



Mechanical Services Specification

Kondinin CRC Upgrade
Lot 263, 49 Gordon Street, Kondinin
AZ17029

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Prepared for
Kondinin CRC Committee & Shire

17 July 2017

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Contact Information

Alphazeta Group Pty Ltd
ABN 95 130 835 479

Suite 22, Level 10
68 St Georges Terrace
Perth WA 6000

PO Box Z5483
Perth WA 6831

Telephone: +61 8 6311 5577

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Table of Contents

Certificate of Design Compliance		
PART A PROJECT SPECIFIC REQUIREMENTS		4
A1 PROJECT OVERVIEW		4
A1.1	Introduction	4
A1.2	Project description	4
A1.3	Project Team	4
A1.4	General scope of works	4
PART B PROJECT TECHNICAL REQUIREMENTS		10
B1 MECHANICAL PLANT AND EQUIPMENT		10
B1.1	High wall type DX split air conditioners	10
B1.2	Filters	11
B1.3	Fans	11
B1.4	Ductwork and fittings	11
B1.5	Balancing dampers	13
B1.6	Grilles and diffusers	14
B1.7	Pipework	14
B1.8	Ductwork insulation	16
B1.9	Electrical	19
B1.10	Controls	20
B2 ACOUSTICS AND VIBRATION		21
B2.1	General	21
B3 TESTING AND COMMISSIONING		22
B3.1	General	22
B3.2	Close control air conditioning units	22
B3.3	Plant items	22
B3.4	Air system	22
B3.5	Controls and electrical	23
PART C TENDER SCHEDULES		24
C1 TENDER SUBMISSION		24
C2 SCHEDULE OF PRICES FOR MECHANICAL SERVICES		25
C3 DETAILED COST SCHEDULES		26
C3.1	Itemised schedule of prices for mechanical services	26
C4 TENDER FORM – SCHEDULE OF RATES		27
C4.1	Schedule of unit rates	27
C4.2	Schedule of unit labour rates for site work	28
C5 ALTERNATIVE SUBMISSIONS FOR MECHANICAL SERVICES		28

PART A PROJECT SPECIFIC REQUIREMENTS

Certificate of Design Compliance
APPROVED

Building Surveyor: John Greenwood

Western Australian Building Act, 2019

A1 Project Overview

A1.1 Introduction

This specification outlines the scope of mechanical works, and details of the quality of the materials and installation. This specification shall be read in conjunction with the associated drawings. The following definitions shall apply to this specification

Project Manager:	The Client's appointed representative
Consultant:	Alphazeta Group Pty Ltd
Builder:	Client's appointed head contractor and builder
Mechanical Contractor:	The successful mechanical contractor that shall be responsible for undertaking the works defined within this specification and associated drawings. The mechanical contractor shall adhere to the project program and is to allow for all works and overtime required to complete the project within the allocated time frame.

A1.2 Project description

This document is the Mechanical Services specification for the proposed upgrade of the Kondinin CRC located at Kondinin WA.

Mechanical services includes the design and provision of all mechanical systems, including, air conditioning to all occupied areas, toilet exhaust ventilation and other general ventilation.

A1.3 Project Team

Role	Company	Contact	Phone Number
Architect	Rosalie Pech Eva Architect	Rosalie Pech Eva	0429 421 287
Mechanical	Alphazeta Group	Jittu George	08 6311 5577
Electrical	Alphazeta Group	Ivy Feng Guan	08 6311 5577
Hydraulic	Alphazeta Group	Rachael McGowan	08 6311 5577

A1.4 General scope of works

The works required for this project and as detailed on the drawings and specified within this document comprise of the provision and installation of the following.

- Preparation of workshop/fabrication drawings
- Air conditioning and ventilation as shown on the drawings and as scheduled
- Fans
- Sheet metal ductwork
- Flexible ductwork
- Refrigerant pipe work
- Condensate pipe work
- Acoustic and thermal insulation

- Air grilles
- Weatherproof louvres (to be installed by the builder)
- Dampers and air balancing equipment
- Hanging apparatus and associated items
- Electrical cabling and fittings
- Controls cabling and devices
- Production of As-built drawings and Operation and Maintenance Manuals.
- Defects and maintenance period.
- Testing and commissioning of all systems.
- Training to the client for all systems.
- Two off post completion visits for fine tuning. Allow two technicians for two hours each

A1.4.1 Drawings

The drawings relevant to this project that outline the detailed scope of works are as follows.

AZ16053-M00 Cover sheet, Legend, Details and General Notes.

AZ16053-M01 Air conditioning and Ventilation Layout - Ground floor plan

Layouts on the drawings shall be taken as accurate for tender purposes, however final locations shall be checked on site prior to installation. The mechanical contractor shall review all structural details as well as architectural elevations and sections to confirm locations of AC units, ductwork, grilles, access panels and wall mounted controllers.

The mechanical contractor is to advise the engineer at the time of tender any discrepancies between the drawings and the specification. In addition to this, unless a written confirmation is received, the contractor shall allow within their tender price the greater cost between the drawings and the specification.

The mechanical contractor shall provide all labour, plant and materials to complete the works and shall include all work obviously required to complete the project in accordance with the building code of Australia and other relevant Australian Standards.

The works shall be co-ordinated by the mechanical contractor with the builder and all other trades.

All rooms with supply air shall be provided with return air grilles, or a return air path even if this is not shown on the drawings.

A1.4.2 Design

All designs shall be in accordance with the NCC (formerly the BCA), including section J for energy.

Air conditioning heat loads shall be calculated using Hourly Analysis Program (HAP) software.

Ventilation shall be calculated in accordance with AS 1668.2, 1991.

All designs and installations shall comply with AS 1668.1, 1998 and AS 3666.

A1.4.3 Acoustics

All designs shall meet the requirements of the acoustic section of this specification.

A1.4.4 Air conditioning

Multi-purpose room and kitchen shall be provided with wall mounted split air conditioning systems capable of cooling each space (excluding store rooms, toilets and change rooms). Flex duct shall not exceed 3m in length.

A1.4.5 Exhaust ventilation

A toilet exhaust system shall be provided to each male and female toilets and changeroom facilities. The exhaust system shall be calculated based on AS 1668.2. Fan shall be complete with VSD drive for balancing purposes.

A1.4.6 Electrical

Local power isolators shall be provided by the electrical trade to all Air-conditioner units. Termination from the local power isolators to the AC units shall be by the mechanical trade.

All other mechanical plant items shall be fed by the Main Switchboard and shall be undertaken as part of the mechanical scope of works.

A1.4.7 Works by others

The following works shall be provided by other trades or the client.

- Provision of access panels within ceiling.
- Handling ceiling tiles.
- Normal making good after the installation of the services (where the services are installed to the program).
- Cut out of any penetration.
- Installation of weatherproof louvers.
- Boxing out of plant items or ductwork.
- Provision of local power isolators adjacent to all mechanical plant items. Power cabling and termination between the isolators and the plant items shall be provided by the mechanical trade. It shall be the responsibility of the mechanical trade to co-ordinate the location and size of isolators and power supplies for the mechanical plant, with the electrical trade.
- Provision of tundishes. All condensate drainage pipes from the wall mounted units to the tundish shall be by the hydraulic contractor. It shall be the responsibility of the mechanical trade to co-ordinate all the mechanical components requiring condensate drainage with the hydraulics trade. All condensate drainage pipework indicated on Hydraulic drawings.

A1.4.8 Design conditions

The installation of air conditioning shall be based on the following internal and external design conditions.

Outdoor Conditions:

36.6°CDB, 22.4°CWB

Indoor Conditions for all areas:

Summer 22.5°C ± 1.5°C, 50% RH ± 10%

Winter 21°C ± 1.5°C, 50% RH ± 10%

A1.4.9 Samples

Samples of the following items shall be issued to the design team prior to purchase of the items.

- Grilles
- Temperature sensor

A1.4.10 Alternatives

Tender submissions shall be provided based on this specification and shall not be based on alternatives to the specification.

If alternatives are to be submitted at time of tender, details must be provided in order for the consultant to review the alternative. Prices including alternatives to the specification shall be issued as an attachment to the base tender.

It shall be the responsibility of the mechanical services contractor to ensure that all alternatives meet the required duties and capacities of plant items (for example, if alternate selections are required, they shall be made by the mechanical services contractor and shall meet the quality and functional requirements of this specification).

A1.4.11 Installation quality and condition of materials

The installation shall be of good workmanship and shall be completed by suitable qualified personnel. The installation shall comply with the relevant Australian Standards, council and government regulations and manufacturer's recommendations and requirements. All sub quality installations shall be corrected by the mechanical contractor as soon as practical.

Where grilles provide vision to ceiling voids, all visible in ceiling items shall be painted black, unless where codes and requirements restrict this.

The locations shown for grilles diffusers, plant items and ductwork are indicative. Actual location may differ by up to 2000mm. The contractor is to liaise with the other trades and builder and to review the architectural drawings prior to the final installation.

Where the installation is to be completed in an area that is under the control of a base building owner, the installation shall comply with all the requirements of the building fitout guide and the requirements of the building management.

All materials shall be ordered with sufficient time for installation within the project program. No additional costs or alternatives of equipment will be accepted based on the specified equipment not being available due to not being ordered with sufficient time to meet the suppliers advised lead times. Should more expensive freight (ie air freight) be required to have the equipment delivered in time for installation to the program, then that cost shall be included in the tender value.

It is the responsibility of the mechanical contractor to gain the current lead times on all equipment at the time of being awarded the project. Any issues associated with the lead times, at the commencement of the project, shall be brought to the attention of the consultant.

The mechanical contractor is directly responsible for the insurances and OHS of their employees and sub-contractors. All employees and subcontractors shall adhere to the requirements of Workcover and shall be qualified with a Worksafe WA General induction for Construction Work – White Card. The White Cards are to be available upon request at all times.

All employees and sub-contractors are to complete the site specific induction course provided by the builder prior to commencing work on the project.

A1.4.12 Workshop drawings

At a minimum of 2 weeks prior to commencement of site works the mechanical contractor shall produce and submit to the consultant for approval workshop drawings. Work shop drawings shall be produced in CAD format and shall be at a minimum equal in quality to the design drawings.

Workshop drawings shall show co-ordinated locations of all plant items ductwork, grilles, sensors and other associated items. Workshop drawings shall show co-ordination with items such as structure (including penetration requirements), ceilings, lights, sprinklers, cable trays, pipe work etc.

Approval of workshop drawings is for the purpose of noting the co-ordination process is being performed and does not relieve the contractor from following the requirements of the design layouts and specification.

A1.4.13 Training of the end user

The mechanical contractor shall allow to complete all training necessary for the client to effectively use all aspects of the installation. The mechanical contractor shall allow to return to site after the client has occupied the project to answer questions and provide additional explanation of systems, and additional training as necessary.

A1.4.14 Rubbish removal

The mechanical contractor shall remove all rubbish and packaging associated with the mechanical materials and installation during the project. At practical completion, all components of the installation shall be clean and in a correct and working order to the satisfaction of the builder and consulting engineer.

A1.4.15 Operation and maintenance manuals and as built drawings

The mechanical contractor shall complete operation and maintenance manuals and as built drawings. These shall be available three weeks from practical completion of the project and will be required for final payment. Three copies of the maintenance manuals and as built drawings shall be submitted once the initial set have been approved by the Engineer.

(a) Operation and maintenance manual

The operation and maintenance manuals shall be bound, A4 in size and include the following.

- Front cover with details of the project, the mechanical contractor company details including a contact number for after hours and emergency maintenance.
- Table of contents
- An outline of the project and the mechanical systems installed.
- Manufacturer's details of all plant items and materials provided.
 - Technical information for all plant items and controls items provided.
 - Detailed description on how to operate the systems provided
 - All maintenance details for systems provided, including a maintenance schedule detailing monthly, quarterly, six monthly and yearly maintenance requirements.
 - Air and water balance data.
 - As built drawings in hard copy and in on CD in AutoCAD format.

(b) As built drawings

As built drawings shall be completed at the end of the project and shall specifically include the following as a minimum:

- Be submitted in both AutoCAD and PDF versions.
- Be of the same size as the design drawings and at a minimum equal in quality to the design drawings.
- Have the mechanical contractors details, client name, project name and address on the title block
- All components of the installation that have changed during the installation shall be modified on the drawings. This shall include all additions, relocations, deletions and substitutes.
- All schedules of plant items and grilles shall be provided.
- Air and water balance figures shall be shown, or a document containing these shall be referenced.

A1.4.16 Maintenance, warranty and defects liability period

Included in this project shall be 52 weeks of preventative maintenance. Plant items shall be checked and maintained as to the manufacturer's recommendations. Filters shall be cleaned or replaced when required every 6 months. Provide within the tender, 2 number of filter changes for each wall mounted units.

The warranty and defects liability period for the general installation shall be 52 weeks, except for specific items that are stipulated otherwise. The warranty and defects period shall commence from the date of practical completion

A1.4.17 Refrigerant

System refrigerant volumes shall not exceed the quantities detailed in AS 1677 as required for the volumes of the rooms they are serving.

Refrigerants shall have zero Ozone Depletion Potential (ODP) and a global warming potential (GWP) of under 2000.

The mechanical services contractor shall provide within this tender additional refrigerant to all systems where the provided refrigerant charge is lower than what is required for installed system. The additional refrigerant shall be provided to meet the requirements of the manufacturer's details.

A1.4.18 Codes and standards

The mechanical installation shall be completed in accordance with the current version of the following relevant Standards

- The Building Code of Australia
- AS 1668 The use of ventilation and air conditioning in buildings

- Part 2 Mechanical ventilation acceptable indoor-air quality

- AS 4254 Ductwork for air-handling systems in buildings
- AS 1677 Refrigerating systems

Building Surveyor: John C. Swanwick

- Part 1 Refrigerant classification

- Part 2 Safety requirements for fixed applications

- AS 1571 Copper-seamless tubes for air conditioning and refrigeration
- AS 1324 Air filters for use in general ventilation and air conditioning
 - Part 1 Application, performance and construction
 - Part 2 Methods of test
- AS 1432-2004 Copper tubes for plumbing, gasfitting and drainage applications
- AS 4041 Pressure piping
- HB 40.1 The Australian Refrigeration and Air-conditioning Code of Good Practice
 - Part 1 Reduction of emissions of fluorocarbon refrigerants in commercial and industrial refrigeration and air-conditioning applications
 - Part 2 Reduction of emissions of fluorocarbons in residential air-conditioning applications
 - Part 3 Reduction of emissions of fluorocarbons in domestic refrigeration applications
- AS 3000 Wiring rules
- AS 3008 Electrical Installation-selection of cables
 - Part 1.1 Cables for alternating voltages up to and including 0.6/1 kV-Typical Australian installation conditions.
- AS 5601 Gas Installations
- AS 2053 Non-metal conduits and fittings
- Workplace health and safety act and regulations

The installation is also to be completed to maintain the other standards outlined within other sections of this specification.

Works shall also be carried out in accordance with any local statutory requirements.

PART B PROJECT TECHNICAL REQUIREMENTS

B1 Mechanical Plant and Equipment

B1.1 High wall type DX split air conditioners

Each air conditioning system shall consist of an outdoor air-cooled condensing unit coupled to an indoor direct expansion fan coil unit, which is equipped with its own individual fan speed and thermostatic control. The capacity of each air conditioning system should not be less than the specified equipment schedule.

B1.1.1 Air cooled condensing unit

The air-cooled condensing unit shall be a factory-assembled unit housed in a sturdy weatherproof casing constructed from rustproof mild steel panels coated with an epoxy powder coating. The condensing unit should be constructed to be compact and light for easy transportation and installation. The noise level shall not be more than 56dBA measured horizontal 1m away and 1.5 m above ground. The condensing unit shall be designed to operate safely when connected to the fan coil unit and shall have the following components.

B1.1.2 Compressor assembly

The compressor shall be a high efficient sealed rotary type with an internal induction motor, and hermetically sealed in a strong metal casing. The compressor should have high EER value. It shall be mounted on vibration isolators to minimize vibration and noise. The compressor assembly shall have low operating noise level and shall be equipped with a complete set of safety devices, including built-in thermal protector and over current relay.

B1.1.3 Condenser assembly

The air-cooled condenser coil shall be constructed with Hi-X copper tubes, mechanically bonded to aluminium fins. The Condenser Coil shall have large heat exchange area for effective heat transfer and to minimize fan noise for a high EER value. The condenser coil shall come with anti-corrosion treatment, with factory immersed, chemically coated P.E. fins. The anti-corrosion treatment shall be suitable to resist salt or acid rain effects with a coating thickness between 2.0 to 3.0 microns.

B1.1.4 Condenser fan and motor assembly

The condenser fans shall be propeller type running at low speed and low noise, and made of pre-moulded polypropylene. The condenser fans shall be dynamically and statically balanced for minimum noise and vibration. The condenser fans shall be directly coupled to an outdoor induction type motor having low power consumption and shall be designed to discharge warm air horizontally which allows installation of condensing units side by side with a distance of 200 mm between them.

B1.1.5 Accumulator

The cylindrical accumulator shall be constructed from mild steel plates pressed into shape. The accumulator shall have sufficient capacity to prevent any liquid refrigerant from flowing back into the compressor suction.

B1.1.6 Refrigerant flow control

The refrigerant flow control shall be of the capillary tube type, with the capacity designed for each individual fan coil unit, by the same manufacturer.

B1.1.7 DX fan coil unit

Each fan coil unit shall be wall mounted or the ceiling cassette type, housed in a stylish cabinet constructed from pre-moulded thermoplastic. Each fan coil unit shall be equipped with a self-diagnostic feature on the controller. The controller shall be either wireless or wired model.

B1.1.8 Cross fin evaporator

The cross-fin evaporator coil shall be constructed from strong clean Hi-X copper tubes mechanically bonded to aluminum fins. The face velocity of the coil shall be exceptionally low to ensure quiet operation and prevent moisture carry-over.

B1.1.9 Evaporator fan and motor

The evaporator fan shall be of the multi-blade centrifugal type, with its length designed to match the evaporator coil width. The fan shall be moulded out of a thermosetting plastic and should be statically and dynamically balanced to ensure low noise and vibration free operations. It shall be driven by a 5-speed motor, mounted after downstream to the evaporator to enable a draw-through air distribution.

B1.1.10 Filters

The air filters made of washable polypropylene and shall be mounted at the return side of the fan coil unit. The removal of the filter shall be accomplished without the need of any tool.

The filter option shall include either the Mould-proofed or the Bacteriostatic, Virustatic & Deodorising type.

B1.1.11 Drain pans

The drain pan shall be made from preformed polystyrene foam, shaped to ensure proper drainage and thermal insulation. It should have an outlet for connection to a plastic drain hose.

B1.2 Filters**B1.2.1 Electrostatic air filters**

High wall mount units, ceiling mounted cassettes, under ceiling suspended units, wall mounted console units, bulkhead mounted units and low static ducted units under 200 l/s shall be provided with electrostatic air filters.

Media shall be air induced electrostatic fibre. Frames shall be galvanised steel. Filters shall have a minimum arrestance efficiency of 72% and an original pressure drop of 13pa @1.5 m/s. Media shall washable.

B1.3 Fans**B1.3.1 In line centrifugal****(a) Construction**

Fan housing shall be manufactured from galvanised steel and be complete with modern flanged connections.

Fan impellers shall be backward curved centrifugal type.

(b) Motors

Fans shall be supplied with direct-driven external rotor or standard TE motors as nominated. Electricity supply shall be single or three-phase as nominated. Bearings shall be sealed-for-life ball type.

(c) Testing

All fans shall be fully tested to BS848:Part 1, 1980 for air flow and BS848:Part 2, 1985 for noise.

B1.4 Ductwork and fittings**B1.4.1 General**

The assembled duct system shall have a smoke development index no greater than '3' and spread of flame index no greater than '0' when separately tested in accordance with AS 1530.3. The assembled duct system shall pass the UL 181 burning test. If any specified items within this specification conflicts with the above noted smoke development index, flame index or burning test the mechanical trade shall use an alternate product that does meet the above noted requirements and inform the mechanical consultant.

Ductwork dimensions provided on drawings are for airway sizes.

At the time of handover all ductwork shall be adequately cleaned and shall be free from oil, duct, dirt, rust, moisture, drilling swarf and free of damage or dints.

B1.4.2 Standard rectangular sheet metal ductwork

Standard sheet metal ductwork shall be manufactured and installed to meet the requirements of AS4254-2002.

Sheet metal thicknesses and reinforcement ratings for standard concealed rectangular ductwork shall be at a minimum as follows. Thicknesses are for uncoated sheet steel.

Maximum duct lengths between joints or reinforcements shall be 1500mm

- Ducts with sides from 50mm up to 500mm 0.6mm steel, J1 Reinforcement
- Ducts with sides from 501mm up to 750mm 0.6mm steel, J3 Reinforcement
- Ducts with sides from 751mm up to 1000mm 1.0mm steel, J5 Reinforcement

Maximum duct lengths between joints or reinforcements shall be 1200mm

- Ducts with sides from 1001mm up to 1200mm 1.0mm steel, J6 Reinforcement
- Ducts with sides from 1201mm up to 1500mm 1.2mm steel, J8 Reinforcement
- Ducts with sides from 1501mm up to 1750mm 1.6mm steel, J9 Reinforcement

Maximum duct lengths between joints or reinforcements shall be 750mm

- Ducts with sides from 1751mm up to 2000mm 1.0mm steel, J10 Reinforcement
- Ducts with sides from 2001mm up to 2400mm 1.2mm steel, J11 Reinforcement
- Ducts with sides from 2401mm up to 3000mm 1.0mm steel, J8 Reinforcement and tie rod

Fittings shall be reinforced similarly to sections of straight duct.

Alternatives for sheet metal size, thickness and reinforcement shall be considered. Alternatives shall be submitted as per clause 1.7 of this specification. Where ductwork pressures exceed 750pa, sheet metal thicknesses and reinforcements shall be provided to meet the requirements of AS4254-2002.

Ductwork shall be prime quality lock forming galvanised steel, grade G2 to AS 2338 with Z275 coating to AS 1397.

All transverse joints, longitudinal seams and duct penetrations shall be sealed. Bullock Ductseal SB or an approved equivalent shall be used. All flange joints shall be sealed with Gasket seals. Bullock TDF flange tape or an approved equivalent shall be used. All sealing products shall have a smoke development index no greater than '3' and spread of flame index no greater than '0' when separately tested in accordance with AS 1530.3. All sealing products shall pass the UL 181 burning test. Prior to applying sealants, ductwork shall be adequately cleaned and shall be free from oil, dust, dirt, rust, moisture, drilling swarf and any other substance that could inhibit bonding.

Ductwork height to width (and vice versa) ratio shall not exceed 4:1.

Tie rods shall be provided as needed as per AS4254-2002.

Ductwork with both widths and heights below 500mm shall use slide drive slip flanges.

All ductwork with dimensions exceeding 300mm shall be beaded or cross broken.

All branch take offs shall be radius elbow type or shoe type. All branch take offs shall be complete with opposed blade volume control dampers. Stream splitters are to be avoided due to turbulence.

All bends shall be radius type unless restrictions do not permit for their use. If square bends are to be used, turning vanes shall be provided.

All offsets and transitions shall be manufactured to meet the requirements of AS4254-2002.

Ductwork access panels shall be provided to access any fire dampers.

B1.4.3 Flexible ductwork

Flexible ductwork shall be manufactured and installed to meet the requirements of AS4254-2002. Ductwork shall achieve a zero for spread of flame, smoke deviation, heat transmission and ignitability indices when tested in accordance with AS1530.3.

Uninsulated flexible ductwork shall be constructed from an aluminium/polyester laminate outer with a spring wire helix bonded to the outer with a solvent based adhesive. Duct shall be Bradflo AAL of approved equivalent.

Insulated ductwork shall be constructed from an aluminium polyester film laminated core with a mechanical spring wire helix and solvent based adhesive. R 1.0 glasswool insulation shall surround the core with an outer sleeve made from an aluminium/polyester laminate. Duct shall be Bradflo AIS_F or approved equivalent.

No single piece of ductwork shall exceed 6m in length. No ductwork shall exceed 10m in length. Any ductwork that exceeds 6m in length shall consist of two joined lengths of duct. Duct joiner shall be a minimum of 1m in length and shall be the same internal diameter as the flexible duct. Duct joiner shall have insulation equivalent to flexible ductwork.

Flexible ductwork shall join to rigid duct and grilles at a circular or oval spigot. Spigots shall be a minimum length of 100mm length and complete with a beaded collar. All flexible duct joiners shall be complete with beaded collars. Ductwork shall be fastener behind the joiner or spigot collar with a worm drive type collar strap. Integrity of vapour seal of flexible ductwork shall be retained by sealing all ends of flexible duct with 50mm wide duct tape. Tape and straps shall meet the requirements of AS4254-2002.

Flexible ductwork shall not be squashed by greater than 25% of it's diameter. If flexible ductwork requires to be squashed over 25% it shall be replaced with a rigid duct to pass through the tight area. Rigid ductwork shall have the same cross sectional area as the un-squashed flexible ductwork and its height to width (and vice versa) ratio shall not exceed 4:1.

Any ductwork with holes in it shall be replaced prior to handover. Repairing holes is unacceptable.

B1.4.4 Hanging of ductwork

Hanging of rigid and flexible duct shall meet the requirements of AS4254-2002. Supports shall be fastened to slab soffits or structural elements. Supports shall not be fastened to or hung from other services, or sarking mesh. Structural approval shall be maintained from structural engineer prior to penetrating slabs or structural elements. Adhesive supports are not acceptable.

Hanging straps sizes, booker rod sizes, strap separation etc shall be taken from the appropriate tables in AS4254-2002.

Flexible duct sag, bend radius etc shall meet the requirements of AS4254-2002. Note that flexible ductwork shall not be laid on ceiling structure, it must be hung from above.

Booker rods shall be coated in rust inhibitor when cut.

B1.4.5 Drip trays

Drip trays shall be made from 0.6mm 316 stainless steel or 0.6mm copper. Tray sides shall be riveted and soldered in order to form water tight seams. Trays shall be graded in order to eliminate water pooling in the tray. A copper drain pipe shall be provided. Trays shall not be mounted from AC units or any other service item. Trays must be suspended from the slab soffit or roof structure.

B1.5 Balancing dampers

B1.5.1 General

Balancing dampers shall be provided at all branches, intakes, supply air spigots concealed behind t-bar ceilings and cushion head boxes connected to ductwork concealed behind fixed ceiling or any other location shown on drawings.

B1.5.2 Circular dampers

Dampers within spigots or circular ductwork shall be butterfly type and shall be constructed out of 1.6mm sheet steel c/w with axle, adjusting rod and lock nut.

B1.5.3 Non-return dampers

Dampers shall be of the parallel blade action type, Bullock 3100 series of approved equivalent. Dampers shall be manufactured from 316 Stainless steel or 6065T-3 aluminium.

B1.6 Grilles and diffusers**B1.6.1** General Certificate of Design Compliance

All grilles and diffusers (supply and return) unless noted otherwise shall be complete with internally insulated cushion head box's. Box's shall be sized to suit the neck dimensions of the grille /diffuser as nominated within the grille schedule, as well as the connecting duct dimensions.

Internal insulation shall be 25mm rockwool with perforated isolation as detailed in the insulation section of this specification.

Unless noted otherwise all cushion head box's being served by ductwork concealed behind fixed ceilings shall be complete with butterfly damper at the inlet spigot, damper adjusting strings and tie off rod.

All cushion head boxes shall be sealed to air terminals with gasket seal. Tech screws or rivets shall be used to fix cushion head boxes to air terminals.

B1.6.2 Egg crate grilles

Egg crate grilles shall be of size as scheduled in mechanical services documents. Grilles shall be flush mount for fixed ceilings and lay in type for t-bar ceilings. Grilles shall be air grilles EG-5 type or prior approved equivalent. Grilles flange shall be extruded aluminium construction with core made from aluminium and shall be finished with powder coat to match the scheduled details. Grille shall be 85% free area minimum.

B1.6.3 External louvers

Weather proof louvers shall be sized to suit the Architect's requirements. Louvers shall be flanged or channel edged. Louvers shall be Air Grilles OAL-75 type or prior approved equivalent. Louver flange and frame shall be colourbond while blades shall be extruded aluminium construction. Louvers shall be finished with powder coat to match the scheduled details.

B1.7 Pipework**B1.7.1** General

Supply and install all items required to complete the system even if not noted on the drawings or in this specification. System shall include but not be limited to, copper, insulation, valves, vents, strainers, make-up, overflow, expansion tanks, test points, etc

Pipework shall be provided from the following materials:

Condensate pipework Copper pipework, type B to AS 1432

Refrigerant pipework Hard drawn Copper pipework, type B to AS 1432

Pipework routes shown on drawings are for diagrammatic purposes. Prior to installing pipework, all routes shall be site measured and shown on workshop drawings for the design team approval. Pipework shall follow the lines of walls and beams unless specifically noted otherwise.

Pipework shall be graded in order to allow for draining and venting. Pipework shall run a minimum of 40mm away (including insulation) from walls, structure and other services to ensure easy access to all sides of the pipe. Where non permanent fittings are provided clearance shall allow the removal of these fittings without disturbing other services.

B1.7.2 Preparation

All pipework shall be new and undamaged. Pipework shall be stored in a dry and dust free area.

Prior to erecting, all pipework lengths shall be cleaned, have their ends reamed and have burs shall be removed from inside and outside.

All pipework lengths shall be capped at their ends at the end of a day's work to ensure that they are vermin free and when exposed to a dusty or harmful environment to ensure they are internally clean from harmful material or product.

B1.7.3 Joints

Permanent joints shall be brazed joints only. Brazed fittings shall be socket type fittings. For sockets under 30mm (NB) on site forming with a socket forming tool is acceptable. For pipework over 30mm (NB) pre-fabricated fittings shall be used.

Brazing shall be silver-copper-phosphorous type. Prior to brazing, fittings and pipe shall be cleaned internally and externally to remove any grime oil or oxidation, and a suitable flux shall be applied to the surfaces.

For non-permanent fittings, used where plant items or other devices are to be removable joints shall be flanged type for all pipe sizes, or screwed type. For pipework 50mm (NB) and below or flared type for fittings 20mm (NB) or below. Flared fittings shall not be used in vibrating pipes.

Reducers shall be eccentric type with the flat section of the fitting located at the high side of the pipe to eliminate air pockets.

Converging junctions shall be single plane 45-degree type. Double plane junctions shall not be used. Radius bends shall be sized with the centre radius of the bend no less than three times the pipe diameter.

B1.7.4 Penetrations

Sleeves shall be provide for all pipework penetrations. Fire collars shall be provided for all penetrations through fire partitions. Escutcheon plates shall be provided for all visible penetrations.

Where pipework penetrates through fire partitions, pipe insulation shall be trimmed to suit the requirements of the installed fire collar. For all other penetrations, pipe insulation shall run continuous through the penetration.

B1.7.5 Supports and expansion

Supports and anchors shall be provided so as to ensure that all pipework as well as fittings and devices are adequately secured. Supports shall be galvanised mild steel, "Unistrut" or prior approved equivalent sized to suit the load requirements of the system without exceeding the support manufacturers recommended loads.

Fixings to the building structure shall be arranged so that they do not weaken the structure.

Clips shall be provided around pipework for fixing to the supports.

Supports shall be provided to ensure that pipe vibration is not transferred into the building structure. Suitable spring mounts shall be provided to eliminate vibration from the structure. The first three hangers from plant items such as packaged air conditioners or pumps shall be anti-vibration type.

All pipework shall be supported at intervals shown below.

Pipe Size mm (NB)	Mounting Intervals mm	
	Horizontal	Vertical
15	1200	1800
20	1200	1800
25	1800	2400
32	1800	3000
40	1800	3000
50	2400	3000
65	2400	4000
80	2400	4000
90	3000	4000
100	3000	4000
125	3500	4000
150	3500	4000

Booker rods and bolts shall be galvanised mild steel with the following minimum rod diameters

Pipe size mm (NB)**Rod diameter mm**

Up to 50

8

65 to 90

10

100 to 150

12

Pipework shall be laid out suitable to allow for expansion and contraction. Provide expansion loops, bellows joints or sliding joints in the system to ensure that the effects of expansion and contraction does not stress the pipework or its supports. Bellows and sliding joints shall only be used if they are rated to meet the working pressure of the system. Provide rolling supports in the system where necessary.

B1.7.6 Flexible connections

Flexible connections shall be proprietary reinforced rubber type with flanged ends. Flexible connections shall not be used on water cooled packaged air conditioners.

Balancing Valves

Balancing valves shall be "Tour and Anderson" make or prior approved equivalent. Valves shall be selected to suit the system working pressure and sized to suit the pipe diameters and water flow rates.

Balancing valves shall be capable of water shut off (isolation) and temperature and pressure testing.

B1.7.7 Isolation valves

Isolation valves shall be "Zetco" ball type or prior approved equivalent selected to meet the working pressure of the system and sized to suit the pipe diameter and water flow.

B1.7.8 Copper refrigeration pipework

Pipework shall be provided to suit the requirements of the pipework clauses within this specification. Pipework shall also meet the requirements of AS 1677 and AS1571.

B1.8 Ductwork insulation**B1.8.1 General**

Unless noted otherwise on design drawings, all ductwork used for carrying conditioned air shall be insulated.

Ductwork within 3m of any fan shall be internally insulated with minimum 25mm or 50mm thick insulation as noted on services drawings.

Thermal insulation shall be either internal or external as per the drawings with R ratings as per the following.

Location of Ductwork	Minimum insulation R-Value
Within a conditioned space	1.2
Where exposed to direct sunlight	3.0
All other locations	2.0

The above are minimum insulation requirements required by the BCA. Acoustic treatment may require additional insulation. Refer to drawings for details.

Both internal and external insulation shall be non-combustible. When tested in accordance with AS 1530.1 and AS1530.3, both insulation, it's adhesives and other fixings shall have indices which do not exceed the following:

Spread of Flame	0
Ignitibility	0
Heat Evolved	0
Smoke Developed	3

Where insulation changes from internal to external, the external insulation shall overlap the internal section by 300mm minimum.

B1.8.2 Ductwork internal insulation

Internal insulation shall be either glasswool fibre bonded with thermosetting resin or rockwool fibre bonded with thermosetting resin. Insulation shall be bio-soluble. Insulation shall be R1 minimum, unless noted otherwise on the drawings.

Insulation shall be factory faced with fire retardant perforated foil sisolation 450p or approved equivalent.

Prior to insulating ductwork ensure all ductwork surfaces, all sheets of insulation and all bonding materials are dry and clean.

All insulation edges shall be tightly butted together to prevent heat leakage.

Insulation shall be held to the ductwork by the means angles at the corners of the ductwork. Along the surface of the duct pins and clips shall be provided. Pins shall be spot welded to ductwork. Pins shall be provided at 300mm intervals at a minimum. Where two pieces of insulation are joined, the pieces shall be tightly butted together and a metal strip with turned down edges shall be overlay the butt joint. Metal strip shall be fastened to the corner angles with pins or rivets.

At the ends of each section of ductwork the insulation shall be fastened with an end channel. The internal edge of the channel shall be turned down and the channel shall be fixed with either pins or rivets.

Each completed length of ductwork shall be cleaned, with drill swarf removed. Ductwork lengths shall be stored in a dry undercover area with their ends sealed with plastic prior to erecting.

For joining flanges in the metal use Foster 32-14 or 32-50 high velocity sealant.

B1.8.3 Heating water pipework insulation

Heating water pipework insulation shall be glasswool fibre bonded with thermosetting resin. Insulation shall be bio-soluble.

Insulation shall be non-combustible. When tested in accordance with AS 1530.1 and AS1530.3, insulation, it's adhesives facings and other fixings shall have indices which do not exceed the following:

- Spread of Flame 0
- Ignitibility 0
- Heat Evolved 0
- Smoke Developed 3

Insulation resistance shall be as follows:

Climate Zone 1,2,3 and 5 and system less than 65kW_r:

- Internally located R1.0
- Within a wall space, an enclosed sub-floor area or an enclosed roof space R1.1
- Outside the building or in an unenclosed sub-floor area or an unenclosed roof space R1.2

Climate 5 and system more than 65kW_r:

- Internally located R1.0
- Within a wall space, an enclosed sub-floor area or an enclosed roof space R1.1
- Outside the building or in an unenclosed sub-floor area or an unenclosed roof space R1.2

Insulation shall be factory faced with fire retardant perforated foil sisolation 450 or approved equivalent.

Prior to insulating pipework ensure all pipe surfaces, all lengths of insulation and all bonding materials are dry and clean.

All insulation butt joints and longitudinal joints shall be tightly butted together to prevent heat leakage.

All joints shall be sealed with pressure sensitive foil tape to ensure the integrity of the vapour barrier. 100mm wide foil tape shall overlap vapour barrier longitudinal and but joint edges by 50mm (each way and at tape ends).

For other installation guidelines refer to the TICA insulation design guideline.

B1.8.4 Sheathing

Pipework running external to a building or within plant rooms or within areas accessible to the public shall be provided with metal sheathing. Metal sheathing shall be provided as well as vapour seal. Sheathing shall be one of the following materials:

For external pipework provide 316 sheet stainless steel 0.5mm min.

For internal pipework provide patented Galvabond (or approved equivalent) sheet galvanised steel 0.6mm min

Metal sheathing shall have a minimum 25mm overlap and shall be sealed with external silicon sealant. Laps shall be located on the side of the pipework with laps pointing to the ground to allow for water shedding. Sheathing shall be fastened with 15mm min wide straps with M5 galvanised or stainless steel nuts and bolts or a prior approved fixing method.

B1.8.5 Refrigeration pipework insulation

Refrigerant pipework insulation shall be provided to all refrigerant pipework. Refrigerant pipework insulation shall be a closed cell nitrile rubber insulation equivalent to "Armacell, FR/Armaflex"

Insulation on refrigerant pipework for refrigerant of not more than 20°C;

Pipe Size	15-40mm	50-80mm	100-150mm	200mm
R-Value	1.3	1.7	2.0	2.7

Climate Zone 5 and system less than 65kW_r:

Insulation on refrigerant pipework for refrigerant of more than 2°C but not more than 20°C;

- Internally located R1.0
- Within a wall space, an enclosed sub-floor area or an enclosed roof space R1.1
- Outside the building or in an unenclosed sub-floor area or an unenclosed roof space R1.2

Climate Zone 5 and system more than 65kW_r but not more than 250kW_r

Insulation on refrigerant pipework for refrigerant of more than 2°C but not more than 20°C;

- Located Internally R1.7
- Within a wall space, an enclosed sub-floor area or an enclosed roof space R1.8
- Outside the building or in an unenclosed sub-floor area or an unenclosed roof space R1.9

Insulation shall be non-combustible. When tested in accordance with AS 1530.1 and AS1530.3, insulation, it's adhesives facings and other fixings shall have indices which do not exceed the following:

- Spread of Flame 0
- Smoke Developed 3

Ensure all pipe surfaces, all lengths of insulation and all bonding materials are dry and clean.

All insulation butt joints and longitudinal joints shall be tightly butted together to prevent heat leakage.

All joints shall be sealed with pressure sensitive foil tape to ensure the integrity of the vapour barrier. 50mm wide foil tape shall overlap vapour barrier longitudinal and but joint edges by 50mm (each way and at tape ends).

When installed external, house pipework under a colorbond top hat section, or equivalent trunking.

B1.8.6 Condensate drainage insulation

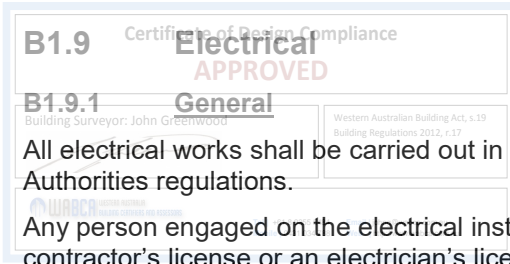
For copper condensate pipework, all pipe shall be insulated with fire retardant closed cell foam with longitudinal joints and but joints sealed with 25mm cloth reinforced tape

For PVC condensate pipework the first 3m of pipework shall be insulated with fire retardant closed cell foam with longitudinal joints and but joints sealed with 25mm cloth reinforced tape.

Insulation on condensate pipework for condensate of not more than 120°C;

Pipe Size	15-40mm	50-80mm	100-150mm	200mm
-----------	---------	---------	-----------	-------

R-Value 1.0 1.0 1.3 1.3



B1.9.2 Local isolators

Local power isolators shall be provided adjacent to all plant items. Essential services isolators shall be pad-locked in the "on" position.

B1.9.3 Wiring

(a) *General*

Wiring shall be rated to suit the respective load circuit. All wiring and cabling shall comprise copper multi-stranded conductors.

Wiring shall be continuous. The use of connectors for joining of cables is not acceptable.

Cable sizes shall comply with the current carrying capacity requirements of AS 3000 and the maximum voltage drop allowed between the board and any item of equipment shall be in accordance with AS 3000 (maximum volt drop not to exceed 7 volts). The minimum size conductors shall be 2.5mm² for power and 1.5mm² for control, except where twisted shielded cable is used.

Where essential services are being powered, MIMS cabling or Radox power cabling shall be used. Cables shall be sized suitable to suit the plant item.

In general all wiring shall be concealed within ceiling spaces and wall cavities, unless ceilings are not present. In cases such as plantrooms, storerooms, etc, without ceilings, wiring shall run exposed.

Cables shall be run with the required segregation to ensure no interference.

B1.9.4 Conduits

(a) *General*

In general conduits shall be UVPC and shall be mechanically secured to any fittings boards or plant items they enter

Where conduit is located in plantrooms, or in any area where they may possibly be exposed to damage, the conduit shall be galvanised steel.

(b) *2.18.5.2 standard conduit*

Conduits shall be minimum 20mm diameter socket fitted type UVPC. Conduits shall be connected to each other using the manufacturers recommended method.

(c) *2.18.5.4 flexible conduit*

Flexible conduit shall be PVC type fitted with manufacturers recommended glands. Where final connections to equipment may be subject to mechanical damage FGS Sealflex shall be used.

(d) *Provision of wiring and mounting*

Wiring types, mounting and sheathing shall be provided as follows:

(e) *Ceiling spaces*

Power Wiring : TPI in UPVC conduit or steel cable duct or TPS run as open wiring.

Control Wiring : TPI in UPVC conduit or steel cable duct or TPS run as open wiring.

Communication Wiring: Krone (or approved equal) in UPVC conduit.

Contact Inputs/outputs : Twisted shielded cable run as open wiring.

Analogue Inputs/Outputs : Twisted shielded cable run as open wiring.

(f) **Plantroom**

Power Wiring : TPS on cable tray.

Control Wiring : TPS on cable tray.

Communication Wiring: Krone (or approved equal) in UPVC conduit.

Contact Inputs/Outputs : Twisted shielded cable in UPVC conduit, steel cable tray or steel cable duct.

Analog Inputs/Outputs : Twisted shielded cable in UPVC conduit, steel cable tray or steel cable duct.

(g) **Earthing**

A complete earthing system shall be installed for the works and shall incorporate the following:

Equipotential bonding conductors of minimal resistance and size as per AS 3000

Metallic water piping to be bonded at all the location of entry and exit to the building

Communications TRC (Telecommunications Reference Conductor)

Earth connections to be provided to all outlets (including lighting), appliances, metallic luminaries, switchboards, metallic enclosures, cable trays.

B1.10 **Controls**

B1.10.1 **General**

The mechanical services installation shall be complete with a full electronic controls system capable of providing all necessary controls to the systems.

Controls shall be provided to the following systems:

- Air conditioning system
- Toilet exhaust systems
- Car park exhaust systems
- Kitchen exhaust systems
- Heating system

B1.10.2 **Toilet exhaust system**

(a) **General**

Fans shall operate through an on/off switch interlocked with the light switch within each toilet and change room.

B2 Acoustics and Vibration



All plant items, equipment and materials shall be provided and installed in a manner to provide a quiet and vibration free system. The installation shall be installed in order to meet the recommended noise levels of AS 2107 (2000).

Unless noted otherwise in this specification or on design drawings, the following points shall be adhered to or provided in order to reduce noise levels.

- General ventilation ducts not to exceed 5 m/s air velocity
- Ductwork within 3m of any fan shall be minimum 25mm internally insulated
- Pipework water flows not to exceed 2.4m/s water velocity
- Pipework bends shall be long radius type
- All ceiling mounted in line fans shall be wrapped with 6 kg/m² "Wavebar" by "Pyrotek" or approved equivalent. Wrap shall overlap ductwork by 300mm on intake and discharge
- Acoustic seals shall be provided wherever pipe and duct penetrates walls

Unless noted otherwise in this specification or on design drawings, the following points shall be adhered to or provided in order to reduce vibration:

- All fans and pumps shall be factory statically and dynamically balanced.
- All condensers shall be provided with anti vibration mounts. 10kW and below shall be provided with waffle pad type while above 10kW shall have spring mounts
- Where ductwork is connected to any fan or fan coil, flexible duct connectors shall be provided. Bullock flexible fan connector or approved equivalent shall be used
- Expansion loops and bends shall be provided to take up vibration in pipework

B3 Testing and Commissioning

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B3.1 **General**

Building Surveyor: John Greenwood

Western Australian Building Act, s.19

All items of the mechanical system shall be tested and commissioned. Minimum two weeks prior to practical completion of the mechanical works or a stage of mechanical works, the mechanical services contractor shall submit to the project manager, consultant and head contractor a list of commissioning items along with processes for commissioning and blank data sheets for the recording of commissioning results and a program for the commissioning.

At the completion of the commissioning all test results shall be forwarded to the consultant for their approval of the results. Mechanical contractor shall remain available on site for adjusting of the system to the consultants requirements until the commissioning has been approved.

If necessary the consultant shall inspect the system along with the mechanical contractor and their certified balancing specialist.

Commissioning shall include, but not be limited to:

- System checks of all plant items including capacity checks.
- Electrical and controls checks to all plant items DB's and control items.

B3.2 Close control air conditioning units

Close control air conditioning units shall be commissioned by the unit supplier's technicians. The suppliers commissioning sheets shall be submitted to the consultant along with other commissioning data.

B3.3 Plant items

B3.3.1 Operation tests

All plant items shall be tested. Fans and pumps shall be tested to ensure impeller direction is correct and that motors are free running,

Fans and pumps shall be tested for excessive vibration. If plant item is found to have excessive vibration, the impeller shall be re balanced, statically and dynamically, or the bearings, shaft, or plant in whole shall be replaced.

All plant items shall be run for a minimum of 12 hours. Any faults in this time shall be rectified. After rectification the specific plant item shall be run for another 12 hours.

For all refrigeration systems, suction and discharge pressures shall be checked and recorded. High pressure safety switches shall be checked by removing method of heat rejection (isolate condenser fan, run PAC without condenser water etc). Test the operation of reversing valves on reverse cycle units, by switching between heating and cooling. Check to ensure refrigerant levels are sufficient. Refer to manufacturer's literature for refrigerant volume requirements.


B3.4 Air system

All air flow rates and air velocities for exhaust air devices shall be measured and recorded. Air flow rates shall be balanced to within 10% greater and 0% less than the design air flow figures. Figures outside these parameters shall be rejected as unacceptable and the mechanical services contractor shall be responsible for rectifying the system in order to achieve the design flow rates within the pre-determined program time frame. It is the responsibility of the mechanical services contractor to ensure all balancing devices are accessible for adjusting at the time of the air balance and for future adjustments.

Air balance tests shall be undertaken and recorded by an accredited, certified air balance technician. All equipment used for reading air flows, velocities, pressures, temperatures etc shall have been calibrated within 4 weeks of the air balance. A certificate of calibration including the date of calibration shall be provided to the consultant with the final air flow figures.

Branches of ductwork shall be balanced through the branch volume control dampers. Ductwork velocities shall be checked with pitot flow tubes. Air grilles shall be trim balanced with the adjusting of local butterfly or opposed blade dampers. Air flows/velocities shall be recorded with an anemometer or hood device.

Air balance results sheets shall have individual corresponding numbers for each grille, duct or louver required to be read or balanced. These numbers shall correspond to individual numbered grilles, ducts or louvers on the as installed services drawing. Provide the following information for each grille, duct or louvre.

APPROVED	
<ul style="list-style-type: none"> • Design air flow 	Building Surveyor: John Greenwood <small>Western Australian Building Act, s.19 Building Regulations 2012, r.17</small>
<ul style="list-style-type: none"> • Design Velocity 	
<ul style="list-style-type: none"> • Actual air flow 	 <small>WABCA Western Australian Building Commission</small> Phone: 08 9252 5484 Email: jgreen@wabca.com.au Fax: 08 9252 5488 Web: http://www.wabca.com.au
<ul style="list-style-type: none"> • Actual Velocity 	

- Duct/grille dimensions (where pitot tubes are used)

B3.5 Controls and electrical

All items of the electrical and controls system shall be tested and commissioned.

Where tests and checks are undertaken, record the results and issue these to the consultant prior to practical completion. Where applicable the following tests shall be undertaken:

- For all plant items, check that the supply voltage meets the manufacturers requirements.
- For all electric motors (fans, pumps, compressors etc.) check that the current draw does not exceed the manufacturer's specification.
- Check that all interlocks are operating correctly.
- Check that all overrides are operating correctly.
- Check that fan motors are wired for correct rotational direction.
- Check that all thermostats are wired correctly.
- Check that all thermostats are calling for cooling where required (for this check, it must be shown that the controls strategy, as detailed in the controls section of this specification, is being adhered to).
- Check that all indication lamps are operating as required.
- Check that all time clocks are operating correctly.
- Check that all staged start-ups are operating correctly.
- Check that all automatic switching between duty and standby systems is working correctly.

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WA Building Certifiers & Assessors - Job No. J005433

PART C TENDER SCHEDULES

C1 Tender Submission



Tender for the Supply, Delivery, Installation, Testing & Maintenance of Mechanical Services.

I/We _____

Hereby tender for the supply, installation, testing and maintenance of all work exactly in accordance with Alphazeta Group Pty Ltd Specification, Reference AZ17029_MSPEC

LUMP SUM TENDER PRICE FIXED TO _____ (DATE)

(in words)

_____ \$ _____

*Certificate of Design Compliance 11 January 2018
WA Building Certifiers & Assessors - Job No. J005433*

Tenderer: _____

Signature: _____

Dated: _____

Witness: _____

C2 Schedule of Prices for Mechanical Services

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For the supply, installation, testing and maintenance exactly in accordance with Alphazeta Group Pty Limited drawings and specification, Reference AZ17029_MSPEC

Building Regulations 2012, r.17

Description	Fixed Lump Sum Tender
Preparation of Operation and Maintenance Manuals	\$
Mechanical Services Costs	\$
Preventative Maintenance Service	\$
Other	\$
PC Sum	N/A
Sub-total:	\$
10% GST:	\$
TOTAL:	\$

Tenderer: _____

Signed: _____

Dated: _____

Witness: _____

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WA Building Certifiers & Assessors - Job No. J005433

C3 Detailed cost schedules

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C3.1 Itemised schedule of prices for mechanical services

Building Surveyor: John Greenwood

Western Australian Building Act, s.19

For the supply, installation, testing and maintenance in accordance with Alphazeta Group Pty Limited drawings and specification.

Description	Cost
Decommission and removal of existing AC units	\$
Provision of Shop drawings in accordance to details as specified in specification	\$
Supply and installation of wall mounted split AC systems specified on drawings and specification	\$
Supply, installation and testing of toilet exhaust air fans with related controller, rigid/flexible ductwork as specified on drawings and specification	\$
Testing of existing AC unit serving the bar area	\$
Air balancing	\$
Controls	\$
Condensate drain Pipe work	\$
Ductwork & Fittings	\$
Modifications to existing systems	\$
Electrics	\$
Operation & Maintenance Manuals	\$
As-Built drawings	\$
Commissioning	\$
Sub-total:	\$
	10% GST: \$
	TOTAL: \$

C4 Tender Form – Schedule of Rates

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The following rates will be used to price approved variations, and shall include all costs, profit and GST associated with the design, supply, installation, testing and commissioning, and defects liability associated with such works. The rates shall allow for all materials, workshop drawing alterations, labour, tools, painting, appliances etc.

Should the Tenderer require differing rates for variation additions as distinct from variation omissions or reductions or differing rates during the various phases of the construction and defect liability period, then those additional rates shall be provided in addition to the following:

C4.1 Schedule of unit rates

The following prices shall be for providing and fitting sheetmetal ductwork on a cost/sqm basis, to the specification and complete with flanges, stiffeners and including sales tax, overhead, profit and amendment and re-submittal of shop drawings.

Description	Rate
Ductwork	
0-300 girth	\$
325-950 girth	\$
1000- 1900 girth	\$
Spiro flex up to 450mm diameter/ meter length	\$
Insulation	
Cost per sqm to insulate ductwork as per specification	\$
42mm Internal	\$
50mm Internal	\$
	\$
Pipework	
Cost per m to supply and install copper Min. type B pipe work as per specification	\$
25mm diameter	\$
32mm diameter	\$
General	
Supply and installation of 200x200 egg crate grilles for the toilets	\$
Miscellaneous	\$

C4.2 Schedule of unit labour rates for site work

Trade Certificate of Design Compliance APPROVED		Normal Time \$ per Hour	Out of Hours \$ per Hour
Sheetmetal Worker	Western Australian Building Act, s.19 Building Regulations 2017, r.17	\$	\$
Plumber		\$	\$
Insulation Applier		\$	\$
Balancing and Commissioning Technician		\$	\$
Superintendent		\$	\$

The above rates should not include site allowances, travel time or other special allowances. The rates should reflect the cost of labour which is employed full-time on the site.

C5 Alternative Submissions for Mechanical Services

Alternative Submissions

List alternative submissions below, together with the individual price adjustment to the base lump sum tender price and the individual time adjustment to the time required to complete the contract.

Submit full technical data for each substituted item of equipment.

Alternative Item	Adjustment to fixed Lump Sum Tender (+) or (-) \$	Time Adjustment (+) or (-) Days
1.		
2.		
3.		

Certificate of Design Compliance 11 January 2018
WA Building Certifiers & Assessors - Job No. J005433

Tenderer: _____

Signed: _____

Dated: _____

Witness: _____