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## TECHNICAL SPECIFICATION FOR MECHANICAL SERVICES

<b>PROJECT</b>	<b>PROPOSED EXTENSION TO EXISTING BUILDING-CRYO LAB</b>
<b>CLIENT</b>	<b>PACIFIC COMMUNITY</b>
<b>PROJECT LOCATION</b>	FNTC ROAD 2, NASINU.
<b>ISSUE STATUS</b>	TENDER ISSUE
<b>PROJECT REFERENCE</b>	3885
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3881-MECH SPECS-T1 - 2023.01.18



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## **1.0 INTRODUCTION**

This specification details the requirements for the detailed design, supply, installation and commissioning of Mechanical Services (HVAC) for The Project. The Scope of Works for the Mechanical Services (HVAC) covers the supply, installation and commissioning of all works depicted on the engineering drawings and all other works necessary to implement this specification.

The Engineering Drawings and this Technical Performance Specification identify the system, concepts, design and standards of performance and quality required, but do not purport to identify minute details, which shall be the responsibility of the Contractor. By submitting a tender, the Tenderer warrants that it is competent in the construction of works of the type specified, and that all work will be suitable for the intended purpose and complying with all relevant statutory regulations.

All sundry and incidental works or equipment necessary for the satisfactory completion of the work shall be allowed in the pricing submission even if it is not specifically nominated in this documentation.

## **2.0 DEFINITIONS**

The General Conditions of Contract shall be as defined in the Tender Definitions Schedule.

The definition of the term "PROJECT" shall be as provided in Tender Definitions Schedule.

The term "Superintendent" or "Project manager" or "Engineer" to contract shall be as defined in the Tender Definitions Schedule.

The term "Superintendents Representative - Services" shall be as provided in Tender Definitions Schedule.

The term "Superintendents Representative - Structural" shall be as provided in Tender Definitions Schedule.

The term "Builder" shall mean the company appointed to carry out the main building works for the project.

The term "Electrical Utility Company" shall mean the organisation defined on the Tender Definition Schedule that supply electricity to the community.



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The term "Telecom Utility Company" shall mean the organisation defined on the tender schedule that supplies telecommunication services to the community.

The term "Water Utility Company" shall mean the organisation defined on the tender schedules that supply water to the community.

The terms "Contractor, Tenderer, Nominated Sub-Contractor" shall mean the company bidding for and having subsequently been accepted to carry out the works in this specification.

The term "Contract" or "Sub-Contract" shall mean the works included in this specification and the accompanying engineering drawings, Contract Specifications and relevant Australian and New Zealand Standards to which the project shall be built. The most updated version of the Australian standards shall apply during the period of construction, and this shall supersede the relevant standards version applicable at the time of tendering and contract negotiations.

"Approved" shall mean subject to the inspection and written approval of the Services Engineer before being worked or fitted into the Contract works.

"Indicated" shall mean as indicated in the Contract drawings and specification and by notes, figures, sketches or writing, thereon or by any combination thereof.

The term "Provide" shall mean the Contractor shall supply, install, test, commission and provide warranty maintenance for the item or scope of works being referred to.

### **3.0 REFERENCE DOCUMENTS**

This specification is to be read with conjunction in all relevant reference documents and engineering drawings that are part of this project. All work covered by this specification shall be subject to all provisions of the Conditions of Contract and the Preliminary and General Sections of the Architectural Specification. The Contractor shall be aware of other services such as light fitting equipment so that the placement of all fittings and equipment including the Mechanical Services equipment shall be facilitated.

### **4.0 STANDARDS AND CODES OF PRACTICE**

Standards of workmanship, materials, and details of construction are to conform to relevant Australian and New Zealand Standards with any amendments unless specifically noted in this specification and drawings.

All work in respect to materials and workmanship shall meet or exceed relevant local and overseas engineering standards, best practices and recommended methods. In particular, relevant applicable sections of the following standards shall be deemed part of this specification.

All works shall comply with the following major standards as well as other codes called upon in these specifications:

4.1	The Fiji National Building Code (FNBC)
4.2	National Code Council – Building Code of Australia (latest current version)
4.3	AS1668.1-(current latest version): The Use of Ventilation and Air-Conditioning in Buildings, Part 1: Fire and smoke control in buildings
4.4	AS1668.2-(current latest version): The Use of Ventilation and Air-Conditioning In Buildings, Part 2
4.5	AS /NZ 3666.1:(current latest version): Air handling and water systems of buildings Operation and maintenance
4.6	VDI 2052-1 :( current latest version :) The German Exhaust Hood Standard
4.7	AS4254-(current latest version): Ductwork for Air-Handling Systems in Buildings
4.8	AS1324.1-(:Air Filters for Use in General Ventilation and Air Conditioning
4.9	AS1682.1-(current latest version) Fire Dampers
4.10	AS4508-: Thermal Resistance of Insulation for Ductwork Used in Building Air Conditioning
4.11	AIRAH Technical Handbook, (latest current version)
4.12	SMACNA : HVAC Duct Construction Standards: Metal and Flexible – (latest current version)
4.13	ASHRAE Standard 62.1-(latest current version): Ventilation for Acceptable Indoor Air Quality
4.14	International Mechanical Code (IMC) (latest current version)
4.15	National Fire Protection Authority (NFPA)

The Mechanical Services Contractor shall carry out Electrical and Telecommunications works associated with Mechanical Services as shown on the drawing.

The Electrical and Telecommunications works associated with Mechanical Services works shall be carried out by Licensed Contractors and Licensed Tradesmen holding qualification and licensing as appropriate.

The Electrical and Telecommunications works associated with Mechanical Services shall be carried out to the following base standards and to standards referenced by these base standards.

4.16	AS / NZS 3000: (Latest current version) – Electrical installation (known as the Australian / New Zealand Wiring Rules )
4.17	AS /NZS 3008.1.1: (Latest current version) - Electrical installation – Selection of cables Cables for alternating voltages up to and including 0.6 / 1kV- Typical Australian installation conditions
4.18	AS / NZS 3084 : (Latest current version) Telecommunications installations – Telecommunications pathways and spaces for commercial buildings



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4.19	AS / NZS 11801.1: (Latest Current Version) – Generic cabling for customer premises General requirements (ISO /IEC 11801-1)
4.20	AS / NZS 11801.2: (Latest Current Version) – Generic cabling for customer premises Office premises (ISO /IEC 11801-2)

## 5.0 CONTRACTORS TO INFORM THEMSELVES

The Contractor shall familiarise themselves with the site and the requirements of this specification before tendering. No allowance shall be given for the lack of knowledge of the site conditions and the requirements of this specification. Any discrepancies with the requirements of the specifications or any difficulties with the site conditions shall be brought to the Services Engineer's attention prior to tendering for clarification. The Contractor shall be fully responsible for meeting the requirements of the specification thereafter.

The Contractor shall be responsible for obtaining Local Municipal and Health Authority approvals, permits, inspections and final compliance certification for all work included in this specification. The cost for the same shall be included in the Tender Price.

Full allowance shall be made in the tender price for all costs, including taxes, duties, local authority fees, transportation and any other applicable costs.

## 6.0 CONDITIONS OF CONTRACT

All work covered by this specification shall be subject to all provisions of the Conditions of Contract documents that are provided as part of the documentation package.

Contractors shall ensure that they read and understand all Conditions of the Contract prior to submitting their tender.

## 7.0 SUPPLY OF ITEMS BY OTHERS

If the Principle directly supplies to the contractor, major items of plant and equipment.

The Contractor shall make allowance to take delivery, store safely, install commission, test and provide warranty maintenance for supply of items by others. The Contractor shall ensure and allow necessary costs and resources for liaising with suppliers to ensure the installation is successfully carried out without delays and / or adversely affecting the installation, operation, performance or warranty of items supplied by others.

## 8.0 COORDINATION WITH OTHER TRADES

The Mechanical Services Sub-Contractor shall at all times liaise with other Sub-Contractors, the Main Contractors, the Project Managers, and the Services Engineer to ensure that works are carried out in a timely, orderly fashion so as to minimise delays, disturbances and damages to any equipment or property.





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## **9.0 SITE MEETINGS**

A representative of the Contractor, who is fully qualified in all aspects of Mechanical Services works, shall be required to attend all site meetings called by the Project Manager. The said representative shall be fully conversant with all aspects of this current project, including the latest site developments, prior to attending meetings. The said representative shall have been authorised by the Contractor to make decisions on the Contractor's behalf which shall be deemed binding on the Contractor.

## **10.0 WORK PROGRAMME**

The Contractor shall submit a programme of works with their tender in Gantt Chart Form, specifying Tasks, Duration, Resources and dependencies between scheduled tasks. This programme shall be kept updated at all times for the entire duration of the project.

## **11.0 OCCUPATIONAL HEALTH AND SAFETY**

The Contractor shall ensure that all personnel are fully trained in matters relating to work safety. The Contractor shall ensure that their personnel are fully equipped with safety equipment and that a strict regime of safety is followed on site that complies with local OHS (Labour Department) Authority requirements.

## **12.0 ERRORS IN DOCUMENTATION**

Errors, ambiguities and omissions in drawings or specifications shall be reported to the Services Engineer for correction before any part of the work involved is started. Unless otherwise expressly stipulated, no additional allowance shall be made because of errors, ambiguities or omissions which should reasonably have been discovered during the preparation of the tender or which may become evident later and which should have been directed to the attention of the Services Engineer in timely manner. The written decision of the Services Engineer shall be final.

## **13.0 NON-COMPLYING TENDERS**

All tenders submitted shall be fully compliant with no tags, exclusions, counter-offers or any deviations from the requirement of the specifications and drawings. Alternative sales agreements or upfront payment requirements shall be considered non-compliant. The Contractor shall state explicitly that their tender is fully compliant.

Alternative, non-complying may be submitted providing detailed information on alternative offering or any deviations.

Strict conformance to this specification is required to ensure that the installed system will function as designed, and will accommodate the future requirements and operations of the Client. All specified operational features must be met without exception.

The equipment to be supplied will be considered only if it meets all sections of the performance specification. Any deviations of system performance outlined in this specification will only be considered when the following requirements have been met:

13.1 A complete description of proposed alternate system performance methods with three (3) copies of working drawings thereof for approval by the Client/Architect/Services Engineer, to be submitted with the tender.



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13.2 The Contractor shall submit a point-by-point statement of compliance for all sections in this specification. The statement of compliance shall consist of a list of all paragraphs within these sections. Where the tender bid complies fully with the paragraph as written, placing the word "comply" opposite the paragraph number shall indicate such. Where the tender bid does not comply with the paragraph as written and the Contractor feels the proposed system will accomplish the intent of the paragraph, a full description of the function as well as a full narrative description of how its proposal will meet its intent shall be provided. Any submission that does not include a point by point statement of compliance as described herein shall be disqualified. Where a full description is not provided, it shall be assumed that the proposed system does not comply.

The Client and the Services Engineer shall reserve the right to reject any non-complying tenders.

#### **14.0 QUALIFICATIONS OF PERSONNEL**

The contractor shall have successfully completed projects of comparable size and complexity. The Client reserves the right to reject any components for which evidence of a successful prior installation performed by the contractor cannot be provided.

The contractor shall have in-house engineering and project management capability consistent with the requirements of this project. The contractor is responsible for retaining qualified personnel for detailed system documentation, coordination of system installation requirements, and final system testing and commissioning in accordance with these specifications.

#### **15.0 PRE-INSTALLATION SUBMITTALS**

The successful Contractor shall submit a detailed project plan that will describe in detail how the provider will approach the project, from inception to finalization. The plan must include at a minimum the following information:

- 15.1.1 Project Staging
- 15.1.2 Project Management
- 15.1.3 Equipment Schedules
- 15.1.4 Installation Time Lines
- 15.1.5 Other Trade Requirements
- 15.1.6 Final Acceptance Testing
- 15.1.7 Personnel Resumes
- 15.1.8 Progress Report Sample
- 15.1.9 Progress Inspection Record Sample

#### **16.0 INSPECTION OF EXISTING SERVICES**

It shall be the Contractor's responsibility to inspect the job site and become familiar with the conditions under which the work will be performed. Inspection of the building may be made by appointment with the Client.

The Contractor shall be responsible for prior coordination of all work and demolition with the Builder.

#### **17.0 PROJECT SITE AND WORK CONDITIONS**

It shall be the Contractor's responsibility to inspect the job site and become familiar with the conditions under which the work will be performed. Inspection of the site may be made by appointment with the Client/Project Manager.



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Contractor is to make monetary and resource allowances in their tender submission for all restrictions and other limitations imposed on this site.

The Contractor shall remove rubbish and debris resulting from his work on a daily basis. Rubbish not removed by the Contractor will be removed by the Client and back-charged to the Contractor. Removal of debris and rubbish from the premises shall be coordinated with the Client on a daily basis.

### **18.0 NOTICE TO TENDERERS**

The Contractor shall note that all correspondence shall be provided in writing form and during tender stage shall be addressed to the Principal's Representative as defined in Schedule 1 provided separately to this document.

The Principal's Representative will then issue NTT's to all of the services contractors. This response shall be referred to as Notice to Tenderers or NTT.

NTT's shall be deemed to constitute an addendum to the tender documentation. If there is any conflicting information between the NTT's, engineering drawings or technical specifications; the latest NTT that has been issued shall take precedence over the rest of the documentation.

Note that the preferred mode of transmission for tender queries shall be e-mail although other written forms will be accepted will also be accepted.

All tender queries shall be provided in no later than 5 working days before the tender closing date. The Principal's Representative will not be held accountable to answer any queries after this date.

### **19.0 BUILDING SERVICES ENGINEERS INSTRUCTION (BSEI)**

During the Construction Phase of the Project, all queries and correspondence shall be formally sent to the Project Services Engineer via email. Contact Details of Project Services Engineer is defined in the tender schedule.

The contractor is to forward all services queries to the Project Services Engineer. Responses to these queries will be issued in the form of Building Services Engineers' Instruction [BSEI].

All BSEI's shall be deemed to constitute an addendum to the tender documentation. If there is any conflicting information between the BSEI's or technical specifications; the latest BSEI that has been issued shall take precedence over the rest of the documentation.

Note that the preferred mode of transmission for tender queries shall be via email.

### **20.0 INSTALLATION PROGRESS REPORTS**

The Contractor shall submit fortnightly progress reports during the construction phase outlining the current installation progress on site. It shall also mention any tests conducted or any alterations from the tender documents. A template of this report shall be part of the tender submittal.

### **21.0 TENDER SUBMISSION**

Details of tender submission requirements are specified in the Instructions To Bidder (ITB) document. Bids shall be submitted on the tender form. One copy of the tender form shall be submitted and one copy retained by the Contractor for his records. All blank spaces for bid prices shall be filled using ink or typewritten. Any exceptions to the tender documents shall be fully explained in the same.

### **22.0 MAINTENANCE AND DEFECTS LIABILITY**

Contractor shall provide a general description and maintenance plan as part of tender submission. After award of tender, the Contractor shall submit a detailed maintenance plan for the Services



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Engineer's approval. A copy of the manufacturer's warranty shall be provided with close-out documentation and included with the operation and installation manuals.

The equipment manufacturer and/or supplier shall maintain a service organization with adequate spare parts. Any defects that render the system inoperative shall be repaired within 24 hours of the Client notifying the Contractor.

A logbook shall be provided to record each service activity that has been performed at each visit, the conditions of the system and equipment at the visit, and any defects found during the visit including rectification tasks. The logbooks shall be located on site as directed by the Services Engineer.

Each maintenance visit shall be recorded with details of work done including any measurements taken. The maintenance record sheet shall be signed off by the technician carrying out the works and shall be countersigned by the client's representative. Copies of the maintenance records shall be submitted to the client AND the Services Engineer.

All maintenance activities shall be carried out by competent personnel who are trained in these activities.

## 22.1 GENERAL MAINTENANCE REQUIREMENTS

- Carry out monthly maintenance of all works under this contract for a period terminating twelve (12) months from the date of practical completion of the whole of the Contract Works.
- Replace or repair any faulty equipment or materials, or the results of unsatisfactory workmanship, free of charge.
- Carry out maintenance and testing as required by relevant standards and local authority regulations.
- Provide replacement of consumables at Contractors cost.
- Provide maintenance records, duly filled and copies submitted as required
- Maintain a stock of spare parts required
- Contractor to make available personnel to attend to any maintenance or emergency calls with a minimum of 2 hour response on 24 hour x 7 day basis, for the defects liability maintenance period

## 23.0 PROJECT COMPLETION

### 23.1 PRACTICAL COMPLETION

- Practical Completion Status for works under this contract shall be granted only after all of the following conditions are fulfilled to the satisfaction of the engineer:
  - Submission of correctly completed ITP's
  - Submission of all progress inspection reports
  - All final testing and commissioning has been completed and all works specified by this document are installed and operating correctly
  - Client instruction and training manuals for the same have been submitted
  - Submission of progressive and final certification by the relevant local authorities
  - Written Certification by the Contractor, Suppliers and Manufacturer's that all equipment has been installed and is operating to the capacities and performance levels specified
  - Submission of approved and final as built documentation
  - Contractors Completed Certificate of Compliance issued to the Services Engineer.



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- A Certificate of Practical Completion will be issued by the Services Engineer on satisfactory completion of all of the above.

## 23.2 FINAL COMPLETION

● Final completion shall be considered achieved when the Maintenance and Defects Liability Period has been satisfactorily completed and all specified requirements have been met to the Services Engineer satisfaction. The following requirements have to be met prior to granting final completion status:

- Final and comprehensive maintenance servicing of all works
- Final inspections with the contractor and sub-contractors of all works
- Rectification, repair and/or replacement of any defective works
- Submission of all regular maintenance reports and evidence that maintenance has been regularly and correctly carried throughout the course of the defects liability period.
- Test and operate all plant and equipment. Demonstrate to the Services Engineer that all plant, equipment and systems are operating correctly as intended.

## 24.0 SCOPE AND DESCRIPTION OF WORKS

The scope of work includes the supply, installation, commissioning, obtaining final permits from the local/municipal authority and maintenance during the defects liability period of all Mechanical Services specified herein.

All works necessary to provide a fully functional and compliant system as detailed in this specification and drawings shall be carried out. These works shall include any minor works and/or materials not explicitly stated but necessary to implement the services required.

The Contractor shall make allowance in terms of cost and time for all necessary equipment and materials required to implement this specification whether or not explicitly stated and whether or not permanently installed upon completion. These items shall include but not be limited to hire of equipment, fastening materials, minor building works such as penetrations for cables and support systems.

## 25.0 SCOPE OF WORKS SUMMARY

The scope of these works shall include but not be limited to the following major equipment's and services:

- Supply and installation of new ducted fan coil unit.
- Supply and installation of ducted conditioning system which includes but not limited to outdoor air louvre, in line fan, rigid and flexible ducting, relevant insulation for ducts, associated filters, dampers, air distribution diffusers and accessories.
- Supply and installation of exhaust fans, exhaust ducting, exhaust grilles, exhaust duct support structures and associated accessories.
- Supply and installation of new split type ceiling cassette and wall mounted units.
- Supply and installation of new outdoor units, its adequate mounting, refrigeration and condensate piping and insulation.
- Supply and installation of thermostats, oxygen sensors and its software and hardware connections to required interfaces and systems.

## 26.0 DESIGN CONDITIONS

26.1 Summer outdoor design conditions 33°C DBT, 29.5°C WBT



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26.2 Summer indoor design conditions 23°C DBT, around 50% RH

The humidity control is by cooling coil only. Humidifiers in lab to operate independently. .

26.3 Room temperature control by individual thermostats.  
Temperature control band 1.5°C

## 27.0 SCHEDULE OF EQUIPMENTS

The mechanical contractor shall select equipments by meeting data specified in equipment schedules in mechanical services drawing.

## 28.0 NOISE AND VIBRATION

The mechanical contractor shall take all necessary precautions to have minimum noise generation and its transmission. Minimum vibration as permitted by ISO standard shall be followed. A few points for guidance only are given below:

- a) The floor supported piping shall be mounted on pipe supports with 7.5mm ribbed neoprene pads between the base plate of the pipes and the floors.
- b) All items suspended from false ceiling shall be isolated on separate hangers.
- c) The expansion-joints or expansion-loops shall be provided to take care of the expansion and contraction in pipes due to temperature rises.

In case of ducts, conduits, pipes & tubes, the annular space between construction and penetrating element shall be sealed with sand cement plaster.

The supply duct starting from air handling unit & plenum shall be provided with 25-mm thick acoustic lining (48 kg/m<sup>3</sup>) or as indicated in the schedule of quantities.

Moving equipment such as fan coil units, and fans supported on hangers shall be provided with kinetic spring hangers comprising of welded steel bracket/casing, free-standing un-housed laterally stable steel spring with neoprene washer or kinetic neoprene isolator incorporating a cast in tapped steel load plate to permit bolting to supported equipment and a cast in drilled steel anchor baseplate. Application shall be in accordance with the manufacturer's recommendation.

The mechanical contractor shall take all other precautions or shall make his own arrangements even if not specified in the tender documents for eliminating high noise levels & shall minimise vibrations in all mechanical equipments without any additional cost.

## 29.0 WORKMANSHIP

All works carried out under this contract shall be according to best trade practice and shall be of a high standard. The Services Engineer to the contract shall reserve to reject any work that does not meet quality or engineering standards.



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### **30.0 EQUIPMENT AND MATERIALS**

All equipment and materials used shall be new, unused and be of first grade quality. The Contractor shall submit complete engineering specifications of all equipment for approval prior to ordering the same for the project. Equipment shall be delivered to site in the manufacturer's original packaging.

Where standard or special fittings or finishes are required, the Services Engineer may require samples to be submitted for approval. These shall be submitted free of charge. Samples shall be returned to the Contractor after inspection by the Services Engineer.

The Services Engineer reserves the right to request pipe work or other equipment to be cut open for examination or analysis. Where the sample removed is found to be defective, reinstatement shall be at the Contractor's expense.

The Services Engineer reserves the right to require a performance vibration and noise test of plant before accepting delivery or approving progress payment. Such tests may be made either on site or on another approved location.

### **31. SITE STORAGE**

Material and equipment stored on site shall be adequately protected and secured in a weatherproof building away from direct sunlight and high temperature environments. Installation shall not proceed until the contract building can provide a suitable standard of protection from the weather and other contract activities. No materials or equipment may be delivered to the site until these storage requirements can be met. The Engineer reserves the right to order that inadequately stored or protected equipment be removed from the site and to refuse progress payment.

### **32.0 STRUCTURAL AND SEISMIC REQUIREMENTS**

The installation of plant units, pipe work and fittings shall meet Structural and Seismic Standards according to NZS4219. Where additional building or structural supports or penetrations are required, the Contractor shall advise these requirements well in advance to the Services Engineer so that these may be reviewed by the Structural Engineer and the necessary details provided.

#### **32.1 SEISMIC SUPPORTS FOR PIPEWORK, DUCTS, CABLE SUPPORTS AND EQUIPMENT**

Pipe work, ducts, cable supports and equipment should be braced to resist seismic loads suitable to the site and importance level of the building by a complete piping, ducting, cabling support system based on a seismic analysis where pipe work, ductwork, cable support system performance should be at least equal to that of the building structure under the earthquake loadings.

The following principles must be applied to the design of the support system to resist seismic loads on pipe work, ductwork, supports for cable and equipment:

- 1) Lateral supports are of sufficient stiffness to force piping to move with the immediate support structure.
- 2) Lateral supports are spaced to limit pipe deflections under resonating dynamic load such that pipe joints, ducts joints, cable and equipment supports and immediate vertical supports are not over stressed;
- 3) Lateral supports are ductile and fixings are designed over-strength
- 4) Stresses due to differential movements of building structures are minimized through the use of piping flexibility or clearances.



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All pipe work, duct work, cable and equipment support should be installed to remain functional when subjected to the seismic loads as specified in AS/NZ1170.

All pipe work, duct work, cable and equipment support should be designed to resist repeated forces due to seismic acceleration of 1g acting on the mass of pipe work, ductwork, cable and equipment support in any direction in addition to the gravity and force. Loads that are greater than NZS 170.5 should increase the support size. The pipe work, duct work, cable and equipment support are detailed for limited ductility and over strength is required in fixings to prevent brittle failure at loadings greater than design earthquake.

The pipe work, duct work, cable and equipment supports should have sufficient flexibility to prevent over stressing of pipes, hangers, and braces in an earthquake. Flexibility should be provided in the X, Y, and Z axes at structural separations.

### **33.0 EXHAUST & SUPPLY VENTILATION**

#### **33.1 FANS**

##### **33.1.1 GENERAL**

The Work shall consist of furnishing and installation of exhaust ventilation system as shown on the drawings and specified in this section.

##### **33.1.2 WALL MOUNTED EXHAUST FAN**

Wall mounted exhaust fan axial impellers shall be direct – driven by speed –controllable external rotor motors with integral thermal protection. The square plates shall be of ABS plastic and the impellers from powder coated, galvanised steel. Wall mounted exhaust air fan to be fitted with bird mesh prevents debris and birds entering building and interrupting operation.

##### **33.1.3 FANS MANUFACTURERS**

###### **Fantech Pty Ltd**

42 – 62 Pound Road West, Dandenong South, Victoria 3175, Australia

Telephone: +61 3 9554 7845

Fax: +61 3 9554 7833

Website: [www.fantech.com.au](http://www.fantech.com.au)

### **34.0 HVAC EQUIPMENTS**

#### **34.1 GENERAL**

All equipments which comprise the entire HVAC system shall be of approved make and shall meet specified performances, complete with interconnecting wiring and controls for fully automatic operation of the system. The capacities shall be as nominated on the equipment schedules attached. All appropriate safety devices shall be incorporated.

The Contractor shall include comprehensive data sheets for all items of equipment to be supplied with the tender submission.





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## **34.2 CONCEALED DUCTED TYPE FAN COIL UNITS**

### **34.3.1 GENERAL**

Furnish and install rigid smooth galvanised steel single skin fan coil units containing coils for refrigerant. These coils shall have capacities which shall not be less than those shown in the Equipment Schedule.

The manufacturer shall be Temperzone, Carrier or Daikin. Full technical data must be provided, including fan curves with plotted operating points.

### **34.3.2 COILS**

All coils shall be constructed from 13mm O.D. seamless copper tube mechanically expanded into aluminium fins and rigid galvanised steel frames.

Headers shall be non-ferrous metal complete with plain sweat connections.

Coil circuiting shall be selected to maximise usage of the available heat exchanger surface area with a maximum pressure drop of 45 kPa.

### **34.3.3 FANS**

Fans shall be selected for the lowest possible outlet velocity whilst remaining in the stable operating area of the fan curve.

Fans shall be of the double width double inlet forward curved centrifugal type.

Fans shall be constructed from galvanised steel with static and dynamically balanced, life lubricated bearings.

### **34.3.4 CONDENSATE DRAIN TRAY**

A sloping condensate drain tray shall be provided for positive draining of the unit.

All intermediate condensate drain trays will be marine grade aluminium.

### **34.3.5 INSULATION**

Insulation shall be 25mm or 50mm perforated foil faced. This shall be glued and pinned at not less than 450mm centres.

Insulation pins will be complete with not less than 40mm diameter retaining button.

### **34.3.6 QUICK RELEASE PANEL**

The units shall be fitted with access panels on both sides of the unit to facilitate easy access and cleaning of the condensate trays.

### **34.3.7 MOTOR**

All fan motors are to be internally mounted to prevent excessive motor breakout noise. Motors must have a minimum enclosure rating of IP55.



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All motors shall be inclusive of full 12 month warranty by the manufacturer. Any defects identified during the defects liability period shall be rectified by the manufacturer at no cost to the client.

The manufacturer must be able to provide spare parts and service nationally without the use of subcontractors.

#### **34.4 CEILING MOUNTED CASSETTE TYPE INDOOR UNITS**

These units shall be installed between the bottom of roof & top of false ceiling.

The maximum allowable height for the cassette type units shall be 300 mm.

The unit casing shall be Galvanized Steel Plate.

These units shall be insulated with sound absorbing thermal insulation material, Polyurethane foam. The noise level of unit at the highest operating level shall not exceed 35 dB (A), at a vertical distance of 1.5 m from the grille of the unit. The unit shall be supplied with suitable decorative panel.

These units shall be supplied with Resin Net filter with Mold Resistance. The filter shall be easy to remove, clean & re install.

#### **34.5 AIR COOLED CONDENSING UNITS (OUTDOOR UNITS)**

The outdoor units shall contain fans, condenser coils and compressors and shall be mounted on wall brackets securely fixed on wall with adequate service access as recommended by the manufacturer. The whole unit shall be treated for operation in a tropical marine climate. The units shall be complete with all necessary safety devices including pressure switches, fuses, crankcase heaters and over-current protection devices.

The unit casings shall have a polyester powder-coated finish. The unit shall be securely bolted to the wall brackets. All care is to be taken to preclude corrosion. All fastenings shall be stainless steel. Paint all exposed components including the mounting brackets with one coat of primer, one coat undercoat and two finish coats of semi-gloss enamel.

The compressors shall be high efficiency hermetic scroll type and equipped with inverter control capable of changing the speed in accordance with the load.

The condenser coils shall be fabricated from seamless copper tubes and anti-corrosion coated fins.

#### **34.6 THERMOSTAT**

Each indoor unit shall each be controlled by a combination ON/OFF switch and adjustable thermostat located 1.5 meters above finished floor level (AFFL) on the adjacent column or wall in the zone being served by the respective air conditioning units as indicated on the drawings. Positions of thermostats shall be shown on the shop drawings and to be confirmed by the Mechanical Contractor prior to final installation.

- All thermostats shall be the digital type with the following controls/visual display:
- On/Off switch
- Operation/ maintenance alarm LED indication.



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- Operation mode indication
- Fan Speed set point and indication
- Temperature set-point and indication
- Room temperature indication
- Louver settings
- Weekly timer
- Temperature setting adjustment (to be locked off after commissioning).

● The temperature settings shall be agreed with the client and pre-set at an agreed setting for daily operation. Once a pre-set temperature setting is agreed, the temperature setting shall be locked and any changes in temperature are to be made by authorised personnel.

● Samples of the proposed thermostats shall be provided for approval before ordering of equipment.

#### **34.7 CONDENSATE PIPE AND INSULATION**

PVC pipes & fittings shall be used for condensate from evaporator unit to drain point. The joints shall be properly sealed so that there is no water leakage. U-trap as required shall be provided at the end. Additional insulation drain tray shall be provided below the evaporator unit, if required.

Use insulation material with a minimum wall thickness of 25mm for polystyrene and 9mm for elastomeric insulation. Polystyrene should be faced with an appropriate vapour barrier such as Heavy Duty foil laminate or mastic coating. Where practical, install elastomeric insulation without slitting the tube. Where slitting is unavoidable, seal all joins with an adhesive recommended by the manufacturer.

#### **34.8 AIR CONDITIONING UNITS MANUFACTURER**

Daikin New Zealand Pty Ltd  
8 Crooks Road, East Tamaki, Auckland 2013  
Telephone: +649 5711108  
Website: [www.daikin.com.nz](http://www.daikin.com.nz)

The manufacturer shall inspect the final works, sign off and certify.

#### **35.0 HANGERS AND SUPPORTS**

The Work shall consist of furnishing and installation of all hangers and supports for mechanical piping, ductwork and equipment as indicated on the drawings and as specified in this section.

Provide factory fabricated vertical piping clamps to suit vertical piping systems and to exactly fit pipe size of bare pipe. Provide copperplated clamps for copper piping systems. Extension clamps shall be of carbon steel and shall be UL listed.

Provide factory fabricated horizontal piping/duct hangers and supports to suit horizontal piping systems. Use only one type by one manufacturer for each piping/duct service. Select size of hangers and supports to exactly fit pipe/duct size, and to exactly fit around piping/duct insulation with saddle or shield for insulated piping/duct. Provide copperplated hangers and supports for copper piping system.



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Hangers clamped directly to the pipe shall be insulated over the hanger; insulation shall be fully adhered to the hanger. In addition, hangers with double rods shall be insulated between the rods. All seams of the insulation shall be sealed with adhesive.

Insulated pipe supports shall be used at pipe hanger locations to prevent the insulation from compressing, shall be comprised of a load-bearing rigid foam insert (high-density urethane or equivalent) with elastomeric foam collars, and shall have a minimum compressive strength of 500 kPa.

### **35.1 CORROSION PROTECTION & PAINTING**

#### **35.1.1 GENERAL**

Make every reasonable attempt to limit corrosion. Contact between dissimilar metals shall be prevented using appropriate spacer material.

Pipe work shall not come in direct contact with concrete. Appropriate spacer material shall be used.

#### **35.1.2 BRACKETS AND BASE FITTINGS**

All brackets, supports and equipment bases outside the building shall be hot dip galvanised after fabrication.

All brackets, duct and pipe supports and equipment bases indoors shall be galvanised steel and painted to the standard described below.

#### **35.1.3 PAINTING**

The following items are to be paint finished:

All exposed condenser components, including bases.

All brackets, duct and pipe supports and equipment bases indoors.

Paint shall only be applied to surfaces thoroughly cleaned of dirt, rust, scale, verdigrease and the like.

#### **35.1.4 PAINTING OF FERROUS SURFACES**

The following procedures are to be adopted for painting of ferrous surfaces

Phosphate coat to BS 3189 Class B Inhibitive priming coat, red oxide/zinc chromate of minimum thickness 40 µm. One coat undercoat. Two finish coats semi-gloss enamel.

### **36.0 DUCTWORK AND COMPONENTS**

#### **36.1 VOLUME CONTROL DAMPERS – OPPOSED BLADE**

Provide dampers of single blade type or multiblade type, constructed in accordance with SMACNA - Low Pressure Duct Standards -with static pressure rating of minimum 50 Pascals.

Provide for each damper quadrant lock device on one end of shaft; and end bearing plate on other end for damper lengths over 300 mm. Provide extended quadrant locks and end extended bearing plates for externally insulated ductwork.



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### **36.2 DUCT ACCESS DOORS**

Provide where indicated, duct access doors of sizes indicated.

Construct of same or greater gage as ductwork served, provide insulated doors for insulated ductwork. Provide flush frames for un-insulated ductwork, extended frames for externally insulated duct. Provide one side hinged, otherwise with one handle-type latch for doors up to 300 mm high and smaller, 2 handle-type latches for larger doors.

### **36.3 FIRE DAMPERS**

Fire dampers of the thermally released or motorised type shall be manufactured and installed in accordance with AS 1682.1 – Fire Dampers, Part 1: Specification and AS 1682.2 – Fire Dampers, Part 2: Installation.

### **36.4 SPECIFICATIONS**

Fire dampers shall be interlocking blade, curtain type, conforming to the requirements of the Australian and N.Z. Building Code and shall be built to comply with construction details proven by prototype tests conducted in accordance with AS 30, AS 1682, or UL 555, to withstand exposure to controlled flame for no less than 4 hours before failure of the assembly as a whole, or any of its components and shall qualify for a 4 hour fire resistance rating, in terms of Australian Standard AS 1530, Part 4, fire resistance test of structures.

Fire dampers shall be equipped for either vertical or horizontal mounting and shall close by release of a fusible link at a temperature of 71°C.

“Safe Test” Test latches and access doors shall be provided for all fire dampers, so that they may be test operated at any time after installation without destroying fusible links and annually in accordance with AS 1851 - 2012 ( Section 13 ), Routine service of fire protection systems and equipment.

Fire dampers shall be installed in wall, or floor openings utilizing factory fitted galvanised steel mounting sleeves and angles, other materials and practices required to satisfy the Australian and N.Z. Building Code and AS 1682 Parts I & II and as shown in the manufacturers installation instructions.

### **36.5 RIGID SHEET METAL DUCTWORK**

#### **36.5.1 GENERAL**

Rigid duct sealing, construction and installation shall comply with AS 4254.2 – Duct work for air handling systems in buildings, Part 2: Rigid Duct.

Sheet metal ducts shall be fabricated out of galvanized steel sheets produced by Hot Dip Process.

All ducts shall be made and installed in workmanlike manner.

Ducts shall be wrapped with insulation outside with lapping joints completely sealed with aluminium duct tape. Internal duct liners shall not be allowed.



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Ducts shall be straight and smooth on the inside with neatly finished joints. All joints shall be made air tight.

All exposed ducts up to 600 mm width within conditioned spaces shall have slip joints - or flanged joints. The internal ends of slip joints shall be in the direction of air flow. Ducts and accessories within ceiling spaces, visible from air conditioned areas shall be provided with two coats of mat black finish paint.

Changes in dimensions and shape of ducts shall be gradual. Air-turns (Vanes) shall be installed in all bends and duct collars designed to permit the air to make the turn without appreciable turbulence.

All ducts shall be rigid and shall be adequately supported and braced where required with standing seams, tees, or angles, of ample size to keep the ducts true to shape and to prevent buckling, vibration or breathing.

All sheet metal connection, partitions and plenums required to confine the flow of air to and through the filters and fans shall be constructed of 18 gage galvanized steel sheet, thoroughly stiffened with 25 mm x 25 mm x 3 mm galvanized steel angle braces and fitted with all necessary inspection doors as required, to give access to all parts of the apparatus. Doors shall be as specified in the detail.

Plenums shall be panel type and assembled at site. Fixing of galvanized angle flanges on duct pieces shall be with rivets heads inside i.e. towards galvanized steel sheet and riveting shall be done from outside.

Self adhesive rubber lining minimum 5 mm thick instead of felt shall be used between duct flanges and between duct and duct supports in all ducting installation.

All duct work shall be independently supported from building construction. All horizontal ducts shall be rigidly and securely supported, in an approved manner, with trapeze hangers formed of galvanized steel rods and galvanized steel angle/channel under ducts as specified in the detail. All vertical duct work shall be supported by structural members on each floor slab. Duct supports may be through galvanized steel insert plates left in slab at the time of slab casting. Galvanized steel cleat with a hole for passing the hanger rods shall be welded to the plates. Trapeze hanger formed of galvanized steel rods and angles/ channels shall be hung through these cleats. Wherever use of metal insert plates is not feasible, duct support shall be through dash /anchor fastener driven into the concrete slab by electrically operated gun. Hanger rods shall then hang through the cleats.

Ducting over furred ceiling shall be supported from the slab above, or from beams. In no case shall any duct be supported from false ceiling hangers or be permitted to rest on false ceiling. All metal work in dead or furred down spaces shall be erected in time to occasion no delay to other vendor's work in the building.

Where ducts pass through brick or masonry openings, it shall be provided with 25 mm thick high quality expanded polystyrene around the duct and totally covered with fire sealant such as fire barrier mortar for complete sealing.

All ducts shall be totally free from vibration under all conditions of operation. Whenever duct work is connected to fans, air handling units or blower coil units that may cause vibration in the ducts, ducts shall be provided with a flexible connection, located at the unit discharge. Flexible connections shall be constructed of fire retarding flexible heavy canvas sleeve at least 100 mm long securely bonded and bolted on both sides. Sleeve shall be made smooth and the connecting duct work rigidly held by



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independent supports on both sides of the flexible connection. The flexible connection shall be suitable for pressure at the point of installation.

Duct shall not rest on false ceiling and shall be in level from bottom. Taper pieces shall taper from top.

## **36.6 DUCT LINER AND INSULATION**

### **36.6.1 DUCT LINER**

Duct liner material and installation shall comply in accordance to AS 4254.2: Ductwork for air handling systems in buildings, Part 2: Rigid Duct.

Duct liners shall have a smoke developed index not greater than '3' and spread of flame index not greater than '0' when separately tested in accordance with AS/NZS 1530.3: Methods for fire tests on building materials, components and structures.

The liner surface designated to be exposed shall face the airstream.

The liner shall be adequately retained within the duct.

The liner shall be neatly butted without gaps at transverse joints.

The liner shall be folded and compressed in the corners of rectangular duct sections or shall be cut and fitted to ensure butted edge overlapping. Longitudinal joints in duct liners shall not occur except at the corners of ducts unless the size of the duct and the standard liner's product dimensions make them necessary.

Interior widths of duct not exceeding 300 mm do not require mechanical fasteners in addition to corner angles and metal nosing.

Mechanical fasteners shall be located at 75 mm from transverse joints and at intervals not exceeding 300 mm with respect to interior dimensions and regardless of airflow direction.

Where the free edge method of internal insulation is applied, fixing pins shall support the edges spaced at 300 mm maximum centres parallel to the edge and within 50 mm of an end or 75 mm of a joint. Elsewhere, the insulation shall be fixed at 300 mm maximum centres with a minimum of one row per duct side.

Longitudinal joints in the insulation shall be covered by a 100 mm wide strip of facing material adhered centrally over the join.

Metal nosing that are either channel or Z profile or are integrally formed from the duct wall shall be securely installed over transversely oriented liner edges facing the airstream at fan discharge and at any interval of lined duct preceded by unlined duct.

Where the free edge method is used, the edges shall be prepared by removing sufficient insulation from the facing to allow a turn back of the facing under the insulation for a distance of not less than 75 mm without crushing the edges. The turn back shall be bonded to the insulation.

Where dampers, turning vane assemblies or other devices are placed inside lined duct or fittings, the installation shall not damage the liner or cause erosion of the liner. The use of metal hat sections is



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typical. The cavity formed between the hat section and the duct shall be filled with the specified insulation before attachment to the duct wall. The hat section shall be secured to the duct wall with bolts, screws, rivets or welds. Where thermal bridging is an anticipated problem special attention should be paid to materials and fixings.

The mechanical fastening devices shall be corrosion-resistant as the material of the main body, will not reduce the fire resistance classification of the liner, do not damage the liner when applied as recommended by the manufacturer of the duct, do not cause leakage in the duct, do not project more than 15 mm into the airstream, will indefinitely sustain a 23 kg tensile dead load test perpendicular to the duct wall, are the correct length for the specified liner thickness, and will not result in condensation on duct surfaces.

Internal facing materials shall have a heavy duty classification in accordance with AS/NZS 4200.1: Pliable building membranes and underlay.

### **36.6.2 DUCT INSULATION**

Duct insulation material and installation shall comply in accordance to AS 4254.2: Ductwork for air handling systems in buildings, Part 2: Rigid Duct.

Duct insulation shall have a smoke developed index not greater than '3' and spread of flame index not greater than '0' when separately tested in accordance with AS/NZS 1530.3: Methods for fire tests on building materials, components and structures.

Material for duct insulation shall be Cross linked polyethylene insulation having a low & stable 'K' value of 0.031 to 0.034 W/m-°K (at 0°C to 23°C) with bulk density of 28 +/- 4 kg/m<sup>3</sup>, fire retardant in self extinguishing non-dripping fire rating class – 1, negligible water vapour permeability having good zone resistance, non fibre erosion and should be CFC free.

Thickness of the insulation shall be as specified for the individual application. Each lot of insulation material delivered at site shall be accompanied with manufacturer's test certificate for thermal conductivity values, density, water vapour permeability and fire properties. Adhesive used for sealing the insulation shall be non-flammable, vapour proof adhesive strictly as per manufacturer's recommendations.

The insulation material shall be affixed to the surfaces of the duct in a manner that prevents cold bridging, maintains vapour barrier, does not compress the insulation to the point where thermal performance is affected, and ensures that the surface of the insulation is in contact with the duct surface.

### **36.7 DUCTWORK SUPPORTS**

Support all ducts by brackets or hangers from the building structure. All ductwork supports will be provided within this Contract to the relevant codes and standards. Supports are required at branches, corners and otherwise as specified in the standard. Use hangers constructed from a minimum of 10 mm threaded rod and 3 x 40 x 40 mm angle as a minimum for ductwork support. Ensure that duct supports shall not penetrate vapour seals.

### **36.8 FLEXIBLE CONNECTIONS**

Provide flexible duct connections wherever ductwork connects to vibration isolated equipment. Construct flexible connections of neoprene-coated flameproof fabric crimped into duct flanges for attachment to duct and equipment. Make airtight joint. Provide adequate joint flexibility to allow for





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thermal, axial, transverse, and torsional movement, and also capable of absorbing vibrations of connected equipment.

### **36.9 FLUSHING OF DUCTWORK**

Prior to balancing air distribution systems all ductwork is to be blown clear of all dust and debris.

### **36.10 DIFFUSERS, REGISTERS AND GRILLES**

Diffusers, registers and grilles shall be factory fabricated of aluminium, type and finish as shown on the drawings or as approved by the Engineer.

### **36.11 EGG CRATE GRILLS**

All squared lattice type fixed exhaust air grilles shall have an aluminium core of 13 mm x 13 mm squares in a 13 mm deep panel housed in a flanged grille frame of aluminium alloy sections, all finished in commercial grade powder or stoving enamel coating. Core style shall be 'straight' or '45° slant' as specified. Where perforated core grilles are specified, the core face shall be 1.0 mm galvanised steel with 4.76 mm diameter perforations at 6.35 mm centres in staggered pattern, housed in an aluminium frame. Where hinged filter return grilles are specified they shall be constructed as for the fixed grille, but shall have an additional aluminium sub-frame allowing the grille to be opened for access to the filter. The plastic framed washable panel filter with EU2 grade media shall be easily removable from the grille neck when unlatched. The hinged/removable grille shall be latched with a suitable fastener. Where grilles (registers) are fitted with opposed blade volume regulating dampers (OBD), the adjustment lever shall be accessible from the register face, or by opening the grille in hinged filter models.

### **36.12 INTAKE AIR LOUVERS**

Intake air louver shall be constructed of heavy gauge extruded aluminium louvers. Blades shall be of storm proof extruded aluminium with corners mitered and welded. Roof and curb caps shall be formed by heavy gauge aluminium and the assembly shall be braced by angular steel.

Provide bird screen, built-up curb and cleanable filters, where required. Size shall be as shown on the drawings.

### **36.13 AIR DISTRIBUTION DEVICES MANUFACTURERS**

#### **Holyoake**

95 Redwood Drive, Dingley, Victoria 3172, Australia

Telephone: +61 3 9551 5022

Fax: +61 3 9551 8414

Website: [www.holyoake.com](http://www.holyoake.com)

### **36.14 AIR FILTERS**

Air filters' filtration efficiency ratings shall comply with AS 1324 – Air filters for use in general ventilation and air conditioning, Part 1: Application, performance and construction; and Part 2: Methods of test; and AS 4260 – High efficiency particulate air (HEPA) filters – Classification, construction and performance.

Arrestance Filters (Coarse G Filters) shall have a filter class of G4 with average arrestance (gravimetric method) of synthetic dust of  $\leq 90A_m$ , and final pressure drop of 250 Pa.



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Efficiency Filters (Fine F Filters) shall have a filter class of F7 with minimum efficiency at 0.4  $\mu\text{m}$  of 35% and average particle size efficiency at 0.4  $\mu\text{m}$  of  $80\% \leq E_m < 90\%$  at final pressure drop of 450 Pa.

The design shall be appropriate to the classification such that the air filter will suit the installation where it is to be fitted. The design shall permit accessibility to the filter for maintenance and service in the field, with suitable drainage if applicable. The design shall be such that the filter is non-hazardous to personnel or deleterious to equipment.

Filters should be manufactured to comply with the standard size range that is accepted by the majority of manufacturers for that particular type of filter.

Subject to size criteria, filters (apart from fabric media) and frames shall be sufficiently structurally rigid to minimize distortion during handling, installation and use.

Packaging shall be adequate to protect the filter during normal storage, handling and shipping processes.

Filter components and frames shall be corrosion-protected or manufactured from non-corroding materials.

Filter frames shall be durable and dimensioned to provide an airtight fit with the enclosing ducting. All joints between filter segments and the enclosing ducting shall be fitted with a gasket or sealed to provide a positive seal against air leakage. A manometer is recommended to be installed across each filter.

Holding frames designed to hold separate integral cells shall have positive clamping to ensure that there can be no air bypass between cell and holding frame. Where holding frames are fixed together in multiples, these shall be sealed between each frame and the structural housing with an elastomeric or non-hardening mastic sealant.

Pressure drop manometers for both air filters shall be installed for monitoring purposes.

### **36.15 AIR FILTERS MANUFACTURERS**

#### **Airepure**

64 Geddes Street, Mulgrave, Victoria 3170, Australia

Telephone: +61 3 9562 0011

Fax: +61 3 9562 1177

Website: [www.airepure.com.au](http://www.airepure.com.au) .

### **36.16 SEALING OF DUCTWORK PENETRATIONS**

All sealing of all penetrations through the structure for fire rating and smoke control and for prevention of sound break out shall be completed by the Mechanical Services Contractor.

Gaps around ductwork shall be grouted up by the Building Contractor to limit the clearance to 5 mm before final sealing is carried out.



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For sound control the gap around the duct shall be sealed with AHI noise stop fibreglass on the low noise level side and non-hardening silicone mastic on the high noise level side.

For fire rating the gap shall be filled totally with Hilti intumescent sealant to full depth.

### **36.17 BUILDING WORKS, PENETRATIONS, MAKING GOOD**

The Contractor shall provide construction drawings for prior approvals showing all locations where penetrations and other changes to the building are proposed. Details of each such location such as penetration size and purpose shall be indicated.

The drawings supplied with this specification are diagrammatic only and the Contractor shall check all details on site including locations of all equipment and any building work requirements.

The Contractor shall provide sleeving for all penetrations. Where service pipes, ducts or cables are passing through fire rated structures, these shall be installed as per fire protection standards. Sleeving and sealing of the penetration with fire rated material shall be the responsibility of the Contractor.

All penetrations shall be covered with escutcheon plates, flush mounted to give a clean, neat appearance.

### **37.0 IDENTIFICATION AND LABELLING**

All equipment including plant, fittings and pipe work shall be labelled with Traffolite labels with 5mm High Lettering. The numbering shall follow a logical and systematic pattern. The physical labelling shall correspond exactly to that which is indicated on the Engineering Drawings.

The identification and colour coding of plant and pipe work shall follow NZS 5807.

### **38.0 DEFECTS LIABILITY**

The Mechanical Services contractor shall be responsible for providing maintenance services for a period of 12 months from the date of practical completion of the Whole Contract Works.

A maintenance services programme based on the equipment manufacturer's recommendations shall be submitted as part of the tender offer. This program shall include a description of the work to be carried out and include sample reports.

The maintenance services shall include replacing or repairing any faulty equipment or materials, or the results of incompetent workmanship, free of charge. The contractor shall submit maintenance reports (minimum monthly) with copies to the client and engineer. All maintenance works must be signed off on site by the client's representative.

A copy of the manufacturer's warranty shall be provided with close-out documentation and included with the operation and maintenance manuals.

The Supplier shall maintain a service organization with adequate spare parts. Any defects that render the system inoperative shall be repaired within 24 hours of the Client notifying the Contractor.



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### **39.0 TESTING AND COMMISSIONING**

The Contractor shall test and commission all the systems and equipment and submit the testing and commissioning report as part of the O&M manuals. Proper, detailed records shall be kept of the testing and commissioning process and these shall be submitted as part of the documentation set. Supply a programme identifying each and every commissioning test. Air and Water systems shall be commissioned within +/- 5% of design specifications.

Supply for approval full details of how the commissioning of each system will be achieved so as to comply with the specified requirements. Information required includes method of measurements, test data record sheets, performance curves and details of instruments. Details shall be submitted at least 2 weeks prior to the start the commissioning.

Allow for provision of all the necessary gauge connections, duct penetrations, thermometer pockets, probe fittings and measuring equipment as necessary for the proposed method of commissioning.

It may be necessary to allow for fittings and measuring equipment additional to those specified as part of the completed systems. Ensure all measuring equipment is accurately calibrated to the satisfaction of the Services Engineer and where appropriate used only by suitably skilled personnel.

### **40.0 CLIENT INSTRUCTION**

Following the completion of the commissioning process, the Contractor shall TRAIN and instruct the Client's representatives, engineers and operators, in the correct, efficient and safe operation and servicing of plant. During this instruction the Contractor shall also explain the content of the as built drawings as well as use of the Operating and Service Manuals.

This instruction shall be carried out by a competent and experienced engineer experienced in this work.

The Training shall include all necessary demonstrations and explanations of the correct sequence of operation and function of the complete system under both automatic and manual control and a description of the actions to be taken in the event of a system fault occurring.

This service shall be provided during normal working hours, before a Certificate of Practical Completion is issued.

## **41 DOCUMENTATION REQUIRED**

### **41.1 SHOP DRAWINGS**

The Mechanical Services Contractor shall provide shop drawings of all mechanical services for approval before commencement of work on site. The drawings are to be a minimum scale of 1:100 for floor plans and 1:50 for sections and plant layouts.

3 copies of shop drawings shall be submitted to the engineer for approval 2 weeks before work is due to commence on site. The drawings shall be reviewed by the Services Engineer and any changes required shall be carried out by the Mechanical Contractor until the drawings have been approved for construction.

Fans - Show general arrangement, weights, principal dimensions, service requirements and space and access for service for all plant.



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Pipework, Ductwork and Fittings - Detail the layout of all pipe work, ductwork and wiring for mechanical services. Include such details as insulation and vapour seals, levels and grades, hangers, hanger brackets, anchors, access doors, volume control dampers, etc, including provision for seismic restraint, vibration isolation, co-ordination and terminal connections to plant and to any existing services. For ductwork include also thickness of sheet metal together with details of joints, assembly of duct sections bracing and reinforcing.

In all cases, shop drawings for pipe work and ductwork are to include sufficient detail to demonstrate compliance with the specified standards.

#### **41.2 AS-BUILT DOCUMENTATION**

The Contractor shall supply As-Built Engineering Drawings of all equipment supplied, including equipment layout on floor plans and/or reflected ceiling plans, detailed engineering drawings showing the ductwork and air-conditioning unit installation details showing dampers, connection points, plenums etc. The drawings supplied shall all the details for both the new units required by this specification as well as the existing units installed.

Detailed manuals for the equipment supplied shall be provided. These manuals shall be in English and contain detailed engineering specifications, operation and maintenance information.

Three full copies of all drawings and manuals are to be supplied. All documentation shall be marked up to show as built status.

The practical completion certificate will not be issued until as built documentation is approved.

#### **42.0 SCHEDULE OF EQUIPMENTS, UNIT RATES & PRICES**

##### **42.1 SCHEDULE OF EQUIPMENTS**

Where a selection of equipment and plant has been made by the Services Engineer for a particular manufacturer or type, the tender shall be based on that selection.

Where equipment has not been selected by the Services Engineer, and a performance specification given instead, the Tenderer shall complete and submit a Schedule of Performance of Specified Equipment, complete with required duties

#### **43 TENDER COMPLIANCE**

All tenders submitted shall be fully compliant with no tags, exclusions, counter-offers or any deviations from the requirement of the specifications and drawings. Alternative sales agreements or upfront payment requirements shall be considered non-compliant. The tender shall state explicitly that their tender is fully compliant.

Alternative, non-complying tenders may be submitted providing detailed information on alternative offering or any deviations. Alternative offers shall be submitted, clearly marked, in separate sealed envelopes. The Superintendents Representative - Services shall reserve the right to reject such non complying tenders.

Strict conformance to this specification is required to ensure that the installed system will function as designed, and will accommodate the future requirements and operations of the Client. All specified operational features must be met without exception.

The equipment to be supplied will be considered only if it meets all sections of the technical specifications. Any deviations of system performance outlined in this specification will only be considered when the following requirements have been met:

43.1. A complete description of proposed alternate system performance methods with three (3) copies of working drawings thereof for approval by the Superintendent, Superintendents Representative -Architect/Services, to be submitted with the tender.



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43.2. The Contractor shall submit a point-by-point statement of compliance for all sections (including sub-sections); in this specification to ascertain that the tender is a fully complying one. The statement of compliance shall consist of a list of all paragraphs within each section of this specification. Each clause shall be answered with one of the following statements:

Response	Definition
Fully Complies	The equipment/system/installation methodology complies fully in all respects with the specification clause.
Partially Complies	The equipment/system/installation methodology offered does not comply fully but offers most or a substantial part of the requirements of the particular clause.
Does Not Comply	The equipment/system/installation methodology offered provides none of the requirements of the particular clause.
Understood and Accepted	The Contractor understands and accepts the conditions imposed by the particular clause and as such is fully included in the tender.
Not Accepted	The Contractor does not accept the condition imposed by the particular clause and as such is not included in the tender. The Contractor shall state as to why this requirement has not been accepted.
Submitted Herewith	The Contractor has submitted the information, material or sample as required by that particular clause.

Where the tender bid does not comply with the paragraph as written and the Contractor feels the proposed system will accomplish the intent of the paragraph, a full description of the function as well as a full narrative description of how its proposal will meet its intent shall be provided.

**Any submission that does not include a point-by-point statement of compliance as described herein may be subject to disqualification.**

**The Superintendent and the Superintendents Representative - Services shall reserve the right to reject any such non-complying tenders.**



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#### 44.0 TENDER FORM

NAME OF COMPANY

TENDERING I/We \_\_\_\_\_

ADDRESS OF

COMPANY TENDERING Of \_\_\_\_\_

Do hereby agree to supply, construct, install, test, commission and maintain during the warranty period and carry out the whole of the works as specified in this specification and its associated engineering drawings.

We hereby confirm that our tender is fully compliant with all requirements of this specification, drawings, engineering standards and relevant regulatory authority regulations.

For the fixed, lump sum price, inclusive of all duties, fees and taxes in Fiji dollars

Amount in words \_\_\_\_\_

\_\_\_\_\_

Amount in F\$ \_\_\_\_\_

Authorised Signatories \_\_\_\_\_

Name of Signatories \_\_\_\_\_

Dated this \_\_\_\_\_ day of \_\_\_\_\_, year \_\_\_\_\_.