducting.*

Ceiling voids: *Provide clear distance of 150 mm (minimum) between underside of any conduit or trunking and the topside of ceiling.*

90-55-15/635 Installing low voltage cables

Standard: *In accordance with BS 7671.*

Timing: *Do not start internal cabling until building enclosure provides permanently dry conditions.*

Preparation: *Store cables above 5°C for 24 hours before installation.*
Clear cable path of debris.

Installation temperature (minimum): *5°C.*

Cables: *Install in one length. Dress cables flat, free from twists, kinks and strain.*

Cable pulling: *Do not overstress. Prevent kinks and twisting of the cable.*

Cable protection: *Cables passing through walls and floors to be sleeved with conduit or pipeduct to a minimum of 300 mm. Bush at both ends. Ensure that appropriate fire stopping materials are used to maintain the original fire integrity of the wall or floor around the penetration.*

Concealed cable runs to wall accessories: *Run vertically from the accessory.*

Exposed cable runs: *Direct to surface.*

Distance from other services running parallel (minimum): *150 mm. Position cables below heating pipes.*

Jointing and termination:

- Final circuit cables: *At electrical accessories only.*
- Core connections: *Using compression lugs to equipment without integral clamping terminals.*
- Terminating cables when not using glands: *Take sheathing of cables into accessory boxes and equipment and protect against abrasion with grommets.*

90-55-15/660 Installing low voltage cables in conduit and trunking

Cable installation: *Orderly and capable of being withdrawn.*

Single core wiring: *Arrange using the loop-in method.*

Cables within trunking: *Tie at 2 m intervals for cables of the same circuit reference. Label ties with circuit reference number at 10 m intervals.*

Cables in vertical conduit: *Provide cable clamps in accessible conduit boxes at 5 m intervals.*

Extra low voltage cables: *Install within a separate partition from low voltage cables where installed in multi compartment trunking.*

90-60-25/640 Installing light switches

Multigang switches: *Connect so that there is a logical relationship with luminaire positions.*

Unused switch spaces: *Fit with blanks.*

Segregation: *Internally segregate each phase with phase barriers. Include warning plates.*

90-60-50/620 Installing luminaires and lamps generally

Orientation: *Linear luminaires to be installed parallel with ceiling.*

Lamps and accessories: *Provide.*

Supports: *Adequate for weight of luminaire.*

System completion

70-80-35/812 Testing and commissioning emergency lighting systems

Commissioning: *In accordance with BS 5266-1, Annex F.*

Results: *Submit two copies of emergency lighting completion certificates, F1, F2, F3, and F4 and Submit two copies of ICEL 1001 authenticated spacing data.*

Certificates of calibration for meters and instruments: *Submit.*

Ω End of system

75-45-20/110 Data distribution system

System outline

75-45-20/110 Data distribution system

Description: *The communications cabling installation will be carried out by Data Path, who are NOCS chosen communication specialist. Data Path will be employed direct by NOCS to carry out this element of the works.*

The Electrical Contractor will be required to increase the size of a small amount of existing cable tray where it rises to first floor level, this will be required as the current cable tray is close to capacity. The new cable tray will be white in colour, with a finish to match the existing communications containment on site.

System completion: *To be defined.*

Ω End of system

75-75-50/125 Cooling systems control

System outline

75-75-50/125 Cooling systems control

Description: *The fan coil units shall incorporate an integral controller which shall provide on/off, fan speed and temperature setpoint adjustment.*

All controls modifications shall be supplied and installed including all controls equipment, controls and power wiring, containment, cable terminations and software by:

Matrix Controls Solutions Ltd
Contact: Gary Foreman
Mobile: 07971 026717
Email: gary.foreman@matrixsee.co.uk

Provision of fan coil controllers and 2 port pressure independent motorised control valves and return air temperature sensors.

The limiting dimension for the FCU controller is 250mm wide x 100mm high x 150mm deep.

Valves and sensors shall be free issue to the fan coil unit manufacturer for factory fitting.

Room temperature and fan coil alarms shall be raised on the BMS.

System performance: *To be defined.*

Objectives: *To be defined.*

Start and stop control: *To be defined.*

Pressurization plant control strategies: *To be defined.*

Distribution control strategies: *To be defined.*

Pumps control strategies: *To be defined.*

Water chillers control strategies: *To be defined.*

Cooling towers control strategies: *To be defined.*

Additional functions: *To be defined.*

Equipment: *To be defined.*

Sensors: *To be defined.*

Equipment interconnectivity: *To be defined.*

Cables: *To be defined.* Containment: *To be defined.* Containment accessories: *To be defined.* Rewireable installations: *Required.* Concealed installations: *Required.*

Control equipment power supply: *Mains supply.*

Execution: *To be defined.*

System completion: *To be defined.*

Ω End of system

75-75-50/155 Mechanical ventilation systems control

System outline

75-75-50/155 Mechanical ventilation systems control

Description: *All controls modifications shall be supplied and installed including all controls equipment, controls and power wiring, containment, cable terminations and software by:*

Matrix Control Solutions Ltd
Contact: Gary Foreman
Mobile: 07971 026717
Email: gary.foreman@matrixsee.co.uk

The controls systems shall include the following:

BMS network connections to the heat recovery ventilation unit.

Equipment: *Contractor's design.*

Sensors: *Contractor's design.*

Equipment interconnectivity: *Contractor's design.*

Cables: *Contractor's design.* Containment:

Contractor's design. Containment accessories:

Contractor's design. Rewireable installations:

Required.

Concealed installations: *Required.*

Control equipment power supply: *Mains supply.*

System completion: *75-75-50/820 Start up and commissioning* and *75-75-50/860 Documentation*.

System completion

75-75-50/820 Start up and commissioning

Standard: *In accordance with BCIA Start up and commissioning guide.*

75-75-50/860 Documentation

Operating and maintenance instructions:

- Scope: *Submit giving optimum settings for controls.*
- Product information: *Include product description, date of purchase, performance characteristics, application (suitability for use), method of operation and control, and cleaning and maintenance requirements.*
- Format: *Paper copy.*

Record drawings:

- Content: *For all controls cabling, the cable origin, circuit designation, route, conductor material and insulation type and colour, number of cores per cable,*

number of cables in ducts, on tray or ladder and Location of control panels, equipment and repeater panels.

- Format: *Electronic.*

Submittal date: *At handover.*

Ω End of system

APPENDIX A

SCHEDULE OF DRAWINGS

APPENDIX A

SCHEDULE OF DRAWINGS

MECHANICAL & ELECTRICAL ENGINEERING SERVICES

Drawing No	Drawing Title
J2171109 M1(00)101	Mechanical Legend
J2171109 M3(02)301	Level 2 Chilled Water Installation Indicating Removals
J2171109 M3(02)311	Level 2 Proposed Mechanical Services Layout
J2171109 E1(00)101	Electrical Legend
J2171109 E9(02)901	Existing & Proposed Electrical Services

APPENDIX B

SCHEDULES OF TECHNICAL REQUIREMENTS

SCHEDULE OF TECHNICAL REQUIREMENTS

B1 HEAT RECOVERY VENTILATION UNIT

(Products Recommendations to be met or matched with equivalent or better specifications)

Supplier: Airflow Developments Limited
Lancaster Road
Cressex Business Park
High Wycombe
HP12 3QP

Contact: Mr Ian Palmer
Telephone: 07825 740 642
Website: www.airflow.com

Reference	HRVU1
Type	Heat Recovery Unit Duplex Vent 800 Multi-Eco
Supply Duty	200 l/s
Supply External Resistance	200 Pa
Extract Duty	200 l/s
Extract External Resistance	75 Pa
Unit Type	Heat Recovery Vent with up to 90% Efficient Heat Exchanger
Mounting	Internal Roof Mounted on Drop-Rods
Colour Finish	Standard
Controller	Touch screen
Dimensions	1800 mm L x 970 mm W x 384 mm D
Duct Spigots	Adaptions to suit ductwork
Electrical Requirements	230 V/1 Ph/50 Hz Supply, 2 x 2.5A, max motor input power 2 x 0.385 kW
Weight	116 kg
Access	From below
Accessories	Ethernet MODBUS interface for fault monitoring by BMS

Notes:

1. To be installed fully in accordance with the Manufacturer's recommendations.
2. Commissioning of all plant must be carried out in line with the requirements of the Manufacturer.

SCHEDULE OF TECHNICAL REQUIREMENTS

B2 ATTENUATORS

(Products Recommendations to be met or matched with equivalent or better specifications)

Supplier: Allaway Acoustics
Old Police Station
1 Queens Road
Hertford
SG14 1EN

Telephone: 01992 550825
Quote Ref: 22562647Q2
Website: www.allawayacoustics.co.uk

For the basis of design the above manufacturer has been selected although the contractor is able to offer equal alternatives for consideration by the Client.

Ref	System	Noise Level (NR)	Volume (l/s)	Model	Atten O/A Dims			Weight (kg)	Max PD (Pa)
					Length (mm)	ID (mm)	OD (mm)		
ATT1	HRVU1 Inlet	35	200	PL	600	250	350	8	5
ATT2	HRVU1 Supply	35	200	PLP	1200	250	350	22	15
ATT3	HRVU1 Extract	35	200	PLP	1200	250	350	22	15
ATT4	HRVU1 Exhaust	35	200	PL	600	250	350	8	5

Notes:

1. The Contactor shall allow for all ductwork transitions to accommodate the selected attenuators.
2. The Contractor shall acoustically insulate all ductwork between AHU plant and attenuators.

SCHEDULE OF TECHNICAL REQUIREMENTS

B3 DUCTWORK ANCILLARIES

(Products Recommendations to be met or matched with equivalent or better specifications)

Volume Control Dampers

Supplier: Contractor to advise

Volume control dampers shall be supplied and fitted in the positions indicated on the drawings.

After commissioning has taken place the settings of each damper shall be recorded and logged by the Mechanical Sub-Contractor in the Manuals.

Ductwork Access Doors

Supplier: Contractor to advise

Duct Width or Diameter (mm)	Access Door Size (mm)	NOTES
800 - 1000	600 x 400	All ducts which are insulated (generally supply ducts) will have access doors with insulation contained within a double-skinned construction.
600 - 800	500 x 400	
500 - 600	400 x 300	
400 - 500	300 x 300	
300 - 400	250 x 250	
200 - 300	200 x 200	
150 - 200	150 x 150	
Below 150	Removable ductwork section in lieu of access door	

Notes:

1. Ductwork access doors are required to be provided adjacent to all fire and volume control dampers and elsewhere as necessary to permit the cleaning and disinfection of ductwork in accordance with HVCA TR19.

SCHEDULE OF TECHNICAL REQUIREMENTS

B4 FABRIC DUCT

(Products Recommendations to be met or matched with equivalent or better specifications)

Supplier: Prihoda UK Limited
Unit 17 George Holmes Business Centre
George Holmes Way
Swadlincote
Derbyshire
DE11 9DF

Telephone: 0121 320 2496
Website: www.prihoda.co.uk

Total Air Volume	200 l/s (720 m^3/hr)
Air Volume / Sock	100 l/s (360 m^3/hr)
No of Socks	2
Sock Type / Shape	Semi-Circular
Sock Size	4500 mm long x 300 mm dia half round
Supply Air Temperature	26°C Summer / 16°C Winter
Room Temperature	23°C
External Pressure Loss of Sock	120 Pa max
Inlet Socket to Sock	1No @ 200mm dia for each sock
Fabric Colour	RAL (TBA)
Accessories	All necessary profiles, connectors, hangers, tensioners required to mount the socks
Drawing Reference	M3(02)311
Spares	1 No complete set of fabric socks to enable cleaning routine to be undertaken

SCHEDULE OF TECHNICAL REQUIREMENTS

B5 FAN COIL UNITS (COOLING ONLY UNITS)

(Products Recommendations to be met or matched with equivalent or better specifications)

Manufacturer: Ability Projects Limited
The Fulcrum Business Centre
2-3 Vantage Way
Poole, Dorset
Bh14 4NU

Telephone: 01202 305821
Quote Ref: KX10149-2
Website: www.abilityprojects.com

Fan Coil Unit Ref	No Off	Airflow (l/s)	Model	Sensible Cooling (kW)	Total Cooling (kW)	CHW Flow Rate 6/12ºC (l/s)	Design PD (Max kPa)	Water Conn Size (mm)	Design Speed Selection	Design NR	Weight (kg)
FCU01	1	204	Evovert High Level Casing Size 400	3.0	3.83	0.152	7.2	15	Med	35	82
FCU02	1	204	Evovert High Level Casing Size 400	3.0	3.83	0.152	7.2	15	Med	35	82
FCU03	1	204	Evovert Low Level Casing Size 400	3.0	3.83	0.152	7.2	15	Med	35	82

Notes:

1. Cased fan coil units, high level units to be front discharge and underside return air. Low level units to be top discharge and underside return air.
2. Fitting of 2 port PICV's and actuators, return air sensors, controllers etc free issued by Controls Specialist - Matrix.
3. Integral on/off switch and fan speed controller.
4. Local temperature setpoint adjuster.
5. Electrical details: 240V/1Ph/50Hz, starting current 1.92 A FLC 0.4A.
6. Unit dimensions:
   High level - 1980mm overall width, 620mm high, 265mm deep
   Low level - 1980mm overall width, 750mm high, 265mm deep
7. All units with 22mm gravity condensate drain connection.

SCHEDULE OF TECHNICAL REQUIREMENTS

B6 VALVES AND PIPEWORK ANCILLARIES

(Products Recommendations to be met or matched with equivalent or better specifications)

Valve Type	Service	Size	Manufacturer	Type
Isolation (Gate Type)	CHW	15-50 mm	Hattersley	Fig 33 X
		65-200 mm	Hattersley	Fig 541
Isolation (Ball Type)	CHW	15-50 mm	Hattersley	Fig 100 (DZR)
Isolation (Butterfly)	CHW	50-300 mm	Hattersley	Fig 970 (fully lugged)
		50-600 mm	Hattersley	Fig 950 (semi-lugged)
Commissioning Sets	CHW	15-50 mm	Hattersley	Fig 1432 + M1000 metering station
		65-300 mm	Hattersley	Fig M733DR + M2000 metering station
DRV	CHW	15-50 mm	Hattersley	Fig 1432
		65-300 mm	Hattersley	Fig M733DR
Check Valves (NRV)	CHW	15-50 mm	Hattersley	Fig 42 (bronze lift battery)
		15-80 mm	Hattersley	Fig 47 (bronze swing pattern)
		50-300 mm	Hattersley	Fig M651 (cast iron swing)
Strainers	All	15-50 mm	Hattersley	Fig 807
		65-600 mm	Hattersley	Fib 920
Drain Cocks	All, within building	15-25 mm	Hattersley	Fig 371
Gland Cock (with hose union and loose lever to be provided)	CHW	15-25 mm	Hattersley	Fig 81 HU
Safety Valves (Pressure)	CHW	15-65 mm	Nabic	Fig 500
		15-80 mm	Nabic	Fig 542

B6 VALVES AND PIPEWORK ANCILLARIES - contd

(Products Recommendations to be met or matched with equivalent or better specifications)

Valve Type	Service	Size	Manufacturer	Type
Safety Valves (Pump/Bypass Relief)	CHW	15-65 mm	Nabic	Fig 500L
Differential Pressure Relief	CHW	Selection based upon 20% of pump duty	Oventrop/ Samson Controls	
Pump Flexible Connections	All	Any	Pipeline Components	RWA Flanged, RWS Screwed Synthetic Rubber Reinforced
Automatic Air Vents (excluding isolation valves)	Heating	Any	Spirax Sarco	AE 30 LVA
	Water Services	Any	Spirax Sarco	AE 36 A

Notes:

1. Contractor is free post-Tender, to offer equal products for approval by Engineer; alternative products shall not be used without prior approval.
2. Automatic air vents are to be installed with a Hattersley fig 100 isolation valve on inlet to AAV for maintenance.

SCHEDULE OF TECHNICAL REQUIREMENTS

B7 ENERGY METER

(Products Recommendations to be met or matched with equivalent or better specifications)

Manufacturer: Meters UK Limited
Whitegate
White Lund Trading Estate
Lancaster
Lancashire
LA3 3BT

Telephone: 01524 555929
Contact: sales@meters.co.uk
Website: www.meters.co.uk

Reference	**CHW01**
Serving	Chilled Water
Flow Rate	0.65 l/s
Max Water Temp	12ºC
Pipe Size	32mm
Meter Type	Heat Meter
Model	HCM4 with Modbus
Volt-Free Contacts	Pulsed Output
Meter Dimensions	124 mm W x 170 mm H x 90 mm D
Weight	0.9 kg

Notes:

1. To be installed fully in accordance with the Manufacturer's recommendations and installation instructions.
2. Each heat meter shall be complete with flow and return temperature sensors suitable for installation into pipe mounted brass pockets, pipeline mounted turbine meter with thermal jacket (to suit flow rate) and wall mounted calculator.

APPENDIX C

HANDOVER DOCUMENTATION AND PROCEDURES

C1 INTRODUCTION

The Client shall maintain, as part of its Health & Safety File and Operation & Maintenance Manuals, an up-to-date series of Record Drawings showing building outlines, partitions and Engineering Services, which may take the form of schematics.

All such information is the property of the Client and as such will not be conveyed to any third party without the express written consent of a duly authorised officer of the Client.

The primary legislation in the UK associated with the operation and maintenance of Building Services is the Health and Safety at Work Act 1974.

Under Sections 3 and 6 of this Act, as amended by the Consumer Protection Act 1987, Designers, Manufacturers and Importers or Suppliers of plant and systems have a duty to provide adequate operating information for the User to ensure that the plant or system will be safe and without risk to health when in use. This should include details of any maintenance required for continued safe operation.

Sections 2 and 6 of the Health and Safety at Work Act imply that building owners must possess adequate operating information for the operation and maintenance of Building Services. The primary items of legislation that apply are:

- Construction (Design and Management) Regulations 2015 (CDM)
- Control of Substances Hazardous to Health Regulations 2002 (COSHH)
- Electricity at Work Regulations 1989
- Environmental Protection Act 1990
- Factories Act 1961
- Regulatory Reform (Fire Safety) Order 2005
- Management of Health and Safety at Work Regulations 1999
- Offices, Shops and Railways Premises Act 1963
- Pressure Systems and Transportable Gas Containers Regulations 1989
- Provision and Use of Works Equipment Regulations 1998
- Workplace Health, Safety and Welfare Regulations 1992
- Disability Discrimination Act 2005
- The Notification of Cooling Towers and Evaporative Condenser Regulations 1992
- The Control of Noise at Work Regulations 2005

It is the Client's intention that, through implementation of its' procedure, all CAD/CAFM drawings supplied to the Client will be compatible with existing drawings.

Where the project affects existing buildings for which records exist, the As-Fitted drawings shall use the existing Record Drawings as their basis; and these shall be requested from the Project Manager before commencing work.

C2 SCOPE AND DEFINITIONS

This Specification details the type and content of technical documentation required to provide for the safe and efficient operation and maintenance of Engineering Services, including As-Fitted and other drawings. The Engineering Services covered by this Specification shall include (as appropriate):

- Mechanical
- Electrical
- Public Health
- Fire Protection
- Security
- Control
- Communication Systems

C2 SCOPE AND DEFINITIONS - contd

For the purpose of this Specification, maintenance terms defined in BS 3811: 1993 have been used as far as practicable. The British Standard Glossary of Refrigeration, Heating, Ventilation and Air Conditioning Terms (BS 5643: 1984) shall be used as guidance for defining terms in the technical documentation.

The following definitions of terms will apply:

Equipment: Any engineering plant, machine or component

System: A basic concept of equipment or appliances, connected, associated, or independent so as to form a complex unity

Installation: A specific system placed in position and set up for use

Supplier of Technical Manuals (called the **Supplier**): The organisation made responsible for providing the correct documentation (even though the organisation employs an Author to supply this, or to carry out associated work)

Author: The person or organisation that writes, collates and presents the information and produces the final Operating and Maintenance Manual (this could be the Supplier but may be either an independent organisation offering this service or in-house staff of the Installation Contractor or Consulting Engineer)

Client: The purchaser of the installation or installations, or an assignee

Enquiry Specification: The Specification for the technical documentation which is prepared by the Client's professional Advisor and against which selected Authors are invited to Tender

Contract Specification: The Specification as modified by a post-Tender discussion to form the basis of a Contract to cover the technical documentation. It may form part of the Specification for an Engineering Installation.

C3 GENERAL REQUIREMENTS

C3.1 Preparation of the Manual

To ensure that the Operating and Maintenance Manual is available when required, unless otherwise agreed, the information shall be issued in accordance with the programme detailed in Section C3.8.

Responsibility for production of the As-Fitted documentation shall be the responsibility of the primary Mechanical and Electrical Sub-Contractor, who shall nominate an individual within his Company or other organisation to prepare the documentation. The individual or firm appointed to prepare the Operating and Maintenance Manual (subsequently called the Author) shall write, assemble and complete the Manual in accordance with the requirements of this Specification.

In the event of the project being a refurbishment or extension, unless otherwise specified, the Manuals shall either form an Addendum to the existing Manuals or (if the project is relatively minor in nature), additional technical information required as a result of the project works shall be incorporated in the existing Manuals.

Where sufficient generic information exists in retained documentation associated with the building in which the project was carried out, then this shall not be repeated in the addendum. Where existing information for the whole building is no longer appropriate or relevant, this shall be removed from the original manual and replaced with revised information.

C3 GENERAL REQUIREMENTS - contd

C3.1 Preparation of the Manual - contd

Prior to commencement of production of the Manual, the Author shall confirm with the Client's Advisor whether the Manuals are to be:

- Entirely new and standalone
- Written as an Addendum to the existing Manuals
- Integrated with the existing Manuals

C3.2 Writing Style and Use of English

All documentation shall be in plain English. The text of descriptive sections shall be concise and complete. The overall aim of the document shall be to provide clarity in conjunction with brevity on a need-to-know basis. All new terms shall be defined when first introduced. Where appropriate, terminology shall accord with BS 3811: 1993 and BS 543: 1984.

Abbreviations shall only be used once their meaning has been made unambiguous. Imperatives shall be used for instructions regarding the operation, maintenance and disassembly of Engineering Services.

C3.3 Graphics and Illustrations

All graphical material shall be legible and fully annotated to suit the purpose for which they have been included in the O&M Manuals. Illustrations, drawing and diagrams that are incorporated in the Manual shall be easily understood in conjunction with the supporting text.

Where possible, original artwork shall be used rather than second generation scans. If original artwork cannot be obtained and images are not clear, diagrams and illustrations shall be redrawn if requested by the Client.

Where diagrams are provided in electronic format, the resolution and file format of the imagery shall be agreed prior to Manual production (eg JPEG, TIFF or EPS). Whichever format is used, the name and version of the original software that created them shall be supplied and the O&M Manuals shall include a suitable viewer.

Electronic copies of the As-Built drawings shall be provided in electronic format (CD, DVD or other prevailing technology) and saved in the drawing software package and version as detailed in the Particular Specification.

C3.4 Content, Layout, Indexing and Cross-Referencing

The Manual shall follow the guidance and proformas set out in Part 2 of the BSRIA Guide BG1/2007 Handover, O&M Guides, and Project Feedback. The order of engineering systems will be determined by the Author and submitted for approval to the Client's Representative.

Manuals shall comprise loose-leaf A4 pages on at least 100 gsm paper in four-ring binders constructed from PVC-covered heavyweight card. Dividers between sections and parts shall use stepped, overlapping, printed card.

All Manuals shall be laid out in accordance with Appendix B and have an alphabetical index or indexes. The index(es) should follow the text and comply with BS ISO 999: 1996 Information and Documentation - Guidelines for the Content, Organisation and Presentation of Indexes.

The indexing and cross-referencing included in other parts of the Manual shall be arranged to provide easy access to any required information. Where project Manuals are spread over multiple binders, binders shall be individually numbered; and each binder shall clearly state what is contained in each of the other binders associated with the project.

C3.4 **Content, Layout, Indexing and Cross-Referencing** - contd

The Author shall be responsible for the correction of any errors or omissions in the documentation provided to the Client.

C3.5 **Collection of Information**

Three principle sources of information will be used by the Author:

- The Scheme Designer
- The Installation Contractor/Sub-Contractors
- Equipment Manufacturers and Suppliers

If the project involves refurbishment of or extension to an existing building and the Manuals are to form an Addendum to or be integrated into existing Manuals, then these shall also be obtained from the Client for reference/updating.

The Author will be responsible for ensuring that close liaison is maintained with each of these sources and that they are aware of the information required by the Author. Such liaison will be arranged to give all parties adequate time to collate the necessary information.

The Installation Contractors will provide copies of all orders for plant, equipment and sub-let packages of work to the Author. The Author will ensure that the performance and technical data included within the Manual is for the actual equipment installed by means of a Site Inspection.

The Author shall use all the information provided and such other information believed to be necessary to produce a uniform suite of Operating & Maintenance Manual, modifying information where appropriate to provide a single, uniform presentation for the project as a whole.

C3.6 **Reader Ability**

Upon appointment, the Author shall identify (from the Client's professional Advisor) the intended maintenance strategy for the installation and the level of technical competence and comprehension of the personnel employed. The Author shall prepare the Manual to suit this level of reader and the Manual shall state the reader's assumed level of technical comprehension and competence.

Unless otherwise specified, the personnel expected to use the Manual will be General Technical Staff with broad-based maintenance skills. The Author will provide a ½ day's training in the use of the Manual for searching for specific items, so that the Building Operators will be able to use them after the building is handed over.

C3.7 **Checking and Approval**

The Author shall supply the Client's professional Advisor with a single copy of the first draft of the Manual immediately prior to the commissioning of the installation. The first draft shall contain all the information identified in this Specification, except that unavailable at the time (such as Commissioning Test Results).

The professional Advisor will check the draft and return it to the Author within a period of 2 weeks from the date of despatch by the Author, together with all comments necessary to obtain a final approved document; or, in the case of a Manual with extensive issues to resolve, a schedule of items to address.

The Client purchasing this Operating and Maintenance Manual shall have sole copyright to the document and shall be able to reproduce any part for its own use.

C3 GENERAL REQUIREMENTS - contd

C3.8 Issue of Draft and Final Information - contd

The following is a generic programme for the latest that the sections of the documentation (as detailed in Section 7.4 of this document) shall be issued for comment/approval, which shall be adhered to unless otherwise agreed:

- Sections 1-6 8 weeks prior to Handover
- Sections 7 & 8 4 weeks prior to Handover
- Section 9 2 weeks prior to Handover - hand drawn if late changes have occurred
- Section 10 As commissioning and witnessing is carried out - at latest by Handover

All final information shall be collated and updated within 2 weeks of Handover; with final electronic format information issued within 3 weeks of Handover.

In order to ensure that the Client have sufficient drawn information at time of Handover, it is imperative that a set of marked up drawings indicating installation progress and design changes is kept on site and updated as the installation progresses. These drawings will be tabled by the Main Contractor for review at monthly Project Progress Meetings.

C4 THE CONTENT, STRUCTURE AND LAYOUT OF O&M MANUALS

The O&M Manuals for Building Services installations will need to contain information in accordance with the categories scheduled in BS 4884, ie:

1. General Description
2. Contact Details/Contractual and Legal Guides
3. Operating Procedure/Detail Description
4. Maintenance Procedure and Spares
5. Fault Finding Procedures/Remedial Action
6. Health and Safety/Emergency Procedures
7. Equipment/Plant Schedule
8. Manufacturers' Literature
9. As-Built Drawings/Details/Schematics
10. Commissioning Data
11. Disposal Instructions and Modification Information

The following sections describe what is required under each heading.

C4.1 General Description

This section should be kept as brief as possible and provide a general overview of the original design intent (available in outline from the Design Brief and in detail from the Specification). It should include a summary for each engineering system installed, giving:

- The parameters and conditions within which it has been designed to operate a system
- The type of each service (gas, electricity and water) required to operate a system
- The intended method of control

C4.2 Contact Details, Contractual and Legal Guides

The contractual and legal records of an installation should include:

- The name and address of the installation
- Details of Local and Public Authority consents
- Details of the Design Teams, Consultants, Installation Contractors and Sub-Contractors
- Dates for the start of the installation, Handover and expiry of the Defects Liability Period
- Information on all guarantees affecting components, systems and plant items, together with expiry dates and names, addresses and telephone numbers of relevant contacts.

C4.2 **Contact Details, Contractual and Legal Guides** - contd

For each item of plant and equipment installed within the building and contained in the list of services covered by the O&M Manual, copies of the following documents should also be provided, where applicable:

- Test Certificates
- Manufacturers' Guarantees and Warranties
- Insurance Inspection Reports
- Safety and Fire Certificates

A clear statement should be made in this section concerning hazards and safety precautions, of which the Operators and Maintainers need to be aware. This should include:

- Any known feature or operational characteristic of the equipment or systems installed which may produce a hazard
- Any known hazards against which protection can be provided
- Any mandatory requirements relating to safety
- Any other safety precautions which should be observed
- Any other relevant warning

C4.3 **Operating Procedure/Detail Description**

This section should provide a detailed description of each engineering system installed. It should include:

- The system type (such as a cold water supply)
- System location and what it serves
- What the system depends upon in order to function
- Design data, basic design parameters, basic assumptions made during design
- Reasons for selecting particular plant
- Expected service life
- Planned operational efficiency

Instructions must be given for the safe and efficient operation of each engineering system, under normal and emergency conditions. These will be in addition to Manufacturers' literature for plant items and should include:

- A recommended strategy for operation and control
- An outline of the general operating mode
- Control data (location, effect, object, sequence, limits of capability, modes, set points)
- Standard operating and emergency operating procedures, and sequences for start-up, running and shutdown, under normal and emergency conditions
- Interlocks between plant items
- Operating procedures for standby plant
- Precautions necessary to overcome known hazards
- The means by which any potentially hazardous plant can be made safe
- Target figures for both energy consumption and energy costs
- Forms for recording plant running hours, energy consumption and energy costs

C4.4 Maintenance Procedures and Spares

i) Instructions

The Manufacturer's recommendations and instructions for maintenance must be detailed for each item of plant and equipment installed. Clear distinction should be made between planned tasks (preventative maintenance) and work done on a corrective basis. Instructions should be given on each of the following:

- The isolation and return to service of plant and equipment
- Adjustments, calibration and testing
- Dismantling and reassembly
- The exchange of components and assemblies
- Dealing with hazards that may arise during maintenance
- The nature of deterioration and checks for defects
- Special tools, test equipment and ancillary services

ii) Schedules

Maintenance Schedules should be provided for all preventative maintenance tasks. These should be based on both Manufacturers' recommendations and other authoritative sources (such as Statutory or Mandatory requirements). The Schedules should include:

- Inspections
- Examinations
- Tests
- Adjustments
- Calibration
- Lubrication
- Periodic overhaul

The frequency of each task may be expressed as specific time intervals, running hours or completed operations as appropriate. Collectively, the schedules will form a complete maintenance cycle, repeated throughout the working life of the installation.

The source of the schedules should be stated, and necessary periodic inspections and tests for instance, insurance or Supply Authority purposes should also be noted.

iii) Lubrication

A schedule of all plant requiring lubrication should be provided, together with Manufacturers' recommendations on the type of lubricants and the method and frequency of application. Where a type of lubricant is identified by product name, a generic reference (such as a British Standard) should also be given. Information must also be provided on special requirements for the handling and storage of lubricants.

iv) Parts Identification and Recommended Spares

This should comprise a parts identification list detailing and identifying replaceable assemblies, sub-assemblies and components. It should include Suppliers' recommendations for both spares and running spares (parts required for replacement due to wear or deterioration). Items normally held in stock by a Supplier, or for which a refurbishment service is available, should be identified separately.

C4.4 **Maintenance Procedures and Spares** - contd

v) **Spares Policy**

This section should offer a guide to the setting up of a spares facility including recommended stock levels. It should be prepared after consultation with the Occupier regarding the consequences of failure, risk to core business, and the period of acceptable downtime. It should also take into account Suppliers' recommendations as given above. Again, those items normally held in stock by a Supplier (or for which a refurbishment service is available) should be clearly identified.

C4.5 **Fault Finding**

Procedures for the logical diagnosis and correction of faults should be provided.

C4.6 **Emergency Health & Safety and Procedures**

This should include name, address, telephone and fax number, and E-mail addresses of the appropriate contacts in the event of fire, theft or burglary, and gas, electricity or water failures, and leaks. It should also list firms or staff to contact in the event of the failure or breakdown of plant, such as lifts, boilers or pumps. Where applicable, the location of fire-fighting equipment, hydrants and rising mains should be described. Special attention should also be given to hazards particular to the building. Depending on Client Policy, a note of security installations may also be included.

C4.7 **Equipment/Plant Schedule**

The Type, Model Number and Serial Number of all component items within the system should be listed, together with the names of their respective Manufacturers or Suppliers.

C4.8 **Manufacturers' Literature**

Details of all Manufacturers and Suppliers of equipment listed in the Manual should be provided, including name, address, telephone and fax number, E-mail contact and website. Any additional information likely to help the building operator make contact with, or obtain advice from; a Manufacturer or Supplier should also be included.

Where appropriate, details of local stockists of spare parts, replaceable assemblies or complete units should also be provided. Details should be arranged in alphabetical order of Manufacturer or Supplier name to provide a logical information retrieval procedure.

A complete set of all Manufacturers' literature should be provided for the plant and equipment installed, and assembled for each Building Services system. This literature should provide the following information:

- Description of the product as purchased
- The cost and date of purchase
- Performance behavioural characteristics of the equipment in use
- Applications (suitability for use)
- Operation and Maintenance details
- Labour, plant, materials and spatial resources required
- Methods of operation and control
- Cleaning and maintenance requirements
- Protective measures
- Labour safety and welfare associated with the equipment
- Public safety considerations

Where the data is not adequately provided in Manufacturers' literature, the author of the O&M Manual should attempt to gather the information. If the information proves unavailable, or if a Supplier is unwilling or unhelpful, this should be treated as a breach of contract.

C4 THE CONTENT, STRUCTURE AND LAYOUT OF O&M MANUALS - contd

C4.9 Plans and Drawings

Where the project affects existing buildings for which records exist, the As-Fitted drawings shall use the existing Record Drawings as their basis; and these shall be requested from the Project Manager before commencing work.

The drawing files will be issued to the Project Team by the Project Manager in the Client standard format/media to be returned in the same format/media once updated. All work undertaken must be clearly shown to enable accurate updating of records in accordance with the requirements of the following sections.

The Client cannot warrant or guarantee the accuracy of drawing files. Checking information and correcting critical dimension and information is the Project Team's responsibility and part of their appointment terms and conditions. Where errors are found to exist between the information received and the building layout and/or services installed, these are to be notified to the Project Manager at the earliest opportunity and instruction as to how to proceed sought.

The Health and Safety File/Operation and Maintenance Manual should contain a complete list of all As-Built drawings. All As-Fitted or As-Built drawings will be supplied in both hard copy form and AutoCAD format (.dwg files) on CD ROM; PKZip or Winzip formats should not be used. The As-Fitted drawings supplied in AutoCAD format shall be true representation of the hard copy drawings supplied.

Where the As-Built CAD drawings are not available at the Handover meeting, or if the project has a phased Handover, at (each) Handover, 2 No sets of hard copies shall be passed hand marked up to clearly show all the changes between the latest set of CAD drawings and the installation.

The Contractor shall ensure that all software used is fully converted to be compatible with the Client's software currently in use.

C4.10 Commissioning Data

The results of all commissioning work and associated tests should be given; this should include:

- Measured data
- Measurement points
- Test equipment used
- Details of Calibration Certificates
- A statement of whether design requirements were achieved

The Commissioning Certificates shall include plant data such as Model, Type and Serial Number. To enable crosschecking against As-Installed Data Sheets, this information shall also be provided in Excel format such that it can be easily transferred into an Asset Database.

C4.11 Disposal Instructions and Modifications Information

Where relevant, information should be provided on the following details:

- Any known dangers likely to arise during the disposal of specific items of plant or equipment, together with the necessary precautions and safety measures
- Methods for safely disposing of or destroying the equipment or parts thereof, including packing, insulation and fluids
- Sources from which further advice can be obtained
- Recycling information for the specific item of plant

Modifications are authorised changes which affect safety, reliability, operation or maintenance of a system or any of its components.

C4 THE CONTENT, STRUCTURE AND LAYOUT OF O&M MANUALS - contd

C4.11 Disposal Instructions and Modifications Information - contd

Information on permitted plant, or system modifications allowed for by Manufacturers or System Designers, should be included for each system. Space must be provided in the Manual for the recording of all modifications and changes as they occur (this would initially comprise a series of appropriately headed blank pages). Furthermore, it is essential that a procedure is devised and incorporated to ensure that all modifications are noted in every copy of the Manual, wherever they are located.

C5 DRAWING RECORDS GENERALLY

C5.1 Drawing Content

i) Mechanical layout drawings should show:

- The size and route of ductwork and pipework
- The arrangement of plant in Plantrooms, including the identity, size and rating of plant
- The identification and location of services concealed within the building structure or buried underground, including the depth and point of entry to the building of services
- The location and identification of pipework regulating, isolating and control valves
- The location and identification of regulating and fire/smoke dampers, and access points
- The location of silencers, grilles, diffusers and terminal units
- Details of vibration dampers

ii) Mechanical schematic drawings should detail:

- All ducting, piping and plumbing systems, including flow rates, temperatures and pressures
- The arrangement of control systems including sensors, field controllers, outstations and control panels

iii) Wiring and Controls Drawings should be provided for all equipment which should indicate:

- The origin, route and destination of each cable
- The conductor size and number of cores, insulation type & rating, cable BS or industry code
- Cable identification method and colour
- Joints and draw boxes
- Power supply cables and their fuse reference
- Location and type of sensors

iv) Electrical layout drawings should show:

- HV/LV switchboards & equipment
- Primary cable/trunking distribution routes
- Distribution switchgear & Distribution boards
- Trunking tray and ladders in Switchrooms and Plantrooms
- Single and three-phase wiring and cable routes, including sub-circuits
- Isolators, starters, socket outlets, control equipment and other associated equipment
- Lighting configuration, including distribution boards, switch locations and circuit ID.
- Emergency lighting luminaires and supply circuits
- Lightning conductors, air terminals, earth electrodes, test clamps, earth tapes & terminals
- Cables providing specialist earth circuits
- Telephone (voice) and IT (data) cabling
- The identification and location of cabling concealed within the building structure or buried underground, including the depth and point of entry to building of cabling
- Cable origin, path, destination, loading, conductor metal and size, insulation type and colour (if required for identification), number of cores in cable, number of cables in trunking
- Whether cables, conduit and trunking are concealed in wall chases, screed, cast in-situ or run on the surface
- The location, route and depth of underground cables

C5 DRAWING RECORDS GENERALLY - contd

C5.1 Drawing Content - contd

v) Electrical schematic drawings should detail:

- Electrical systems, including cable size, type and number of cores
- Fire alarm systems
- Emergency lighting
- Other ancillary systems, such as security and public address systems

vi) Production Drawings of factory-built equipment - should form part of the Record Drawings.

C5.2 Drawing Set Up

The drawings are to be in AutoCAD format and must be virus checked. Raster images, hard copy, scanned images are not acceptable. Each drawing shall be created as a separate CAD file and carry a filename that is both unique and identifies the drawing.

All drawings are to be contained within their own drawing border suitably completed. Where Client drawing borders are used, all attributed data to be completed in order for drawing details to be imported into Automanager Workflow.

A basic layer standard has been established requiring a 'named layer', which consists of a general prefix and a name indicating the element so that layers can be readily recognised and filtered as scheduled below. Text layers should also be created where text is discipline specific; all associated text to be included on the associated layer. Only those layers actively used on a drawing are to existing in the AutoCAD file, switched on, thawed and unlocked, with the drawings purged of all unused or empty layers. Should additional layer names be created, they should be consistent throughout the project.

C5.3 Line Definition, Text and Scale Standards

Drawings that are required to be plotted in colour should be created with a specific plot style. This should be consistent across the project and should be supplied when drawings are distributed.

Line types should be standard AutoCAD line types; and Ltscale needs to be kept to a standard setting to maintain uniformity of appearance between drawings.

The AutoCAD font ROMANS.shx should be used in all drawings. Alternative standard AutoCAD fonts may be used to emphasise particular aspects on the drawing. Dimensions and general notes should be 2.0 mm or 2.5 mm, sub-headings should be 3.5 mm high and main headings should be 5.0 mm high.

All scale drawings must be created at 1:1 (full size) and even where paper space is being used, the model should still be at 1:1. Where scale drawings are created, text heights and other variables such as Ltscale and Dimscale need to be altered to suit as follows:

Drawing Scale	Lt Scale	Dim Scale	General Text and Dimensions		Sub-Headings 3.5 mm Text	Main Headings 5.0 mm Text
			2.0 mm	2.5 mm		
1:1	10	1	2	2.5	3.5	5
1:20	200	20	40	50	70	100
1:25	250	25	50	62.5	87.5	125
1:50	500	50	100	125	175	250
1:100	1000	100	200	250	350	500
1:200	2000	200	400	500	700	1000

C5 DRAWING RECORDS GENERALLY - contd

C5.4 Layering Convention

The standard layer convention does not determine the allocation of screen colours or line types to any particular layer, but these should be determined in accordance with the line definition described herein.

Prefix Layer Usage

B Building; Walls, Doors, Windows, etc
E Electrical Services
F Furniture and Fittings
G General; Title Blocks, Grids, etc
M Mechanical Services; HVAC, etc
S Substructure; Piles, Foundations, etc
X External Services; Road, Survey Data, etc

An index should be provided of all As-Fitted drawings supplied during the installation process, identified by number and title. The index should also include a Schedule of Drawings issued by Manufacturers and Suppliers during the course of the installation work, such as control panel wiring diagrams. Refer to the following sections for the specific requirements of the drawings.

List of Layer Definitions (Abridged)

Layer Name	Layer Usage		
0	AutoCAD Block Insertion	F_KITCHEN	Kitchen, Bar and Vending Fittings
		F_SANITARY	Sanitary Fittings
B_SHELL	Building Shell (M&E Services)		
		G_DWGSHT	Drawing Sheet
E_ALARM	Nurse Call	G_DIMENSION	Dimensions
E_COMM	Comms and Telecomms	G_GRID	Grids
E_EARTH	Earthing	G_TEXT	Text
E_EHV	Extra high Voltage >3000v	G_UPDATE	Drawing Update (temp layer green)
E_HV	High Voltage 650 – 3000v	M_AIR CON	Air Conditioning
E_LV	Low Voltage 250v max	M_GASES_MED	Medical Gases
E_ELV	ELV 50 – 250v max	M_GASES_NAT	Natural gases
E_MV	MV 250 – 650v max	M_GENERAL	Heating
E_FIRE_LEGEND	Fire Legend	M_PLUMB	Plumbed Services
E_FIRE_ALARM	Fire Alarm System	M_STEAM	Steam Main
E_FIRE_APPLIANCE	Fire Appliances	M_CWM	Cold Water Main
E_FIRE_ESCAPE	Fire Escape Routes	M_GEOTH	Geothermal
E_FIRE_STRUCTURAL	Fire Doors etc	M_VENTILATION	Ventilation
E_FIRE_ZONE_LEGEND	Fire Zone Legend	M_DRAINAGE	Drainage
E_FIRE_ZONE1 etc	Fire Zones		
E_GENERAL	General - Electrical	X_DRAIN	Land Drainage
E_LIGHT	Lighting	X_DUCT	Duct ways, Subways
E_POWER	Electrical Power Supply	X_GENERAL	General – External Works
E_SECURITY	Security Systems	X_SERVICE	Engineering Services
E_TRANSPORT	Lifts, Escalators etc	X_SURVEY	Survey Information
E_TRUNKING	Trunking		

C6 MECHANICAL RECORDS

C6.1 Documentation

Documentation should record the following as installed:

a) The location, including level if buried, of all public service connections (eg fuel, gas and cold water supplies) together with the points of origin and termination, size and materials of pipes, line pressure and other relevant information.

b) The layout, location and extent of all piped services showing pipe sizes, together with all valves for regulation, isolation and other purposes as well as the results of all balancing, testing and commissioning data.

c) The location, identity, size and details of all apparatus and control equipment served by, or associated with, each of the various services together with copies of any Test Certificates for such apparatus where appropriate. The information with respect to size and details may be present in schedule form.

d) The layout, location and extent of all air ducts showing dampers and other equipment, acoustic silencers, grilles, diffusers or other terminal components. Each duct and each terminal component should be marked with its size, the air quantity flowing and other relevant balancing data.

e) The location and identity of each room or space housing plant, machinery or apparatus.

C6.2 Drawings

Drawings should record the following as installed:

a) Detailed general arrangements of Boiler Houses, machinery spaces, air handling plants, Tank Rooms and other plant or apparatus, including the location, identity, size and rating of each apparatus. The information with respect to the size and rating can be presented in schedule form.

b) Isometric or diagrammatic views of Boiler Houses, Plantrooms, Tank Rooms and similar machinery, including valve identification charts. It is useful to frame and mount a copy of such drawings on the wall of the appropriate room.

c) Comprehensive diagrams that show power wiring and control wiring, including size, type of conductor or piping used and identifying the terminal points of each.

C7 ELECTRICAL RECORDS

C7.1 Documentation

Documentation should record the following, including locations, as installed:

a) Main and sub-main cables showing origin, route, termination, size and type of each cable; cables providing supplies to specialist equipment, eg computers, should be identified separately.

b) Lighting conduits and final sub-circuit cables showing origin, route, termination and size of each, together with the number and size of cables within each conduit. The drawings should indicate, for each conduit or cable, whether it is run on the surface or concealed, eg in a wall chase, in a Floor screed, cast in situ, above a false ceiling, etc. These drawings should also indicate the locations of lighting fittings, distribution boards, switches, draw-in boxes and point boxes, and should indicate circuitry.

C7 ELECTRICAL RECORDS - contd

C7.1 Documentation - contd

c) Location and purpose of each emergency lighting fitting, including an indication of the circuit to which it is connected.

d) Single and three-phase power conduits and final sub-circuit cables showing locations of power distribution boards, motors, isolators, starters, remote control units, socket outlets and other associated equipment.

e) Other miscellaneous equipment, conditions and cables.

f) Lightning conductor air terminals, conductors, earth electrodes and test clamps.

g) Location of earth tapes, earth electrodes and test points other than those in f); cables providing each circuits for specialist equipment, eg computers, should be identified separately.

Documentation should also include, when applicable:

h) Distribution diagrams or schedules to show size, type and length (to within 1 m) of each main and sub-main cable, together with the measured earth continuity resistance of each.

i) Schedule of lighting fittings installed, stating location, Manufacturer, type or catalogue number, together with the Manufacturer's reference, voltage and wattage of the lamp installed.

j) Schedule of escape and emergency lighting fittings installed, stating location, Manufacturer, type or catalogue number, together with the Manufacturer's reference, voltage and wattage of the lamp installed. For battery systems, the position of the battery, its' ampere hour rating and battery system rated endurance in hours should be stated.

k) Records of smoke detectors, sprinklers, fire precautions generally, as well as security precautions (see BS 8220: Part 1).

l) Incoming supply details; the type of system, voltage, phases, frequency, rated current and short circuit level, with the details of supply protection and time of operation as appropriate.

m) Main switchgear details; for purpose-made equipment this should include a set of Manufacturer's drawings and Site Layout.

n) Transformer, capacitor and power plant details; the leading details should be given, eg for transformers, the V.A rating, voltages and type of cooling.

o) Completion Certificate, according to IEE Wiring Regulations.

C8 COMMUNICATION SYSTEMS RECORDS

C8.1 Application

The detailed recommendations given in this sub-Clause apply primarily to telecommunication, intercommunication and paging systems but much of it is also applicable to more sophisticated information systems.

C8 COMMUNICATION SYSTEMS RECORDS - contd

C8.2 Drawings

Drawings should be in accordance with the provisions of C5 as appropriate, and should show the following as installed:

a) Telephone extension wiring, exchange lines and all other similar communications cable for direct speech intercommunication systems, and the following for digital data communications:

i) Details of cable routes, sizes and types of conduits and ducts; number of cable pairs fitted for immediate use, and also spare ways; joint boxes, sub-distribution frames and extension instruments or other terminal apparatus (circuit reference numbers should be shown)

ii) In the case of digital communication cabling, detail of the type of cable in use (eg twisted pair, fibre optic, etc), and the type of wall mounting outlet (ie simple type or loop-around)

iii) Floor plans of Equipment Rooms showing location and type of equipment; main distribution frame; batteries and charging equipment; operators' consoles and all associated cabling, trunking and ducts (any special provision such as anti-static or computer Flooring should be noted and Floor plans should also include details of any switching or processing equipment associated with direct speech telecommunication or digital data communication systems)

iv) Radio paging and loop systems, including routes and details and the location and details of equipment

C8.3 Schedule of Telephone Extensions

A schedule of telephone extensions should be maintained and should include:

a) Total number of extensions

b) Extension plan facilities

c) Auxiliary equipment and exchange lines

d) Equivalent information as in a-c) above for direct speech intercommunication and digital data communications systems

e) Comprehensive interconnection information for the main distribution frame

f) Master telephone extension directory, including the facilities available to each extension

g) Special information such as extension hunting groups

C8.4 Schedule of Radio Paging Systems

A schedule should be maintained for radio paging systems, to include details of:

a) Paging codes against Holders' names and extension numbers
b) Frequency and effective radiated power of transmitter(s)
c) Transmitting frequency of call-back type pagers
d) Special features such as emergency calling groups

APPENDIX D

PRE-CONSTRUCTION M&E ENGINEERING INFORMATION FORM

Client	National Oceanography Centre, Southampton	
Project	MARSIC Synthetic Environment Project	
Job No	Completed By	Date
J2170905		03/11/2017

Pre-Construction Information Form - Sheet 1 of 77

Item		Comments	
1.0	**DESCRIPTION OF PROJECT**		
1.1	**Name**	MARSIC Synthetic Environment	
1.2	**Location**	University of Southampton Waterfront Campus	
1.3	**Background**	Change of use for existing room W2/13	
1.4	**Description of the Works**	Remodelling of existing room W2/13 to new presentation, meeting, IT room.	
1.5	**Programme**		
1.5.1	Key Dates:	Start on Site: Duration: Completion:	May 2018 16 weeks June 2018
1.5.2	Minimum Time (to be allowed between appointment of Principal Contractor and commencement of work on site):	Date for Letting of Contract: Start on Site: Lead-in Period:	Client to confirm As above
1.6	**Project Directory**		
1.6.1	Client:	National Oceanography Centre Southampton	
1.6.2	Project Manager:		
1.6.3	Lead Designer:		
1.6.4	Structural Engineer:		
1.6.5	M&E Services Consultant:		
1.6.6	Specialist:		
1.6.7	H&S Project Co-ordinator:		
1.6.8	Contract Administrator:		
1.6.9	Quantity Surveyor:		
1.6.10	Principal Contractor:	Appointed Tenderers	
1.7	**Is the site a Workplace?**	Yes	

Pre-Construction Information Form - Sheet 2 of 4

Item		Comments	
1.0	**DESCRIPTION OF PROJECT** - contd		
1.8	**Existing Records and Plans**		
1.8.1	Existing H&S File:	Available from NOCS	
1.8.2	Existing O&M Manuals:	Available from NOCS	
1.8.3	Existing Structural Drawing:	Available from NOCS	
1.8.4	Existing Main Services Drawings:	Available from NOCS	
1.8.5	Previous Site Investigation Reports:	N/A	
1.8.6	Asbestos Management Plan:	Available from NOCS	
2.0	**THE SITE ENVIRONMENT AND ON-SITE RISKS**		**RAMS Required?**
2.1	**Site Definition and Access Arrangements**	Refer to NOCS site rules and induction	
2.2	**Restrictions on Deliveries**	Refer to NOCS site rules and induction	
2.3	**Adjacent Users/Uses**	Refer to NOCS site rules and induction	
2.4	**Storage of Waste and Hazardous Materials**	Refer to NOCS site rules and induction	
2.5	**Location of Existing Primary Services (Buried/Overhead, etc)**	Refer to NOCS site rules and induction	
2.6	**Ground Conditions**	Refer to NOCS site rules and induction	
2.7	**Existing Structural Particulars**	Refer to NOCS site rules and induction	
2.8	**Existing Defects**		**RAMS Required?**
2.8.1	Fire Damage, Ground Shrinkage, Movement or Poor Maintenance:	None identified	
2.8.2	Plant and Equipment:	None identified	
2.9	**Health & Safety Information Contained in Earlier Design or As-Built Drawings**	N/A	
2.10	**Asbestos**	Refer to NOCS register	
2.11	**Contaminated Land**	N/A	
2.12	**Existing Structures Containing Hazardous Materials**	N/A	
2.13	**Health Risks Arising From Clients Activities**	Refer to Clients documentation	

Pre-Construction Information Form - Sheet 3 of 4

Item		Comments	
3.0	**CLIENT'S PROCEDURES AND MANAGEMENT REQUIREMENTS**		**RAMS Required?**
3.1	**Planning and Managing the Construction Work**	Refer to Clients site rules	
3.2	**Communication**	Refer to Clients site rules	
3.3	**Security of the Site**	Refer to Clients site rules	
3.4	**Welfare Facilities**	Refer to Clients site rules	
3.5	**Site Hoardings and Screens**	Refer to Clients site rules	
3.6	**Waste Management**	Refer to Clients site rules	
3.7	**Site Transport Arrangements or Vehicle Movement Restrictions**	Refer to Clients site rules	
3.8	**Arisings**	Refer to Clients site rules	
3.9	**Client Permit-to-Work Systems**	Refer to Clients site rules	
3.10	**Noise**	Refer to Clients site rules	
3.11	**Dust**	Refer to Clients site rules	
3.12	**Pollution**	Refer to Clients site rules	
3.13	**Fire Precautions**	Refer to Clients site rules	
3.14	**Emergency Procedures and Means of Escape**	Refer to Clients site rules	
3.15	**'No go' Areas or Other Authorisation Requirements**	Refer to Clients site rules	
3.16	**Areas the Client has Designated as 'Confined Spaces'**	Refer to Clients site rules	
3.17	**Smoking and Parking Restrictions**	Refer to Clients site rules	
4.0	**SIGNIFICANT DESIGN AND CONSTRUCTION HAZARDS**		**RAMS Required?**
4.1	**Significant Assumptions and Suggested Work Methods, Sequences or Other Control Measures**	Working in MEDA's/risers etc	Yes
4.2	**Temporary Works**	N/A	
4.3	**Arrangements for Co-ordination of Ongoing Design Work**	N/A	
4.4	**Information on Significant Risks Identified During Construction**	Yes	Yes
4.5	**Material Requiring Particular Precautions**	None	

Pre-Construction Information Form - Sheet 4 of 4

Item		Comments
5.0	**THE HEALTH AND SAFETY FILE**	
5.1	**Testing and Commissioning, Record Drawings, O&M Manuals**	Required
5.2	**Completion and Presentation of the Documentation for and Final Arrangement and Presentation of the H&S File**	Required
5.3	**Contents of the H&S File**	**Contents shall include:** ▪ **A brief description of the work carried out;** ▪ **Any hazards that have not been eliminated through the design and construction processes, and how they have been addressed (eg surveys or other information concerning asbestos or contaminated land);** ▪ **Key structural principles (eg bracing, sources of substantial stored energy - including pre or post-tensioned members) and safe working loads for floors and roofs;** ▪ **Hazardous materials used (eg lead paints and special coatings);** ▪ **Information regarding the removal or dismantling of installed plant and equipment (eg any special arrangements for lifting such equipment);** ▪ **Health and safety information about equipment provided for cleaning or maintaining the structure;** ▪ **The nature, location and markings of significant services, including underground cables, gas supply equipment, fire-fighting services, etc;** ▪ **Information and as-built drawings of the building, its plant and equipment (eg the means of safe access to and from service voids and fire doors)**

ADDITIONAL NOTES