

SETU – NetLab Chiller Replacement

Volume One

Preliminaries for the Services Installation

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SPECIFICATION LAYOUT

VOLUME ONE

Services Preliminaries

VOLUME TWO

Descriptive and Technical Specification

VOLUME THREE

Equipment Schedules

VOLUME FOUR

Controls Specification

INDEX

1. EXTENT OF WORKS	6
2. CONTRACT DRAWINGS AND DOCUMENTS	8
3. VALUATIONS FOR INTERIM CERTIFICATES	9
4. BUILDER'S WORK CO-ORDINATION	10
5. SECONDARY STEELWORK	10
6. SUPERVISION	11
7. CO-ORDINATION	11
8. INSPECTION BEFORE CONCEALMENT	15
9. STANDARDS AND REGULATIONS	15
10. HEALTH & SAFETY	16
11. PROTECTION OF THE WORKS	17
12. EARLY DELIVERY OF PLANT	18
13. USE OF SYSTEMS DURING CONSTRUCTION	18
14. DAMAGE DUE TO FROST	18
15. MATERIALS AND PRODUCTS	18
16. PLANT SUBMITTAL	20
17. The Use of Document Management Systems for Submittals and RFI's	23
18. Email Communication	23
19. COST REDUCTIONS	23
20. STATUS OF COMMENTS MADE BY THE EMPLOYER'S REPRESENTATIVE	23
21. ACCESS FOR PLANT INSTALLATION & SUBSEQUENT REMOVAL	24
22. ACCESS FOR MAINTENANCE	24
23. EASE OF MAINTENANCE	25

24. SPARES AND SPECIAL TOOLS	25
25. "AS INSTALLED" RECORD DRAWINGS	25
26. OPERATING and MAINTENANCE MANUALS.....	26
27. OPERATION OF SYSTEMS BEFORE THE PRODUCTION OF THE O&M's	29
28. COMMISSIONING AND TESTING.....	30
29. SUBSTANTIAL COMPLETION.....	30
30. COMPLETION CERTIFICATE.....	32
31. DEFECTS PERIOD.....	32
32. INTERPRETATION.....	33
33. BCAR	33
34. WIRING RESPONSIBILITIES FOR MECHANICAL ITEMS	34
35. SERVICES SUPPORTS.....	34

1. EXTENT OF WORKS

Description of Works

The project involves the replacement of a chiller on the roof of the NetLab building in the Carriganore campus of SETU – Waterford.

The proposed works comprise supplying and installing a new single 98kW air-cooled chiller to provide chilled water cooling to the NetLab data centre. The existing chiller installation is approaching the end of its operational life, with one of the existing chillers already non-operational, and the proposed replacement will provide a reliable primary source of cooling.

The new chiller shall be suitable for the existing chilled water operating conditions and shall incorporate free-cooling capability, taking advantage of the relatively high chilled water return temperatures identified within the existing system. The contractor shall reuse the existing steel plant platform, subject to a structural assessment.

The works shall include all necessary mechanical modifications associated with the new chiller installation, including modifications to the existing chilled water pipework, connections, valves, and associated ancillaries. The existing chiller shall remain operational while these works are being completed.

Large equipment shall be removed/located on the roof via a crane lift. This crane lift is to be organised with SETU and agreed prior to the lift. The lift shall also be out of hours (over the weekend) to accommodate SETU scheduling.

Pumps for the new chiller shall be relocated internally within the adjacent plantroom to improve equipment protection and service life. The pumps shall be arranged in a duty/standby configuration to improve system redundancy. Furthermore, a new pressurisation unit is to be installed in this plantroom, along with other ancillary items.

Electrical and controls works shall include modifying the existing chilled water MCC panel to suit the new 98 kW chiller and associated pumps, together with all necessary power, control and interlock connections. The new chiller installation shall use an open protocol to facilitate integration with the building management system (BMS), including monitoring of operating status, temperatures, alarms and system performance. Existing BMS graphics shall be updated to incorporate the new equipment, and the client's existing data-logging system should be retained and integrated with future BMS upgrades.

The chiller and new ancillary items will be powered from a new DB located in this plantroom. This board is to be fed from the removed chillers 400A supply. It shall also have capacity for second new chiller when upgrade works are undertaken.

On completion, the installation shall be tested, commissioned (including seasonal) and balanced to demonstrate correct operation of the chiller, pumps, controls and chilled water system, with appropriate operation and maintenance information and record documentation provided.

General Works

The work shall comprise the whole of the labour and materials necessary to form a complete services installation with such tests, adjustments, commissioning, and maintenance as may be required to give effective and safe working installations to the satisfaction of the Employer's Representative.

The words "complete services installation" shall mean not only the major items of plant and apparatus described, but also the incidental sundry accessories and components necessary for the complete execution of the works and for the proper and safe operation of the installation together with their labour charges, whether or not these sundry accessories or components are mentioned in detail in the Tender Documents issued in connection with the Contract.

The tender drawings are prepared primarily to describe, in a basic manner, the design of the Engineering System Installation works, the working principles of the systems and the general intended methods of installation. The tender drawings are, accordingly, part diagrammatic with runs of piping, ducts, cable, conduit being shown to small scale and not necessarily indicating exact installation positions, or all offsets required to complete the installation. Allow for all necessary sets, bends, transformations and supports to complete the installation.

The services elements of the works are described in the services specifications and drawings, and include the following:

- Arranging for delivery, lifting, hoisting, safe and secure storage and movement of all plant equipment and materials forming part of the services packages.
- Fixing or correctly installing all plant, equipment, and materials.
- Providing builders works as required to support the services installation, including minor steel works, fixings to the fabric and services hangers and supports. Ensure that builders work openings are suitable for the fire dampers used on the project. Provide concrete separation in risers as required.
- Providing supports for services that run on roofs, including suitable platform to distribute the weight of roof mounted services or plant, including "Big Foot" or equivalent systems where required.
- Treating, testing, and commissioning the complete installation including adjusting and balancing as necessary.

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- Demonstrating that equipment supplied is capable of the performance and method of operation specified to the satisfaction and acceptance of the Employer's Representative.
- Checking the complete services installation for workmanship or operational defects, creating a list of defects (snags) and making the list available to the Employer's Representative. Arranging for all defects (snags) to be rectified and check the installation thoroughly before presenting the installation to the Employer's Representative for checking. Informing the Representative in writing that the installation is ready for inspection before substantial completion.
- Demonstrating that the overall and complete systems perform correctly in the required manner and as intended by the Specification to the satisfaction and acceptance of the Employer's Representative. Inclusive of two return visits required to demonstrate seasonal performance of the systems.
- Provision a full set of commissioning, system balancing, and test results, in digital format to the Employer's Representative no later than one month before substantial completion.
- Providing operating instructions, maintenance manuals, and "as installed" drawings for the complete systems in digital form.
- Instructing the client in the use, operation, and maintenance of the complete services installation in the presence of the Employer's Representative and achieving a signed confirmation of demonstration and receipt of manuals and drawings from the Client's Representative.
- Handing over all tools, keys, spares, oils, chemicals etc. required to access the system, and carry out routine maintenance.

2. CONTRACT DRAWINGS AND DOCUMENTS

2.1 Documents Provided

Refer to the document transmittal sent with the tender documentation. All drawings and documents that are contained on the transmittal or that are sent as part of the tender pack form part of the services works.

Ensure that all drawings and documents identified have been received and request copies of any documents that have not been received.

The drawings shall be read in conjunction with all architectural and structural drawings.

No allowance will be made for a lack of understanding of the buildings structure or finishes during the tender period if the information was available at the time of tender.

The purpose of the drawings issued shall be confirmed by the consultant on request. If it is confirmed that the tender drawings are issued for contract or construction, then the contractor shall use them for that purpose. The Contractor shall not require drawings to be individually marked with their purpose of issue and confirmation of purpose of issue shall be deemed to be adequate.

2.2 PROVISION OF DRAWINGS IN ELECTRONIC FORMAT

All drawings and other documents will be provided in an electronic format. Allow for printing hard copies of the drawings and other documents as required to complete the installation. Take care to ensure that printed versions of the drawings reflect the electronic versions, with all information displayed. This clause shall take precedence over any other clauses within the contract relating to the provision of services drawings in paper form.

Subsequent to printing drawings, take sample dimensions from elements of known dimensions to ensure the drawings are printed to the correct scale and with the correct extents.

Ensure that the software required is available to accurately read, display and print AutoCAD drawings and PDF files that are saved in a version of software that is no more than one year behind the latest version of the software available.

3. VALUATIONS FOR INTERIM CERTIFICATES

At the time of every valuation of the works for interim certificates, submit to the Employer's Representative, the following information in digital format (excel or other spread sheet format that can be directly imported into excel):

A detailed breakdown of the amounts allocated to each section of the services works as detailed in the elemental breakdown of services costs, and the relevant amount claimed for each section.

The gross amount (including retention) claimed in the current application.

The amount certified to date by the Employer's Representative.

Statements shall not include any equipment stored off site or stored on site in an insecure or unprotected manner.

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Statements shall not include for any materials or equipment stored on site that are not fixed within the building. For example, the value of stored pipework, fittings etc. stored on site, awaiting installation shall not be included within interim certificates.

The Employer's Representative withholds the right not to issue a payment cert if the information above is not provided in the correct format.

4. BUILDER'S WORK CO-ORDINATION

Where the forming of openings or the modification of the building works is required to support the services installation, ensure the requirements are determined and planned in advance of the works.

Co-ordinate the builder's works to ensure that the number of openings are minimised. Produce co-ordinated builders works drawings and provide them to the structural engineer for confirmation of structural suitability before proceeding.

Determine the location of all openings required within the fabric, all plinths, all step overs, platforms, or other secondary steel.

The contractor shall be fully responsible for identifying the openings required for the installation, in advance of the formation of the structure. Where builders work drawings are provided at tender stage, they are provided for information only and must be further developed and adjusted by the contractor, as required to match the actual installation. In the event that the contractor fails to identify a required opening prior to the forming of the structure, the contractor shall form new openings as required or cover the cost of the re-routing of services to use alternative openings.

The contractor should assume that openings are required within the full dimension of risers where they are provided.

Allow for forming separate openings for fire dampers or forming concrete supports between dampers as required by the damper provider.

In the event that the builders work drawings fail to identify required openings and services have to be re-routed as a result, then no payment will be due for the re-routing of services

5. SECONDARY STEELWORK

Include for the supply and installation of all steelwork or other secondary support materials required to securely support the services within their works and provide adequate access to them.

Include for any equipment ballasts or other elements required to secure plant and services to the details required from the equipment or system manufacturers.

Include for all roof mounts required to support equipment and services. Confirm with the equipment supplier and the structural engineer to ensure proposed roof supports are appropriate for the roof finish provided.

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Provide a “walk on” steel mesh floor to all fully accessible risers and cut the mesh to allow services to pass through. Where floor supports are omitted by agreement, provide labelling clearly noting that the fire stopping provided between riser floors is not suitable for placing weight on

Ensure that all services are securely and safely attached to the building.

Fully determine and consider the buildings structure and finishes and allow for all required fixings and supports required to support all systems, plant, and equipment safely, securely, and neatly.

Ensure that Any ‘confined spaces’ (eg tanks or vessels requiring internal cleaning or maintenance) have full lifting gear and structure fixings provided to suit the positions of access hatches such that operative winches can be mounted where required.

6. SUPERVISION

Make available throughout the duration of the works a project supervisor with appropriate qualifications, skills, and knowledge to act as the services installation representatives and to receive such instructions as are necessary for the execution of the contract and to attend site meetings when requested. The project supervisor must have previously completed projects of a similar size and complexity in order to fully understand the requirements of the works.

7. CO-ORDINATION

Ensure that the services are fully co-ordinated with each other and with all other building elements.

No adjustments will be made to the contract sum where additional work is required due to poor co-ordination or where the Employer’s Representative has not been informed in good time of a co-ordination difficulty that could have been resolved by a design decision had the issue and its full implications been advised to the Employer’s Representative in good time.

No adjustments will be made to the contract sum for services that have to be removed due to being installed in a manner that causes a conflict with the building or other services.

Co-ordination activities that shall carried out by the contractor shall include:

- Agreeing the principles of co-ordination of services.
- Highlighting any areas of concern and proposed solutions to the Employer’s Representative wherever the solutions proposed have a design or visual implication and obtaining permission to modify the installation as required.

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- Seek assistance from the Employer's representative where design input is required to confirm a proposed co-ordination solution proposed is appropriate from a design perspective.
- Taking site measurements as necessary prior to ordering any plant or equipment. In particular, measure all wall and ceiling mounted equipment locations and compare against the works requirements, highlighting in good time any potential clashes or difficulties and proposed solutions to the Employer's Representative. No allowance shall be made for the replacement of plant or equipment that does not fit due to failure to check dimensions prior to ordering.
- Taking site measurements to ensure that items of plant and equipment can be successfully delivered to their required locations. Any concerns about delivery routes to required locations shall be highlighted to the Employer's Representative prior to the start of construction.
- Provide set-out drawings for any openings or equipment that requires precise positioning, including all drainage openings through slabs.
- Checking interaction of various elements with building elements such as doors, walls etc.
- Adjust the layout of services runs to avoid other services and building elements.
- Split services runs where required to fit the space available or avoid obstructions.
- Adjust the aspect ratio of ductwork where required to avoid obstructions, maintaining a constant cross sectional area and avoiding aspect ratios greater than 1:4 except where approved.
- Use the most direct and shortest routes for services while maintaining orthogonal orientation except in the case of waste pipes.
- Arrange all services neatly and evenly spaced.
- Seek assistance in selecting alternative sizes for services where services are split or their aspect ratio is altered.
- Arrange services so that they are not visible, except in locations explicitly agreed with the Employer's Representative.
- Align wall mounted fittings so that they are orthogonal and aligned with other wall mounted elements. Ensure spacing between wall mounted elements is consistent

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and ensure the height of wall mounted elements fits with mounting height rules advised by the Employers Representative.

- Adjust services routes and add any components required to flush, commission, and maintain the systems, including pockets for taking measurements, flushing loops, access hatches etc.
- Adjust services to allow for the future maintenance, removal, or adjustment of services except where specific agreement is provided with the Employer's Representative.
- Ensure services routes are safe and don't propose a trip or injury hazard during normal usage and maintenance.
- Locate all components that require maintenance such as strainers, pumps, meters, and key valves, within normal reach from ground level except where a specific agreement has been reached in advance with the Employer's representative.
- Detail all requirements for safe access such as permanent access platforms, step overs etc.
- Ensure noise levels are not excessive (not above 45dB(A) or a specific figure provided for a particular area or system) , giving consideration to the combined effects of attenuators and plant generation noise. Ensure break out noise is also maintained below this level. Ensure elements that may cause regeneration noise such as dampers are appropriately robust and sized to prevent excessive noise regeneration.
- Establishing the location of all fire or fire and smoke dampers, developing damper support details, and ensuring that the damper supplier will sign off on the proposed details, adjusting as necessary in good time.

Prior to the submission of any information to the Employer's Representative, check and approve all drawings, schedules and any other information provided by manufacturers, suppliers, or sub-contractors to ensure that all the requirements of the contract documentation have been incorporated. Accompany all documents submitted with a certificate indicating that they have been checked. The Employer's Representative reserves the right to refuse to comment on any documents that are not accompanied by a certificate stating that they have been checked before submission and the Employer will not be liable for any project delays that result.

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Any changes in services routes that are required to accommodate other services or accommodate building elements must be outlined to the Employer's Representative prior to installation. In the event that the Employer's Representative is not informed before carrying out the works and has not explicitly confirmed that the proposed changes are acceptable, cover any associated costs such as plant modifications or other design elements that could have been avoided through the early notification to the Employer's Representative.

Before installing services that connect to or relate to fixed equipment / furniture (including service drops or other services that line up with the final fixed equipment, outlets, or furniture), first review the latest room layouts including furniture layouts and details and ensure that the services are positioned to suit the final fixed equipment / furniture positions.

Where room layout details are provided showing the elevational layout of services confirm which document takes preference in the event of the discovery of a discrepancy between the services layout and elevation layout details.

No allowance shall be made for abortive works that result from adjusting or replacing services that due to failure to fully examine, understand, or co-ordinate the locations of final outlets or equipment.

7.1 Co-Ordination Responsibilities

While the main contractor shall have overall responsibility for co-ordination, each services contractor shall co-ordinate their works with the building and ensuring that the services they install do not clash with or infringe on other services or prevent ease of maintenance of any services.

The mechanical services contractor shall take the lead in co-ordinating the mechanical and electrical services. This task shall include the following:

- Leading co-ordination meetings to agree services routes.
- Overlaying services drawings and providing combined co-ordination drawings.
- Developing combined services sections where required.
- Agreeing cost optimal solutions that consider the possibility of savings from one contractor and additional costs from another.
- Where an insurmountable clash occurs between mechanical and electrical services, the services engineer shall determine which service element shall take precedence. In such an eventuality, any diversions or alterations to final positions shall be deemed to be included in the contract.

7.2 Co-Ordination and Noise Nuisance

Arrange services so that they do not generate excessive noise. In particular carefully locate control components to the recommendations of their manufacturers and ensure they are selected to be capable of operating quietly with the pressures experienced. Place dampers on branches as far as practical from final outlets.

8. INSPECTION BEFORE CONCEALMENT

Whenever work requiring inspection or testing is subsequently to be concealed, due notice shall be given to the Employer's Representative so that inspection may be made, or tests witnessed before concealment at the scheduled site meetings.

Failure to give due notice, prior to the scheduled site meeting at which the works can be inspected, shall necessitate the uncovering the work and reinstating it at their own expense.

The Employer's Representative reserves the right to forego its inspection; however, this will in no way relieve the responsibility to comply with the specification and drawings.

All work that is not installed to the required standard or does not demonstrate adequate co-ordination with the building and other services must be removed and re-installed in full compliance with the tender documentation and relevant standards.

9. STANDARDS AND REGULATIONS

9.1 Standards

Reference is made within this Specification to various Irish Standards, European, British Standards and ISO Standards. Irish Standards shall take preference in all cases, provided that no conflict exists between the Standard and the particular requirements of the Systems Specification. In such circumstances the Employer's Representative shall determine on which standard takes precedence.

Where a European standard has been modified or appended to allow for the Irish context then the modified version shall be used in preference to the European version.

If a standard specified has been updated or clearly superseded before the date of pricing, then the newer standard will apply unless directed otherwise by the Employer's Representative.

9.2 Regulations

The services works to which this Specification relates must comply with the current issue of the following:

- The Building Regulations
- Safety, Health, and Welfare at Work Act
- The Asbestos Regulations

- Local Authorities By-Laws and Regulations
- Utility Supply Authority's requirements
- Fire Officers' Requirements
- IS 10101 National Rules for Electrical Installations

The works shall be carried out in accordance with the requirements and regulations of all relevant local authorities, fire brigades, and water, gas and electricity authorities.

Any such portion of the works requiring the inspection and approval of such authorities shall not be built-in, covered or otherwise obscured until such approval has been obtained.

Authorities shall be notified as necessary about the connection of utilities.

Programme and co-ordination of the utility services to ensure that the overall building programme is achieved.

Ensure that notice is given to the utility companies or authorities, together with the appropriate documentation, in good time to allow the utilities to programme their work in such a manner as to meet the contract programme. Obtain all required forms, circulate to the signatory parties, and ensure that the documents are returned to the utility providers in good time. When circulating the documents for signing by others a clear statement must be given on the required return date for the signed documents and adequate time must be given for the document signing.

Organise the utility connections, gathering forms required for applications and submitting them to the Employer's representative, organising site meetings with the utility providers, and explaining the requirements to the utility providers. The Employers Representative will provide load calculation information on request.

On completion of the works each sub-contractor shall provide the assigned certifier with a statement confirming that the installation under the control of the sub-contractor complies fully with the Building Regulations

10. HEALTH & SAFETY

Include for complying with the Safety Health and Welfare at Work Acts and Regulations current at the date of tender in the installation of the services.

Include for providing two full size paper set of "As Installed" record drawings for inclusion in the Safety File, in addition to any other certificates, or other documentation requested for the safety file.

Include for all works required to make the installation safe, including the piping of safety relieve valves to a safe location where safety relief valves are provided.

Every rotating, reciprocating or moving part of machines supplied shall be properly protected by manufacturer's standard or purpose made machine guards at no additional cost to the contract. All machine guards shall be manufactured from solid sheet metal or wire mesh or iron frame, all galvanised after manufacture and shall be so designed with hinges and/or removable sections to allow for maintenance and all necessary tachometer readings.

11. PROTECTION OF THE WORKS

The installations shall be properly protected at all times. Should the measures taken be inadequate, then it shall be the sole prerogative of the Employer's Representative to determine if repairs may be affected and suitable recompense made to the Employer or whether damaged installations shall be completely replaced. See the below section on making good damage for further details.

At no time is the Employer's Representative obliged to accept anything other than new totally undamaged, correctly installed and selected equipment.

No second fix services shall be installed prior to the weather sealing of the rooms in which they are due to be installed. No plant shall be delivered to site until the room into which it is to be delivered is fully weather sealed.

No systems shall be installed in areas of the building where water ingress can occur and any system in locations where water ingress has occurred shall be replaced.

Do not bring any items of plant to site until a fully weather sealed area of the building is available for their storage. Any plant that becomes damaged while on site shall be replaced at no cost to the project. If plant is stored in an area that is not watertight or water is found to be leaking into the area that the plant has been installed in then a certificate confirming that the plant has not become water damaged will be required before payment can be made for the plant.

11.1 MAKING GOOD DAMAGE

Inspect all equipment and materials on arrival on site for defects or any failure to meet the specification and shall replace any defective equipment or materials.

Make good, any damage or defacements caused to equipment or materials to the entire satisfaction of the Employer's Representative and shall remove all rubbish, unused plant, and material from the site on completion.

At substantial completion present all plant and equipment to the Employer's Representative in a fully working and un-damaged and "as new" condition. Any damaged plant, equipment, controls, or plant casings must be replaced prior to substantial completion. Failure to deliver un-damaged plant and casings at substantial completion may lead to their exclusion from the substantial completion certificate and the delay of the commencement of the defects period and warranties for the equipment in question.

12. EARLY DELIVERY OF PLANT

Plant shall not be delivered to site more than 6 months before substantial completion except by express agreement with the employer.

13. USE OF SYSTEMS DURING CONSTRUCTION

The systems installed shall not be used to assist with the construction works without achieving written approval from the Employer's Representative. The buildings systems shall not be enabled or run for any purpose other than testing, commissioning, and demonstrating the systems prior to the acceptance of substantial completion.

In the event that the Employer's Representative approves the use of a system for other purposes, all appropriate safety precautions must be taken to prevent damage to plant and the system must be fully re-commissioned and certified by the manufacturer prior to substantial completion.

If the Employers Representative approves the use of systems during the construction period then consumable components shall be replaced at substantial completion, or an agreement must be reached with the Employers Representative on the compensation of the Employer for the provision of used systems.

14. DAMAGE DUE TO FROST

Make good at no cost to the client any damage caused by frost to any part, of the services works, for any reason up to the point of substantial completion and re-commission any of the systems affected by frost damage, providing certificates to the Employer's Representative.

Replace any components damaged by frost during the defects period in the event that the services frost protection routines or controls were not set up as specified.

15. MATERIALS AND PRODUCTS

15.1 General Requirements

Materials and workmanship shall be the best of their respective kinds and in accordance with the specification. All materials shall (unless otherwise stated) conform to all statutory requirements. The installation shall be constructed from entirely new materials and equipment.

All equipment and components supplied shall be the latest model that is available at the time of ordering of the equipment. No equipment shall have a date of manufacturer of more than six months prior to its installation.

Equipment that has previously been installed or partially installed on other sites shall not be used except by explicit agreement with the Employer's Representative.

All materials considered by the Employer's Representative to be unsound, damaged or compromised during the installation, not in accordance with the Specification, or not appropriately stored, shall be immediately removed and replaced, and all work carried out imperfectly or with faulty materials must be removed and properly replaced to the satisfaction of the Employer's Representative.

All equipment and materials shall be provided by manufacturers who have available timely maintenance and servicing capability within the Republic of Ireland.

15.2 Suitability

Use materials and products which:

- are suitable for the services and conditions of use normally expected to apply after the installation is completed.
- are able to withstand the testing and commissioning conditions specified.
- do not initiate mould growth, support vermin, contain animal hair, contain crocidolite, asbestos or support bacterial life.
- are free from objectionable odours at normal working temperatures.
- do not suffer deterioration at the maximum temperature and under the specified conditions of use.
- are capable of being applied to any of the base surfaces without causing damage or deterioration of the base.
- are not a fire hazard or evolve dense or toxic fumes if subjected to excessive heat such as in a fire.
- when of similar type, are made by the same manufacturer throughout.
- are IS/ISO marked, wherever possible; are in accordance with ISO9001 - Quality Assurance Scheme, wherever possible

If using products or materials that are likely to cause a reaction with other materials used in the installation by any Contractor e.g., PVC cabling and certain insulation types. Ensure that this reaction does not occur by providing appropriate protection.

15.3 Ordering

Order all necessary materials and products at an appropriate time to allow the completion of the works within the project programme.

No delay to the Substantial completion or completion of any part of the works due to delays in ordering of materials or products will be accepted.

15.4 Handling and Storage

Deliver, off-load, store and transport about the works all materials and products in a manner recommended by their manufacturers.

Provide adequate, safe, and secure covered storage and protection for all materials and products.

Store components and materials on purpose-made racks, in an environment fully sheltered from the elements and adequately support to prevent bending and distortion.

Seal ends of pipework, conduit and similar products with purpose-made caps and plugs.

Protect all threads with purpose-made caps and plugs.

Where materials and products cannot be stored in dry buildings, raise them clear of the ground and adequately support, protect and cover to prevent any damage from flooding and site dirt.

Adequately coat materials and products to prevent damage by oxidation or chemical action, maintain this coating until ready for final finishing.

15.5 Samples

Allow for the provision of samples of all visible elements of the works when requested.

Samples for appraisal shall be provided in a timely manner (at least 2 months before the ordering date) for appraisal for all items which may be viewed in or on the building within normally occupied spaces or on the exterior. All samples shall be submitted prior to confirmation of orders for supply. These shall be made available at the Employer's Representative's office, or at another point agreed by the Employer's Representative.

When requested, embody in the works any such samples which have been approved, or set up samples in place within the works to allow them to be viewed in context.

16. PLANT SUBMITTAL

Ensure that the proposed equipment fully complies with the specification and equipment schedules. In order to assist in the early identification of potential non-compliances, submit to the Employers Representative a plant submittal.

The Employers Representative will examine the information provided and may issue comments for assistance. These comments shall not in any way remove the responsibility to fully comply with the specification.

Provide a complete set of plant submittals within the earlier of the following conditions:

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- Within four months of formal appointment.
- No more than 50 working days before the ordering date for the plant or equipment.
- As required to ensure comments can be received and accommodated.

The order dates for all plant equipment should be included in the monthly progress report and programme.

The plant submittal shall consist of the following:

- A cover sheet for each equipment type stating its performance characteristics.
- Manufacturer's technical information on each plant item in English, demonstrating compliance with the specification.
- The submittal shall include all items of equipment within a single submittal in order to allow all items to be considered together.
- The submittal shall be provided in digital form and shall be clearly labelled to allow the ease of identification and review of each plant item.

Examine the submittal before it is sent to the Employers Representative and assure them that the plant proposed fully complies with the specification.

If request for a deviation or relaxation of any part of the specification is submitted, this shall be clearly identified in the plant submittals. Unless the Employers representative specifically allows a relaxation in writing, the specification shall continue to apply, irrespective on any comments made on the plant submittals.

In the event that the Employers Representative identifies any significant non-compliance, or any non-compliance that could have easily been identified prior to submission to the Representative, the Employers representative shall abort the process of reviewing the submittal until a version is submitted that has been fully checked for compliance prior to submission. Any delay to the contract as the result of the repeated submission of non-compliant proposals shall be the responsibility of the contractor.

If an item of plant is at any stage found to be non-compliant with the specification in a material way (if it is found that the equipment is inferior in terms of performance, durability, longevity, efficiency, dimensions, or appearance), then the Employers representative reserves the right to withhold payment for the plant until a compliant item is supplied.

If the proposed plant or equipment that deviates from the specification, or requires any additional wiring, plumbing, or other works to that shown within the specification, adjust the system to accommodate the equipment or plant proposed with no cost to the employer.

16.1 Equipment specification deviations

The equipment provided must comply fully with the technical requirements outlined within the specification and associated equipment schedules.

Equipment that deviates from the specification may be proposed for consideration, but such a proposal must consist of the following:

- A detailed submittal of the proposed equipment including its dimensions, duty and energy efficiency.
- A list drawing attention to any specific deviations from the technical specification requested.
- A confirmation that the dimensions of the proposal have been checked against site dimensions and fit fully with the works.
- A list specifically drawing attention to any deviations from the specification.
- A proposed saving offered to the Employer if relevant for the alternative proposed.

The alternative equipment proposal must be submitted to the Employers Representative in good time to allow its assessment. This shall be defined as at least 50 working days before the ordering of the plant or equipment.

If the equipment proposed is found not to comply with the specification in any form that has not been specifically identified within the alternative equipment submittal, then the submittal will be rejected until it has been correctly compiled.

The Employers Representative, on reviewing the submission, may allow a deviation from one or more of the requirements within the specification for a particular item of equipment. This acceptance of a deviation in the specification does not constitute the approval of every aspect of the alternative offered and the requirements of the specification and schedules remain with the exception of any specific modification approved.

Where an item is offered that deviates from the specification in a way that affects other elements of the system, include for all measures necessary to make the equipment and the total installation equivalent to that specified e.g. upgrading pumps where pressure drops are higher, carrying out discrimination studies where MCB types are changed, upgrading cable sizes where electrical loads are higher and produce all necessary drawing and co-ordination to demonstrate the successful installation.

The cost of any re-design work required to make a particular alternative perform to the design intent and any knock-on redesign of other systems as a result of the change shall be paid by the Contractor. This includes knock on effects that may not immediately be identified.

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In the event that proposed equipment is offered that deviates from the specification, but the deviation has not been explicitly drawn to the attention of and accepted by the Employers Representative and the items is later found not to comply with the specification (even after substantial completion is issued), the item shall be immediately replaced with a compliant item.

Any plant or equipment that is installed in the works which does not comply with the specification in any way that has not been approved by the Employers Representative must be immediately removed and replaced at the request of the Employer's Representative.

17. THE USE OF DOCUMENT MANAGEMENT SYSTEMS FOR SUBMITTALS AND RFI'S

Submittals and RFI's shall be issued to the Employers Representative by email, or file transmittal system where the size of the documents is too large to email. Any file transmittal system used shall not require a licence for the receipt of documents.

The Employers Representative reserves the right to respond in a digital format of their choosing.

Should the contractor wish to use a specific document management system to manage submittals and RFI's, the system proposed will be considered but will not be used if it is not deemed to meet the requirements of the Employers Representative.

18. EMAIL COMMUNICATION

Web based systems shall not be used for general communication and all general communication shall take place through email, or an alternative that is agreed by the Employers Representative.

All email correspondence sent to the Employers Representative shall contain a fixed project name in the subject, followed by a clear indication of the purpose of the email.

19. COST REDUCTIONS

If the Employers representative requests a change to the specification for the purpose of achieving a cost saving, a response shall be provided with an appropriate saving noted within a one-month period including a breakdown of the revised costs of the proposal. If the saving and details are not provided within this period, the cost saving shall be valued by the Employers Representative.

The breakdown of costs shall include material costs, labour times and rates required for the works. Savings offered shall include all associated works.

20. STATUS OF COMMENTS MADE BY THE EMPLOYER'S REPRESENTATIVE

Whenever information is submitted, comments received, if acted upon will not in any way invalidate or diminish the responsibility to comply fully with the specifications and drawings in full. If a reduction in or deviation from the requirements of the specification are requested,

this must be obtained independently, in writing as a specific statement acknowledging the relaxation in specification.

Should the Employers Representative agree to the use of a web based submittal management system and that system does not allow responses to be closed out with the term “no comment”, any use of the term “Approved” by the Employers Representative shall be deemed to have the meaning “no further comments” and will not signify the “Approval” of a submittal. If a deviation from the contract documents is requested, then that deviation must be explicitly stated and approval received.

21. ACCESS FOR PLANT INSTALLATION & SUBSEQUENT REMOVAL

Before work is put in hand and orders are placed for any item of plant, check on site, the dimensions of all doorways, ceiling heights etc., serving as access to ensure that each item can be admitted to its allotted position and installed as specified together with all other services that it can be replaced with similar replacement equipment at some future date.

Failure to determine that plant or equipment can be installed and replaced easily prior to ordering shall result in the plants replacement. In this event cover all re-stocking charges associated with the replacement of the plant or equipment.

The Employer’s Representative may request a demonstration that plant and equipment can be easily removed for replacement or maintenance purposes, using the same materials, and without any destructive operations.

Should a clear demonstration that equipment and plant can be easily removed for maintenance or replacement purposes not be achieved, the installation must be modified as required to allow a level of access that is acceptable to the Employer’s Representative.

22. ACCESS FOR MAINTENANCE

Where access may be required to any element of the services installation for maintenance proposes, provide details to the Employer’s Representative in the form of a marked up drawing prior to the installation of the services.

Co-ordinate the access requirements to minimise duplication of access requirements for different service types.

In the event that an access requirement is not identified to the Employer’s Representative prior to the installation of the services, and the Employer’s Representative deems that the location of any services elements that require access are not in an appropriate location for visual or practical reasons, then the services element shall be re-located without charge to the contract.

Include for all access hatches required to access valves and cleaning points throughout the installation.

23. EASE OF MAINTENANCE

At all times consider the future maintenance of plant and include for such component parts or tools as are required for this purpose. (Panel keys, air vent keys, any specialist fixings that cannot be opened or operated with standard tools etc.)

Where services cross access routes at low level purpose made step-overs shall be installed without any additional cost to the contract in order to provide safe access.

Installation of equipment shall be arranged to give ease of subsequent removal.

Co-ordinate all services to ensure that items that require access for removal for maintenance are installed within reach of an operative and can be removed without requiring ladders, scaffold, or other access platform.

24. SPARES AND SPECIAL TOOLS

Provide at substantial completion a complete set of tools required to carry out routine maintenance on the system during the first year of operation, including control panel keys, air vent keys etc. Provide a schedule of all such tools and obtain a signature from the end user, confirming that the items were received. In the event of a dispute, it will be necessary to display this signature and schedule in order to demonstrate that the tools were provided.

Provide any routine disposable items that are required during the defects period with the exception of filters. Provide at substantial completion one complete set of new filters either installed within the plant and unused or free issued to the end users.

As part of the maintenance manual, submit an additional list of special tools and test equipment likely to be needed during the useful life of the installation, i.e., over and above the 12 months period. If this information is not provided in good time and the Employer is thereby prevented from carrying out proper maintenance of the installation, carry out the maintenance at no cost to the employer. This requirement is in addition to the provision of the spares and tools required for routine maintenance and access.

25. “AS INSTALLED” RECORD DRAWINGS

The services elements of the works will only be included in a Certificate of Substantial completion, when the final “As Installed” drawings and diagrams have been submitted. All drawings shall be provided in the latest release of AutoCAD (or a release that is no more than three years behind the latest release). Drawings shall also be provided in PDF format (Portable Document Format – latest version)

Issue of drawings shall be on USB key with a backup provided on a second USB key.

On final issue of the “as installed” drawings, obtain a signed record of delivery signed by the Clients representative. Failure to produce this record if requested within a period of one year after substantial completion is issued may (at the discretion of the Employer’s Representative) result in the requirement to deliver further copies of the drawings.

Before the above-mentioned final issue, send a digital version of the “As Installed” drawings and diagrams to the Employer’s Representative for comment on format and general content. Allow ten working days for a response.

Include on the “As Installed” drawings and diagrams the following:

Each drawing provided as part of the tender package, and to the scale provided for tender, but with all installed modifications added. Identify clearly any key elements of the installation that may be required for maintenance purposes.

Manufacturer’s internal wiring diagrams for each piece of Electrical or controls equipment supplied under the contract, together with physical arrangement drawings to locate and identify the component parts.

The completed Record Drawings shall be submitted at the same time as the Operating and Maintenance Instruction Manuals for comment.

Drawings must represent the actual installation and in particular ensure that all components that are likely to require access are correctly located and indicated.

In the event of non-compliance with this Clause, the Employer’s Representative reserves the right to employ an alternative company to produce the documents with the costs being deducted from the amount due for the services elements of the works. The sum deducted will be the actual cost of the work and may be greater than any sum declared due to the need to carry out a survey and arrange for the works to be carried out at short notice. Any Employer’s Representative checking charges may also be deducted.

26. OPERATING AND MAINTENANCE MANUALS

A digital operating and maintenance manual shall be provided.

If the provision of a web-based O&M is agreed with the client, then the contractor shall provide all information required to complete that system. The information provided as a minimum shall include the information detailed below.

If a web-based system is used, a copy of the drawings, Revit model, and all plant data sheets shall also be issued directly to the Employers representative at each stage of the checking process, in addition to a final version of the completed documents.

Manual Content

A digital operating and maintenance manual shall be provided. This manual shall an index with hyperlinks to all relevant information and supporting documents. Hyperlinks must be relative to allow the manual to be stored in other locations.

Where the skills required to produce the manual do not exist within the contract team, employ additional external resources to complete the documents.

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This manual must be prepared in advance of substantial completion and handed to and demonstrated to the Employer on completion of the building.

Obtain a signed cert form the client to indicate that the manual has been handed over and that its operation has been demonstrated.

The manual shall contain the following:

26.1 Contacts

Contact details for the following:

- The Contractor.
- The M&E and Lift contractors.
- The design team.
- Equipment suppliers.
- Emergency contacts for relevant utility network providers.

26.2 Emergency Procedures

Information shall be provided that clearly identifies key shutdown tasks such as isolation of utilities both to the entire building and to sections of the building.

The location of key services isolation points etc. Shall be made by using photographs and drawings.

26.3 Equipment Details

A cover sheet for each equipment type that makes it clear what has been installed and where.

PDF manuals for each item of equipment installed. The manuals must be in English and must specifically identify the actual models installed in the building.

26.4 System descriptions

Brief, easily understood (non-technical), English descriptions shall be provided for each of the building systems. These shall describe the systems installed in a logical and sequential manner describing the service where it enters the building and working through to the outlets.

Photographs of the actual equipment used in the building shall be included so that the end users can easily identify what each bit of equipment is and what it does. Photographs for each item of equipment in the equipment schedules shall be provided.

26.5 Installation and Test Certificates

Scanned copies of all of the signed installation and test certificates shall be provided.

26.6 Maintenance instructions

Maintenance requirements and recommendations shall be provided. General recommendations to appoint a maintenance company shall be tabled, followed by specific systems and maintenance intervals recommended.

26.7 Drawings

A list of drawings with clear non-technical descriptions and links to the PDF versions shall be provided.

26.8 Process of gathering information

For assistance, the steps involved in creating this manual are as follows:

- Obtain Manufacturers Literature
- Obtain literature for ALL of the actual equipment installed in the building in PDF format. This literature must be provided in ENGLISH. Literature must include product details, operating instructions, and maintenance instructions for all items of plant and equipment.
- Obtain System Drawings

Compile all “as installed” drawings in PDF format with white backgrounds.

An AutoCAD version of the “as installed” drawings shall also be placed in the folder used to store the PDF version of the drawings.

- Obtain Certificates

Compile installation and test Certificates for all systems and commissioning data in PDF format

- Maintenance Requirements

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Produce a list of maintenance requirements for all systems in simple English. See template for an example of the language and clarity to be used.

- Photographs

Gather good quality digital photographs of all items of plant in the building. In particular photograph and reset buttons or other devices that the end user will have to interact with.

- Contacts

Obtain a contacts list for the design team and contract team.

- Prepare the manual

The manual can be prepared as a word or PDF document but must contain relative references to ensure that the references stay current when the documents are stored in alternative locations. On completion test the document in various locations before issuing.

- Issue for comment

Issue the completed manual USB key to the Employer's Representative for checking prior to substantial completion, make any corrections required, and issue to the Employer.

- Meet with the Client

Copy the manual to the Employers computer as a working copy and explain how the manual should be used.

Get the clients Representative to sign a document stating that they have received the manual and associated training. Keep this signed document for at least one year after handing over the manual.

In the event that the manual and associated drawings have not been issued prior to substantial completion, the Employer's Representative may employ an alternative company to complete the documents and deduct all costs from the amount owing.

27. OPERATION OF SYSTEMS BEFORE THE PRODUCTION OF THE O&M'S

In the event that substantial completion is accepted prior to the handover of all drawings and manuals: The contractor shall provide attendance, at no expense to the Employer, to

put into service, operate 24 hours a day and maintain the systems to the Employer's requirements, including the provision of suitable competent labour.

28. COMMISSIONING AND TESTING

Notify the Employer's Representative in writing when the Engineering Installation works or parts thereof are ready for testing and commissioning. Carry out the testing and commissioning in full compliance with the CIBSE guides. Prove that all test results are in accordance with the specification. Operate the installation or selected parts thereof in the presence of the Employer's Representative and shall make all specified tests to the satisfaction of the Employer's Representative.

Where it is not possible at the particular time of commissioning and testing for full load conditions to be obtained or simulated, repeat such operations of full load or simulation thereof at a time when this can be achieved. In particular, refer to the seasonal commissioning requirements contained within the control's specification.

In particular, load test each of the building's meters, and provide a written record of the load tests, demonstrating that the meters are reading correctly both at meter level and on the Building Management System.

Where portions of the work are commissioned and tested separately, upon Substantial completion or Completion of Section as defined in the Contract, demonstrate to the Employer's Representative that all the several portions are capable of proper simultaneous operation.

In cases where the construction programme is such that it will be necessary to return to the portion of the building taken over and occupied by the Employer in order to undertake testing, balancing, adjustment, etc., take all necessary precautions against, and shall be responsible for, any damage caused whilst working in such areas for that purpose.

For the purposes of commissioning and testing of the installation provide all necessary skilled and unskilled labour and all necessary instruments and testing equipment.

Subsequent to the completion of all testing and commissioning to the satisfaction of the Employer's Representative, operate the plant and shall demonstrate that the overall systems function correctly in accordance with the requirements of the Specification.

29. SUBSTANTIAL COMPLETION

Substantial completion of the services works, or agreed phase or part of the works, shall not be achieved until the contract conditions are achieved and demonstrated to the satisfaction of the Employer's Representative. In particular demonstrate that the following aspects are complete: -

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- All works to be complete other than minor snags or defects which could be reasonably completed within an agreed programme without causing disruption to the Employer or their agent's use of the building.
- All tests and demonstrations to have been undertaken in the presence of the Employer's Representative as are required in the Specifications.
- All final copies of the Record Drawings, Schedules, Operating and Maintenance manuals to have been supplied in a format agreed to the Employer's Representative.
- All spares, keys, tools, and other materials required by the specification for the running and maintenance of the Engineering Systems as specified are to have been supplied.
- All instruction of the Employer's staff has been satisfactorily completed and a signed record of the demonstration meeting and the handing over of the interactive O&M and drawings have been obtained.
- The Employers staff have been fully trained in the operation and maintenance of the systems.
- All load tests have been completed on meters, submitted, and have been accepted by the Employers Representative.

Provide experienced personnel to instruct the Employer's personnel in the operation, maintenance, and servicing of all the installations and the interactive operation and maintenance manuals.

Give both the End User and the Employer's Representative at least three weeks' notice of the intended date for the demonstrations.

Obtain signed certificates of demonstration from the client's Representative.

Hold a minimum of two training and demonstration days with the client.

Record the handover in digital HD format and shall provide the client with a USB record of the training provided.

Meet with the client's representatives and set up all timing schedules for all systems to the clients' required settings.

Provide to the client, a schedule of all heating zones and all of the time clocks within the building detailing their purpose, location, and individual operational time settings. This information shall be provided in its own section of the O&M's.

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A commissioning certificate incorporating details of the settings provided on individual detectors on the lighting controls shall be provided and included in the Operating & Maintenance Manuals.

A laminated wall chart shall be provided explaining common operating/maintenance procedures.

30. COMPLETION CERTIFICATE

Upon completion of the installations the following certificate must be filled out by the consulting engineer. The contractor shall confirm in writing that each item on the list has been completed and provide same to the consulting engineer prior to handover:

31. DEFECTS PERIOD

During the defects period, ensure the proper performance of the services installations provided.

Any system or component defect due to its selection, manufacture, installation, commissioning, or operation prior to building handover, shall be rectified without cost to the Employer.

The defects period shall be one year after receipt of substantial completion.

Remain liable for any equipment, systems, or parts of systems that have been excluded from the substantial completion cert or take the form of snags or defects that are identified by the Employer's Representative for a period of one year after receipt of a certificate of completion, or the confirmation of snag completion (by the Employer's Representative) for the items identified.

In the event that any plant or equipment that is shown to be defective due to manufacturing, installation, or commissioning faults during the defects period, obtain an extension to any applicable manufacturer's warranty in order to cover the full original warranty period of the item, starting at the date of resolution of the fault or replacement of the equipment. In the event that it is not possible to achieve a revised manufacturer's warranty, remain liable for replacement of the item of plant or equipment in the event that it fails during the revised equivalent warranty period.

If a large number (more than 5%) of components of the same type fail during the defects period then the contractor shall, at the discretion of the ER replace all components of that type which are installed at no cost to the client.

If any plant or equipment is found to be defective or incorrectly commissioned during the defects period, then the equipment and any associated systems that may be affected by its repair, replacement, or re-commissioning must be re-commissioned and tested and certificates must be provided to the Employer's Representative.

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During the defects period, maintain a clear log of all failures or malfunctions of any part of the system and the remedial actions taken.

31.1 Response during the defects period

During the defects period, all snags identified must be rectified within a reasonable time period. "Reasonable time period" is defined as follows:

- Where the snag or defect has a direct and significant effect on the building preventing its use or preventing part use of the building: Within a maximum of 24 hours of receiving notification of the snag or defect.
- Where the snag or defect prevents the correct functioning of a system but does not prevent the use of any area of the building: Within one week.

Where the snag or defect does not immediately affect the operation of the building and does not rely on third party input (suppliers) etc: Within one month.

- Where the snag or defect does not immediately affect the operation of the building and requires third party input that prevents the immediate resolution of the item (lead times for equipment supply etc.) and this constraint is notified to the Employer's Representative within one week of the identification of the item: Within Two months.

Where the above targets are not met, the client reserves the right to employ an alternative company to complete the items identified and to subtract the costs of same from the project retention. This intervention shall not affect liability for any systems or parts of systems that are not directly altered to rectify the snag or defect.

Where a snag or defect has a significant effect on the energy performance of the building, and the issue is not resolved within one month of its identification, cover the loss of potential savings incurred by the client following the one-month period.

Evidence must also be provided in the form of a photograph to verify each snag or defect has been addressed.

32. INTERPRETATION

If unsure of the meaning of any item within the tender this shall be identified during the tender period in the form of a clarification request. In the event that a clarification request is not issued then the meaning stated by the Employer's representative shall apply.

If an apparent contradiction exists within the tender documents, raise any uncertainty within the tender period. In the event that the uncertainty is not expressed during the tender period, the Employer's Representative shall determine which element of the works requirements takes precedence.

33. BCAR

Ensure that the services installation complies fully with the Building Regulations. Provide all test certs in good time to allow the submission of the completion certificate.

Provide ancillary certs confirming compliance of the services installation with the Building Regulations.

Separate CIF ancillary certificates will be required from the mechanical and electrical contractors, fire detection & alarm provider, and lightning protection specialist.

34. WIRING RESPONSIBILITIES FOR MECHANICAL ITEMS

The contractor shall provide all wiring required for the chiller replicant including pump, chiller, and pressurisation unit wiring and all associated control.

Arrange for a qualified electrician to complete and certify the works.

35. SERVICES SUPPORTS

The mechanical contractor shall provide all of the supports required for mechanical services and the electrical contractor shall provide all of the supports required for the electrical services.

Where services share supports the contractors may collaborate. If agreement is not reached, then each shall support their services separately.

Each contractor shall be responsible for ensuring the structural integrity of the supports used for their services and the mechanical contractor shall be responsible for ensuring the structural integrity of supports where supports are shared.

Where a contractor has a concern about the integrity of supports or the structure from which it is supported, they shall raise the issue with the main contractor who will in turn raise the issue with the project structural engineer for consideration.

Provide additional supports directly adjacent to fire stopping, with spacing's complying with the fire stopping product manufacturers requirements.