

HIGH COURT OF AUSTRALIA

SECURITY OFFICE RELOCATION

MECHANICAL SERVICES

TENDER ISSUE

DRAWING LIST

M1000	COVER SHEET
M1001	LEGEND
M1002	STANDARD DETAILS AND EQUIPMENT SCHEDULES
M2000	DEMOLITION LAYOUT
M2100	AIR CONDITIONING AND VENTILATION LAYOUT
M6000	CONTROL SCHEMATIC

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HIGH COURT OF AUSTRALIA
SECURITY OFFICE RELOCATION

DRAWING TITL

MECHANICAL SERVICES COVER SHEET

A1

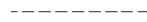
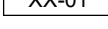
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177025	M1000	A	

MECHANICAL LEGEND

GENERAL ABBREVIATIONS

AE	EXISTING
AF	AIR FILTER
AP	ACCESS PANEL
ATT	ATTENUATOR
ATU	AIR TREATMENT UNIT
CA	CLEAN AIR
CC	COOLING COIL
CE	CARPARK EXHAUST
CHWP	CHILLED WATER PUMP
CV	CONTROL VALVE
CHWP	CHEMICAL WATER PUMP
DA	DIRECT ACTING
EA	EXHAUST AIR
EX	EXTERNAL INSULATION
FA	FROM ABOVE
FCL	FAN COIL UNIT
FD	FIRE DAMPER
FIP	FIRE INDICATOR PANEL
FR	FIRE RATED
FW	FLOOR WASTE
HC	HEATING COIL
HE	HAZARDOUS EXHAUST
HWP	HEATING WATER PUMP
I	INTERNALLY LINED
KE	KITCHEN EXHAUST
MA	MAKE-UP AIR
MCD	MOTOR CONTROL CENTER
MOT	MOTORIZED DAMPER
NC	NORMALLY CLOSED
NO	NORMALLY OPEN
NRD	NO RETURN DAMPER
OA	OUTSIDE AIR
OAL	OUTSIDE AIR LOUVER
ODD	OPPOSITE SIDE DAMPER
OR	OVERPRESSURISATION
RA	RETURN AIR
SA	SUPPLY AIR
SD	SMOKE DAMPER
SE	SMOKE EXHAUST
SP	SET POINT
SPL	SPLIT AIR
TB	TO BELOW
TA	TRANSFER AIR
TDR	TIME DELAY RELAY
TE	TOILET EXHAUST
TS	TIME SWITCH
VAV	VARIABLE AIR VOLUME
VCD	VOLUME CONTROL DAMPER

GENERAL SYMBOLS

	EXISTING ITEM / EQUIPMENT TO REMAIN
	EXISTING ITEM / EQUIPMENT TO BE REMOVED
	EXISTING ITEM / EQUIPMENT TO BE RELOCATED TO POSITION SHOWN
	MOTOR CONTROL CENTRE (MCC)
	TEMPERATURE SENSOR
	RELATIVE HUMIDITY SENSOR
	CEILING ACCESS PANEL (BY OTHERS)
	EQUIPMENT REFERENCE
	TYPE 'XX' GRILLE FLOW 'YY' L/S
	CONTROL POINT

GENERAL SYMBOLS

A schematic diagram of a four-pipe air handling unit. It consists of four horizontal rectangular boxes stacked vertically, each representing a different air stream. From top to bottom, the boxes are colored light blue, light pink, light green, and light orange. Each box has a small arrow on its left side pointing to the right, indicating the direction of airflow. To the right of each box is a text label identifying the air stream.

SUPPLY AIR
RETURN AIR
OUTSIDE AIR / MAKE-UP AIR
EXHAUST AIR - GENERAL

DUCTWORK SYMBOLS

	RIGID RECTANGULAR OR CIRCULAR SHEET METAL DUCTWORK
	25mm INTERNAL INSULATION
	38mm INTERNAL INSULATION
	75mm INTERNAL INSULATION
	100mm INTERNAL INSULATION
	25mm EXTERNAL INSULATION
	38mm EXTERNAL INSULATION
	75mm EXTERNAL INSULATION
	100mm EXTERNAL INSULATION
	FIRE RATED DUCTWORK
	TRANSFORMATION - EQUAL TAPER
	TRANSFORMATION - FLAT ON SIDE
	ATTENUATOR - SEE SCHEDULE FOR TYPE
	FLEXIBLE DUCTWORK WITH VCD AT TAKEOFF
	SUPPLY DUCT DROPPING
	SUPPLY DUCT RISING
	RETURN/EXHAUST DUCT DROPPING
	RETURN/EXHAUST DUCT RISING
	FIRE DAMPER COMPLETE WITH ACCESS PANEL
	SMOKE DAMPER COMPLETE WITH ACCESS PANEL
	VOLUME CONTROL DAMPER (PLAN/SECTION VIEW)
	DUCT MOUNTED ACCESS PANEL (SIDE/BOTTOM)
	HEATING COIL / COOLING COIL
	VARIABLE AIR VOLUME TERMINAL UNIT
	SUPPLY/RETURN/EXHAUST AIR GRILLE WITH SCOOP TYPE DAMPER
	CEILING MOUNTED SUPPLY AIR DIFFUSER 4-WAY BLOW COMPLETE WITH PLENUM BOX
	CEILING MOUNTED SUPPLY AIR DIFFUSER BLANKED TO 3-WAY COMPLETE WITH PLENUM BOX
	CEILING MOUNTED SUPPLY AIR DIFFUSER BLANKED TO 2-WAY COMPLETE WITH PLENUM BOX
	CEILING MOUNTED SUPPLY AIR DIFFUSER BLANKED TO 1-WAY COMPLETE WITH PLENUM BOX
	CEILING MOUNTED SUPPLY AIR VAV DIFFUSER
	CEILING MOUNTED CIRCULAR SUPPLY AIR DIFFUSER
	SUPPLY AIR JET DIFFUSER
	LINEAR SUPPLY AIR DIFFUSER OR RETURN AIR GRILLE
	CEILING MOUNTED RETURN, EXHAUST OR TRANSFER GRILLE
	DOOR GRILLE AS DESIGNATED - BY BUILDER

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PROJECT

HIGH COURT OF AUSTRALIA SECURITY OFFICE RELOCATION

DRAWING TITLE

MECHANICAL SERVICES LEGEND

A1

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177025	M1001	A	

NEW DUCTWORK INCLUDING SUPPORT BRACKETS WITHIN SECURITY CONTROL ROOM IS EXPOSED AND SHALL BE PAINTED MATT WHITE TO MATCH THE CEILING. AFTER FD DUCTWORK TO STEP- UP AND BE AS CLOSE AS POSSIBLE TO SOFFIT. PREFERRED JOINT METHOD DRIVE SLIP (DS)

NEW FIRE DAMPER (FD) IN ACCORDANCE WITH AS 1682.2

(E) 450x650mm SA DUCT

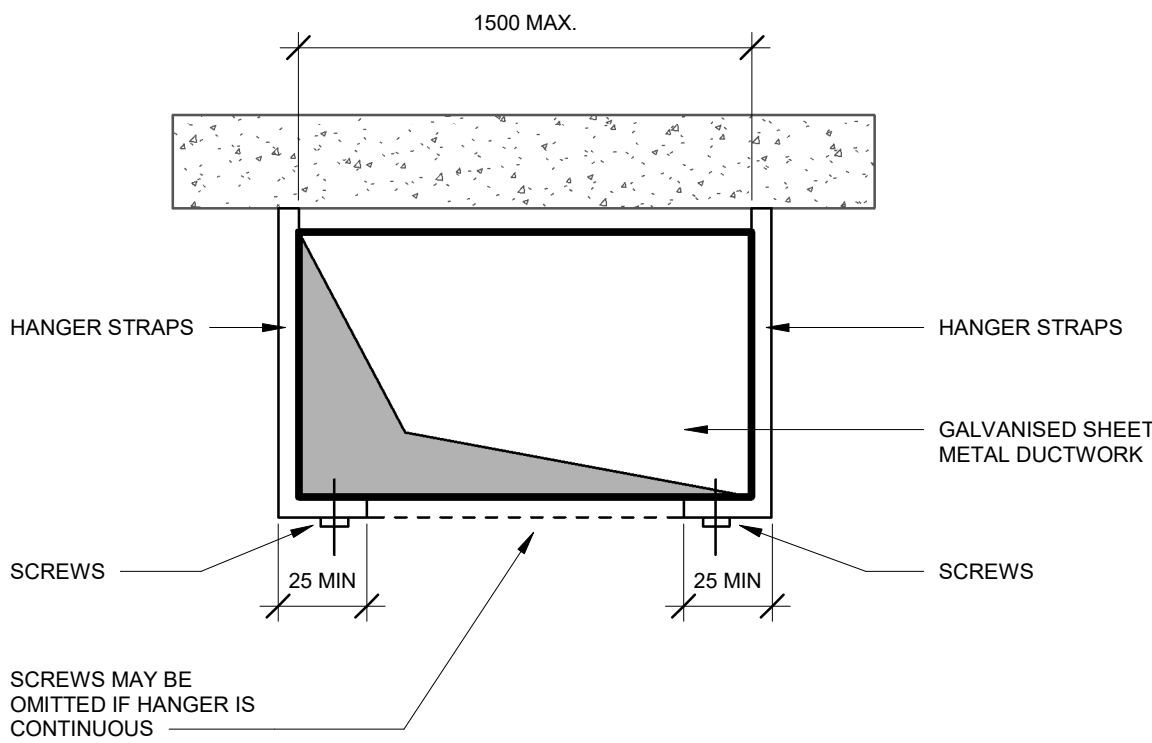
NEW PACKING

(E) AIR CONDITIONING PLANTROOM 5

NEW SECURITY CONTROL ROOM

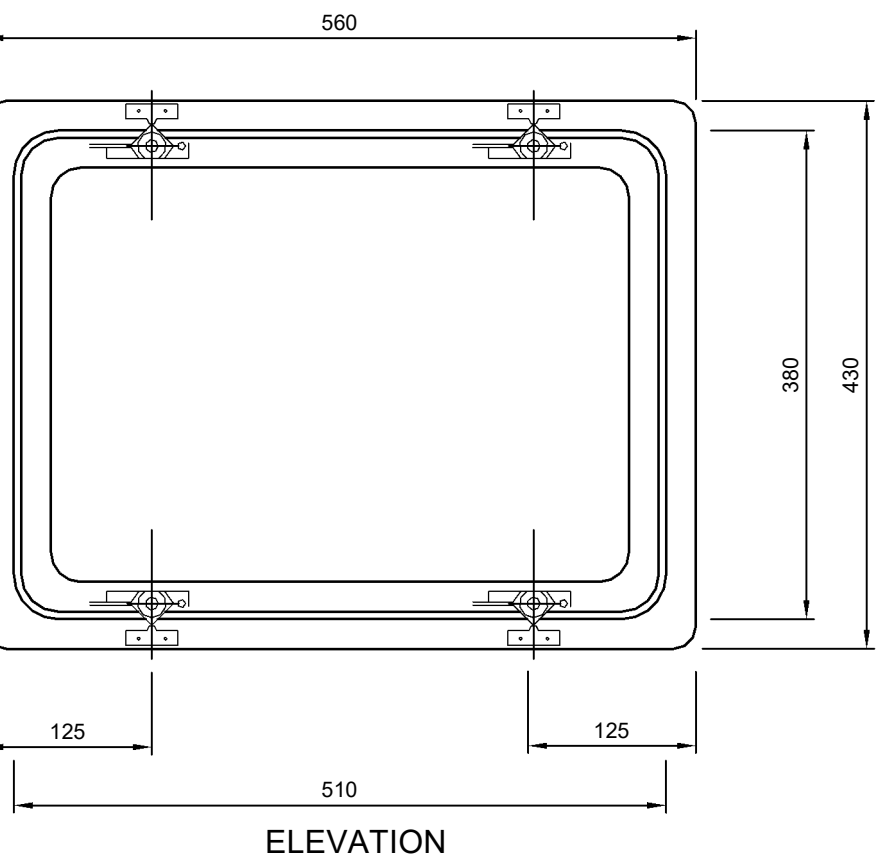
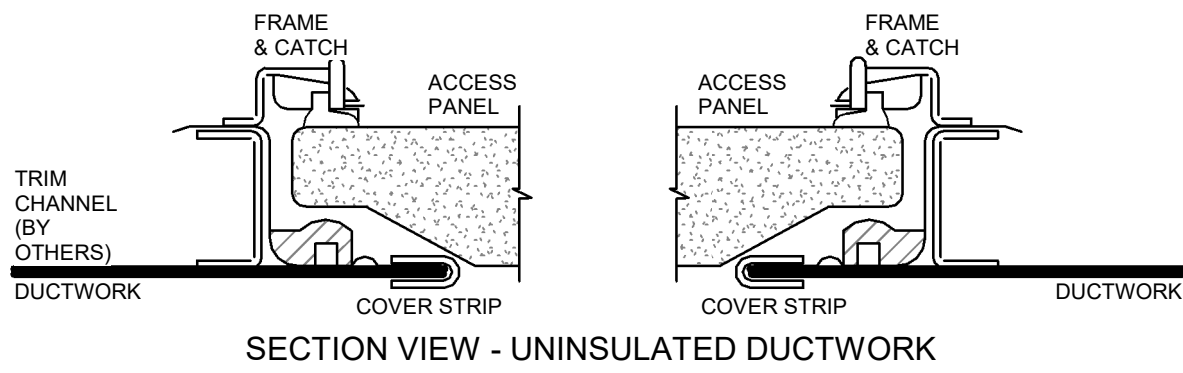
LEVEL 1
562600

GROUND FLOOR
559750

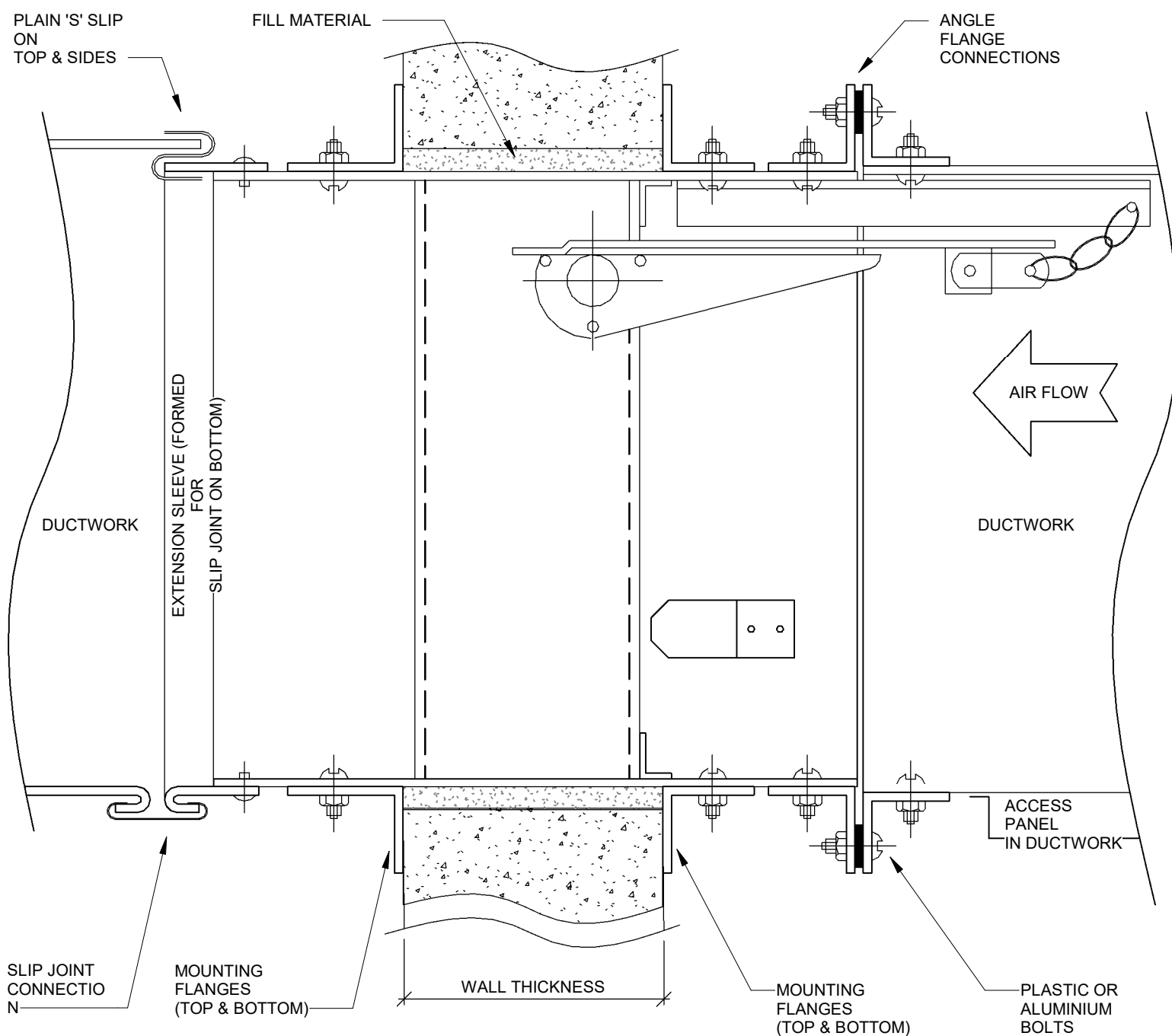


1 SECTION THROUGH SECURITY CENTRE ROOM
1 : 50

2 TYPICAL DUCT SUPPORT
NTS



3 TYPICAL DUCT ACCESS PANEL
NTS



4 TYPICAL FIRE DAMPER 'BREAKWAY' DUCT CONNECTION
NTS

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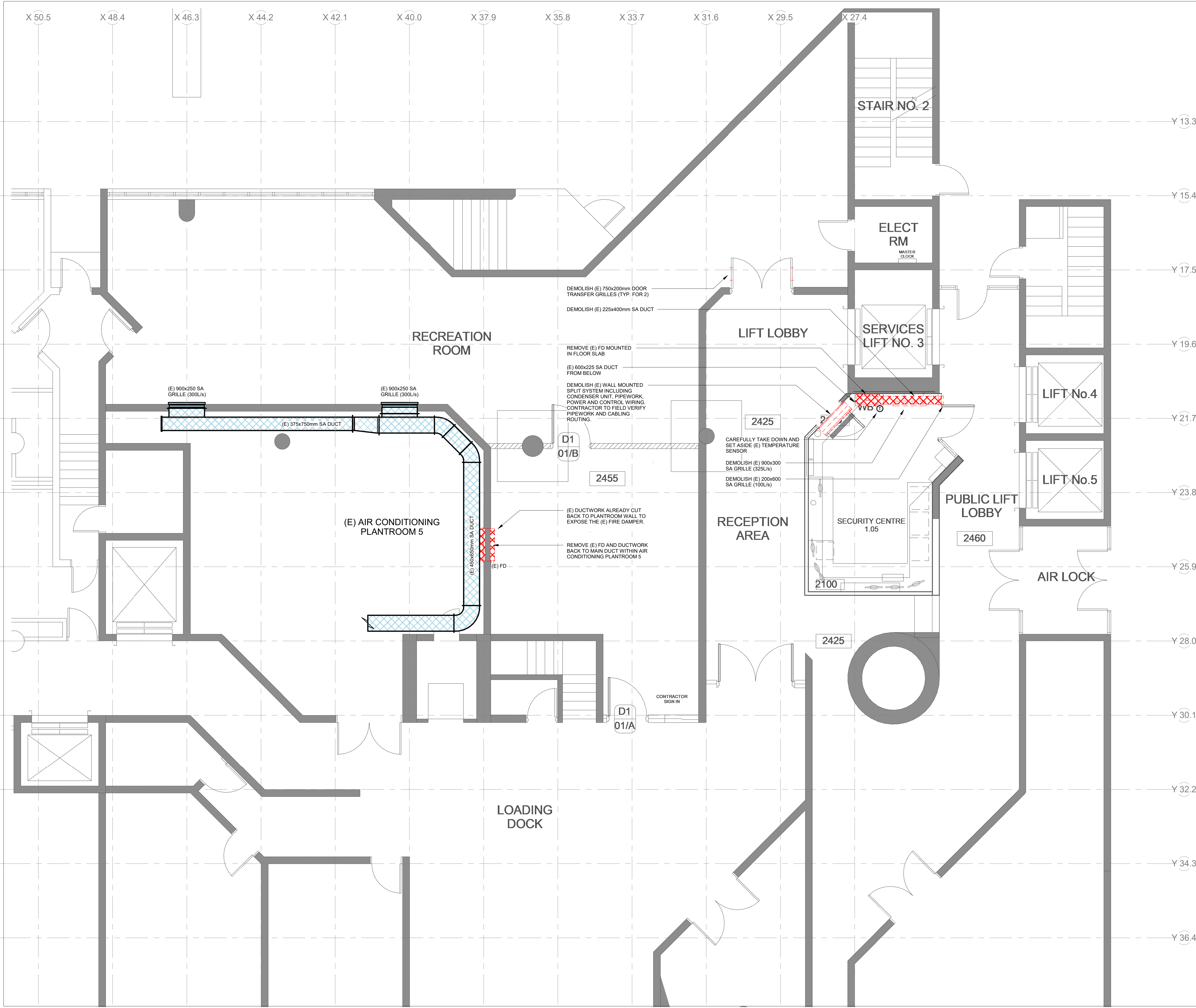
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HIGH COURT OF AUSTRALIA
SECURITY OFFICE RELOCATION

DRAWING TITLE
MECHANICAL SERVICES
STANDARD DETAILS AND
EQUIPMENT SCHEDULES

A1

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SECURITY OFFICE RELOCATION

DRAWING TITLE
MECHANICAL SERVICES
DEMOLITION LAYOUT



A1

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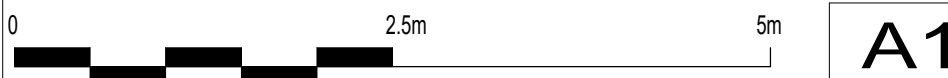
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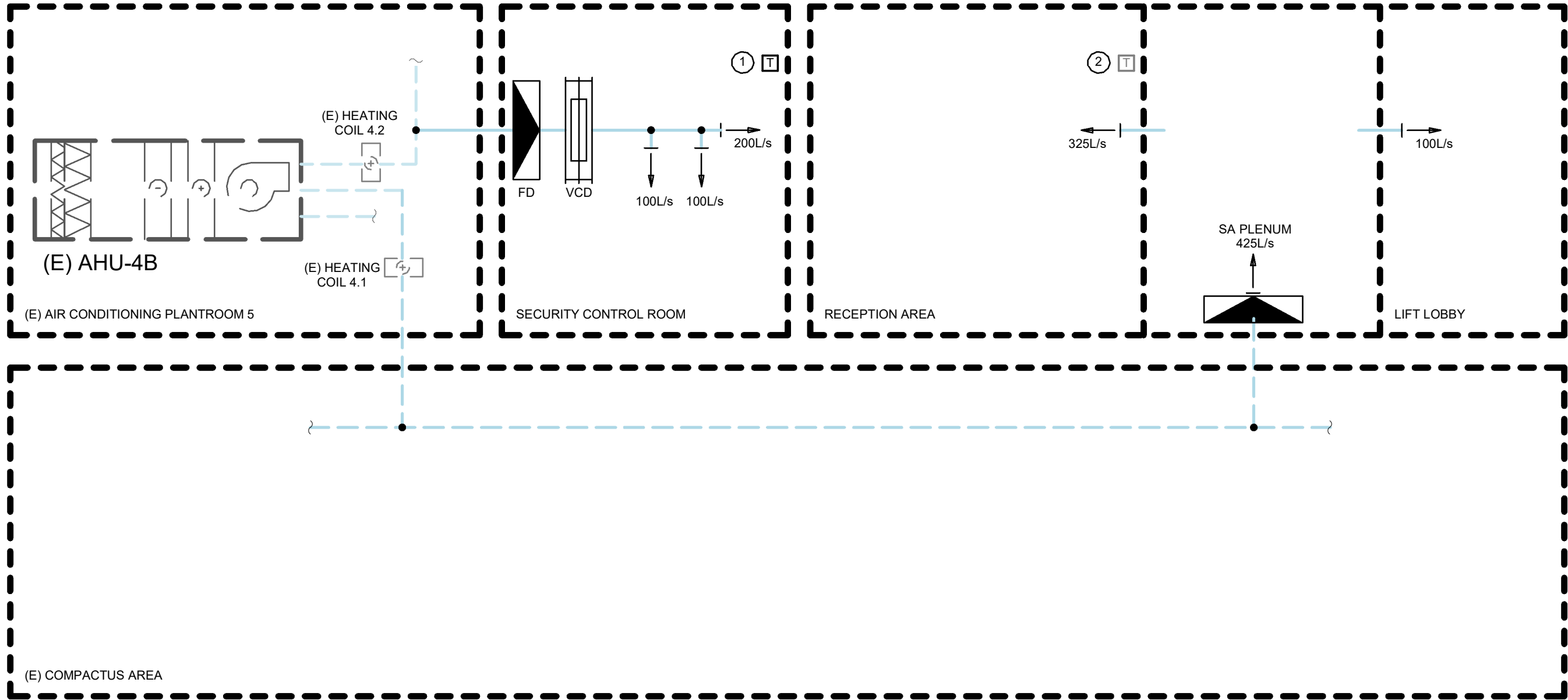
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SECURITY OFFICE RELOCATION

DRAWING TITLE
MECHANICAL SERVICES
AIR CONDITIONING AND
VENTILATION LAYOUT



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1 SECURITY CONTROL ROOM SCHEMATIC

BMS CONTROL POINTS				
CONTROL NUMBER	SENSOR / EQUIPMENT BEING CONTROLLED	DESCRIPTION	SIGNAL	B.M.S.
1&2	TEMPERATURE SENSOR	AVERAGE THE SECURITY AND THE RECREATION (GYM) TEMPERATURES. COMPARES THIS AVERAGE TEMPERATURE WITH THE AVERAGE READING BETWEEN THE COMPACTUS AND RECEPTION AREA SENSORS. THE LOWEST READING DETERMINES THE AHU SA SET-POINT.	AI	YES

NOTE: ASSOCIATED CHW & HHW PUMPS TO BE TIME SCHEDULE TO ENABLE AFTER HOURS ON WEEKDAYS. START/STOP OF PUMPS TO BE USER ADJUSTABLE.

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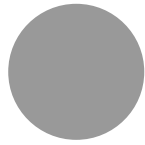
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MECHANICAL SERVICES
CONTROL SCHEMATIC

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SPECIFICATION

STEENSEN VARMING



177025 High Court of Australia New Security Centre A. Preliminaries



Document Revision and Status

Date	Rev	Issue	Notes	Checked	Approved
19.02.2019	A	For Tender		DMC	MAC
22.02.2019	B	For Tender		DMC	MAC

Canberra February 22, 2019

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Principal Engineer

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1.0 Project Particulars

1.1 Introduction

This section of the specification forms part of the contract documents.

The purpose of this section is to describe the works in general terms and to specify general conditions and requirements for their execution, including sub-contracting, approvals, testing and completion.

This section sets out what is required to complete the works in accordance with the contract. The items contained in this section are not specific to the other work sections contained in this specification but relate to the cost-significant items required by the method and particular circumstances under which the works are to be carried out.

Provision should be made in the Tender Return Schedules for compliance with this section.

This section of the specification must be read together with the following:

- Section B. System Descriptions;
- Section C. Material and Equipment Clauses;
- Associated Drawings.

1.2 The Project

The High Court Building is one of Australia's national buildings and is located on the shores of Lake Burley Griffin in Canberra's Parliamentary Triangle. Design of the building began in 1973 with construction starting on site in 1975; the completed building was first occupied in June 1980. It houses three main courtrooms, Justices' chambers with associated library and staff facilities, administrative offices and public areas including provision for a restaurant/cafe.

The High Court of Australia building is arranged over eleven floors and rises some 41 metres above ground at the tallest section. The building has approximately 18,515 square metres of internal floor area over eleven floors and houses three main court rooms, Justices' chambers with associated library and staff facilities, administrative offices and public areas, including provision for a restaurant/café. A major feature is an internal atrium rising over 24 metres high, extending from the ground floor up to level 8 of the building. The external façade includes over 4000 square metres of glazing, principally on the north and south faces of the building.

The High Court of Australia building was completed in 1980 and is listed on the Register of the National Estate (11 August 1987). It is an item on the Commonwealth Heritage List under the Environmental Protection and Biodiversity Conservation Act 1999.

Much of the HVAC system dates from the original installation in 1980 and has recently undertaken a major refurbishment to replace or recondition the HVAC equipment and associated services.

During this stage of works, the security office is to be relocated and conditioned accordingly. Refer to Section B of the specification for details of the project.

1.3 Definitions

In interpreting this section, the following words shall have the meaning assigned to them below:

Approved or Approval:	means approval by, or to the approval of, the Principal's Authorised Person and/or all relevant Authorities.
Authorities:	means any authority having jurisdiction over the works such as the following: ■ Local Council/ Department of Planning; ■ Energy Australia; ■ WorkCover Authority; ■ AGL; ■ Telstra, Austel, Optus; ■ All Australian Standards and referenced International Standards.
Consultant:	means Steensen Varming (Australia) Pty Ltd.
Contract	The agreement between the Contractor and the Principal constituted by the Contract Documents.
Contract Documents	The documents described as such in the Contract together with: ■ This specification; ■ Completed Tender Return Schedules; ■ Associated Drawings (including equipment schedules).
Contractor:	means the organisation, engaged by the Principal or Managing Contractor to undertake the works.

Drawings:	means the services drawings listed in this specification and other drawing referred to in the Contract Documents.
Principal:	means High Court of Australia or their nominated representative.
Project	means the development of the High Court of Australia, new security centre
Specialist Sub -Contractor	means the organisation engaged by the Contractor or Sub-Contractor to undertake specialist services, other than a Consultant or a Supplier.
Principal's Authorised Person:	means Alan Freemantle or other person appointed by the Principal and notified to the Contractor.
Sub-Contractor:	means the organisation engaged by the Contractor to undertake the services works, other than a Consultant or a Supplier.

2.0 The Contract

Prior to commencing the works, the Contractor shall ensure it is familiar with the contract documents, including the drawings and specification and all other associated documents. The Contractor shall notify the Principal's Authorised Person of any work or material shown or specified in these documents which in its opinion will not give satisfactory results.

It should be noted that the drawings are diagrammatic only and may not show all the building and services details. The Contractor shall utilise structural and architectural drawings as well as those provided by specialist contractors for accurate assessment and measurement.

All equipment and services shall be coordinated with the building, its finishes and other services and to the approval of the Principal's Authorised Person.

Any inconsistency between the drawings and the specification or in either document separately shall be reported to the Principal's Authorised Person by the Contractor before any work is commenced. The Principal's Authorised Person will decide the course of action to be followed.

Any items either shown on drawings or described in specification are deemed to be included.

2.1 Roles, Objectives and Expectations

The Contractor shall possess relevant specialist expertise and experience in the type, scale and complexity of work necessary to complete the works.

The Contractor shall:

- Raise any issues requiring design input or clarification, in time to allow it to meet the contract program, particularly in respect to:
 - Interpretation of the specification or drawings;
 - Problems in complying with the specification;
 - Omissions from the construction documents;
 - Suggested alternatives / substitutions.
- Certify compliance with contract documents, including all variation instructions, at completion;
- Certify compliance with all Authority requirements;
- Pay all fees and charges associated with meeting statutory and Authority requirements;
- Obtain all Authority permits and certificates in a timely manner to allow the progress of the work in accordance with the contract program;

- Implement procedures to ensure that only competent tradesmen are used for the works;
- Be cognisant of the role of all relevant parties during the construction phase of the project and to assist them in the conduct of their duties wherever possible;
- Contribute, in the spirit of partnering, towards the successful execution of the Project;
- Provide manufacturer's and construction drawings;
- Provide samples and prototypes where specified or appropriate;
- Make final plant selections to meet the requirements specified;
- Stage the works as agreed with the Principal or the Principal's Authorised Person, to ensure the full functionality of the space.

2.2 Site Visit

The Contractor shall visit the site (by appointment) taking all notes and measurements necessary to provide a detailed and comprehensive tender for the works specified herein. Claims for variations based on lack of knowledge of the site conditions or information that could have been ascertained by inspection will not be accepted after submission of the tender.

2.3 Related Documents

This specification and associated drawings shall be read in conjunction with all other contract and reference documents, including but not limited to the following:

- Architect layouts and Specifications;
- Structural Engineers drawings;
- Hydraulic and Fire Services;
- Acoustics;
- NCC;
- Other documents as identified within the Head Contract;
- All other relevant documents to the project.

2.3.1 Cross References

General

The Contractor shall read and note all clauses in the General Requirements of Contract and Annexure and preliminaries as applicable to its trade.

The Contractor shall provide all plant, labour and materials to complete the works and co-ordinate and co-operate with all other trades associated with its trade work.

Other Documents

Reference shall be made to other relevant documents including but not limited to the following:

- NCC Report;
- Mechanical, Electrical, Lighting, Hydraulic, Kitchen, Structural, Acoustic and Architectural Drawings and Documents;
- Other documents as identified within the Head Contract;
- All other relevant documents to the project.

2.4 Coordination Responsibility

The Contractor is responsible for coordination at both the coordinated workshop drawing stage and onsite installation stage.

In the process of preparing coordinated workshop drawings, the Contractor acknowledges that tender drawings have been drawn to show design and reticulation routes in principle, and is required to develop from these principles detailed workshop drawings, taking into account the final equipment selection, architecture, structure, installation and access requirements and coordination with other sub-contractors and their coordinated workshop drawings. The Contractor is deemed to have allowed for this exercise and any necessary deviation of routes from the tender drawings that may be required as a result of this exercise.

At the installation stage, the Contractor is required to coordinate both in spatial terms with the architecture, structure and other trades to confirm their respective coordinated workshop drawings and also in respect of sequence of installation to ensure that all trades and services can be installed in accordance with coordinated workshop drawings. The Contractor is deemed to have allowed for this exercise and any necessary deviations from the workshop drawings that may occur in this exercise.

2.5 Co-Operation / Co-Ordination

Works on the site executed under other contract(s) may be proceeding concurrently with the works included in this contract. The Contractor shall co-operate as necessary with all other contractors and with each firm to whom part or parts of the contract works are sub-let.

The Contractor shall be responsible for co-ordination with all trades to ensure that all services are accommodated satisfactorily, particularly in voids and cavities. Details of other services, supports for suspended ceilings, etc. should be obtained from the Principal's Authorised Person and the relevant trade.

2.6 Understanding of Design Intent

By submitting a tender for this project, the Contractor is expected to have acquainted itself with all the tender documents and fully understand the design intent of all systems for the project, in terms of programme, performance outcome, energy and environmental impacts and life expectancies.

It is a requirement of this specification that the Contractor presents a statement of understanding as part of its tender submission to illustrate that they fully understands the design intent of the tender documents.

2.7 Obvious Work

Obvious Works includes all works and equipment of a minor nature not specifically mentioned but necessary for the operation of the specified equipment and systems.

If neither the specification nor plans contain any mention of minor parts which in the opinion of the Principal's Authorised Person are reasonably and obviously necessary for the satisfactory completion of the contract works such parts shall be provided by the Contractor without any additional charge or cost.

2.8 Notices and Fees

The Contractor shall throughout the course of the works give all notices, pay all fees, charges, levies and deposits and otherwise conform with the requirements of all properly constituted authorities with respect to the scope of work.

2.9 Design Finalisation Responsibility

The Contractor acknowledges that due to the nature of the building services that tender documents show design intents in principle and it has a role in carrying these principles forward to finalisation through its confirmation of equipment selection, final coordination with the builder and other trades as part of the Contractor works.

2.9.1 Schedule of Allocation of Design and Management Activities

The schedules of Design and Management Activities given in this section are based on BSRIA BQ6/2014, modified to be specific to this project where appropriate.

The schedules break design into pro-forms that align with the stages in the RIBA Plan of Work 2013. The Schedules have been completed for Building Services and they do not preclude the normal involvement of other members of the Project Team.

The Activity Schedules are not a detailed description of all activities required to carry out the Works but are intended to draw attention to particular requirements which may be otherwise overlooked when preparing tenders. They do not replace requirements given elsewhere in the Contract Documents or in the Principal Contractor's management and scoping documents or the management procedures used by the Contractor.

Where the Building Services Contractor is allocated design activities these are part of the Contractors Design Portion (CDP).

2.9.2 Design and Management Activity Schedules

For this project, contractors Design and Management responsibilities begin at RIBA Stage 5. Where items are struck through, they are not relevant to this particular project and can be discounted.

2.9.3 RIBA Plan of Work Stage 5: Construction

Ref	Design activity in connection with building services	Allocated to ...								Comments
		(one party only)								
		CL	AR	SV	QS	PC	SC	SP	CS	
	General obligations, external liaison (statutory bodies, utilities)									
5.1.1	Notify the necessary statutory bodies (building control, fire officer, and environmental health) in respect of all tests and demonstrations required.						x			
5.1.2	Carry out airtightness test of completed building envelope.					x				Support from SC
	Prepare and submit the Building Air Leakage Report.									
5.1.3	Seek full statutory approval of the works and arrange all necessary attendance, and documentation.						x			
	Co-ordinate Utility Suppliers works with the overall Works programme.					x				Support from SC
	Co-ordinate the Utility Suppliers works with the overall Works. Agree final locations of incoming services with Utility					x				Support from SC

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Ref	Design activity in connection with building services	Allocated to ...								Comments
		(one party only)								
		CL	AR	SV	QS	PC	SC	SP	CS	
	Suppliers. Co-ordinate final locations of incoming services with sub-structure and structure.									
	Obtain confirmed/final quotation for Utility Suppliers works.					x				Support from SC
	Carry out inspections and tests on the Building Services Works necessary to achieve statutory approvals.						x			
	Notify the Statutory Authorities, the Statutory Undertakings/Utility Suppliers and service providers of tests. Agree the procedure for notification.					x				Support from SC
	Examine and comment on the Contractors Documents as described in the Building Services Documents in respect of the design intent.			x						
	Advise the Lead Consultant on the need for any special inspections or tests.			x						
	Inspect Works on Completion and Record Defects.			x						Support from AR
	Client liaison (briefing, handover, surveys)									
5.2.1	Oversee the instruction of the client's staff (FM team and end-users as appropriate) in the use, operation and maintenance of the installations.						x			
5.2.2	Instruct the client's staff (FM team and end-users as appropriate) in the use, operation and maintenance of the installations in advance of handover.						x			
5.2.3	Examine and comment on the contents of the operating and maintenance information in order to ensure compliance with the specified requirements.			x						
5.2.4	Modify and update operating details to reflect commissioning results.						x			

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Ref	Design activity in connection with building services	Allocated to ...								Comments
		(one party only)								
		CL	AR	SV	QS	PC	SC	SP	CS	
5.2.5	Modify the record drawings as the works progress, so that all alterations from the installation drawings are recorded.						x			
5.2.6	Inspect draft record drawings at agreed intervals and comment on their content with respect to the size and positions of installed systems and plant.			x						
5.2.7	Establish central and visible 'home base' for aftercare team as defined by Soft Landings.						x			Support from PC
5.2.8	Arrange for all appropriate maintenance contracts to be in place for start immediately after hand-over.					x				Support from SC
5.2.9	Provide recommendations for the commencement and carrying out of operation and maintenance during and after the defects liability period.						x			
	Team liaison (builders' work, spatial coordination, energy targeting)									
5.3.1	Finalise location of test points.						x			
5.3.2	Prepare accredited as-constructed energy consumption information for Building Regulations and (if relevant) the actual Energy Performance Certificate.						x			
	Select and detail sleeves, inserts, frames, and fixing anchors, and any other items required to be cast or built into the structures by others, including coordination of positions to such extent and accuracy to allow structural construction to proceed.						x			
	Detail and co-ordinate all access platforms, stairs, rails and protection elements required for future maintenance and operation of plant/equipment.					x				AR and SC shall provide support. Relates to those items not already documented by AR
	Detail all fire stopping and sleeving systems.						x			AR and PC shall provide support.

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Ref	Design activity in connection with building services	Allocated to ...								Comments
		(one party only)								
		CL	AR	SV	QS	PC	SC	SP	CS	
	Design weatherproofing details for all services passing through external elements of the building.						x			AR and PC shall provide support.
	Detail all acoustic stopping for services penetrating builders work elements.						x			AR and PC shall provide support.
	Carry out final detailed spatial co-ordination between all Trade Contractors.						x			
	Carry out final detailed spatial co-ordination between the Building Services and the structure/architecture.						x			
	Modify the final detailed spatial co-ordination for approved alternative equipment or materials.						x			
	Carry out final detailed location and dimensioning of 2nd fix equipment based on architectural information.						x			
	Prepare detailed construction programme for installation and remaining design activities.						x			
	Check/co-ordinate documents issued by Specialists before issue						x			
	Identify/coordinate special access required to achieve a safe and serviceable installation.						x			
	Attend all relevant site meetings.						x			
	Co-ordinate the works of the Commissioning Specialist and the Automatic Control Specialist to carry out pre-commissioning site inspections to ensure that commissioning facilities required have been installed and checked for compliance with specified codes, guides and standards.						x			Support from CS
	Co-ordinate the works of the Commissioning Specialist and the Automatic Control Specialist to provide assistance where required to set up, test, commission and performance test the Building Services Works, e.g. setting						x			Support from CS

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Ref	Design activity in connection with building services	Allocated to ...								Comments
		(one party only)								
		CL	AR	SV	QS	PC	SC	SP	CS	
	minimum fresh air rates, fan tracking, and suchlike.									
	Co-ordinate and supervise the manufacturer's commissioning engineers during the inspection, testing, commissioning and performance testing.						x			
	Attend commissioning of BMS and Control Systems.						x			Support from SV
	Liaison as required to determine values for BMS software schedules.						x			
	Oversee and co-ordinate the testing and commissioning of all Specialists' works including BMS/Controls.						x			
	Selection of plant and specialist designers									
5.4.1	Review sub-contractors' or specialists' information against detailed design drawings and co-ordinated working drawings or against building information model(s) (if relevant).						x			Support from SV
5.4.2	Incorporate changes arising from sub-contractors' or specialists' information in detailed design drawings and co-ordinated working drawings or against building information model(s) (if relevant).						x			Support from SV
	Select plant, equipment, components and material to meet the specified performance. Where these differ from provisional selections ensure they are fully compatible with all the other system parameters, components and design requirements.						x			
	Advise whether alternatives offered comply with the selection criteria.						x			

STEENSEN VARMING

Ref	Design activity in connection with building services	Allocated to ...								Comments
		(one party only)								
		CL	AR	SV	QS	PC	SC	SP	CS	
	Advise whether the alternative suggestion is acceptable.			x						
	Re-evaluate all parts of the services design which may be affected by acceptance of alternative plant, equipment, and components.						x			
	Re-evaluate all parts of the building design which may be affected by acceptance of alternative plant, equipment, components.						x			
	Amend the design to incorporate agreed alternative plant, equipment, or components.						x			
	Check plant and system sizing once full co-ordination of the works has been undertaken.						x			
	Agree final equipment selections and manufacturers prior to confirming agreed final fixed costs with the Client.			x						
	Monitor the Specialist Design input for compliance with the design intent.						x			
	Evaluate the impact of the Specialist Design on those parts of the overall design that are provisional.						x			
	Amend and complete the design as appropriate.						x			
	Monitor the ongoing progress of the procurement, manufacture, installation and commissioning of all plant and equipment items.						x			
	Review Sub-contractors or Specialists information against Detailed Design Drawings and Co-ordinated Working Drawings and Installation Drawings (if relevant).						x			Support from SV

STEENSEN VARMING

Ref	Design activity in connection with building services	Allocated to ...								Comments
		(one party only)								
		CL	AR	SV	QS	PC	SC	SP	CS	
	Incorporate changes arising from Sub-contractors or Specialists information in Detailed Design Drawings and Co-ordinated Working Drawings and Installation Drawings (if relevant).						x			Support from SV
	Agree pipework cleaning and flushing method statements before carrying out work.						x			Support from SP
	Co-ordinate the works with the Water Treatment Specialist.						x			Support from SP
	Offer all stages of the cleaning and flushing operation.						x			Support from CS
	Remove and clean strainers only at times agreed. Record and submit the 'clean' working pressure drop of all strainers after the final clean.						x			Support from SP
	Submit a record statement describing when, how and by whom each part of each system was cleaned and flushed. Include record statements in the O&M manuals.						x			Support from SP
	Retain samples at each stage from agreed locations.						x			Support from SP
	Maintain detailed records of all chlorination procedures carried out including a log of events detailing each process stage, time scale and current water quality (e.g. pH, TDS, Fe content, etc.) during the flushing and cleaning process.						x			Support from SP
	Remove any fluid, chemical or any other substance not permitted to enter the drainage system from site safely. Obtain written approval from the Statutory Authority prior to discharging flushing or chemical-laden water into existing drains.						x			Support from SP

STEENSEN VARMING

Ref	Design activity in connection with building services	Allocated to ...								Comments
		(one party only)								
		CL	AR	SV	QS	PC	SC	SP	CS	
	Co-ordinate the works with the Pipework Cleaning and Flushing Specialist.						×			Support from SP
	Agree acceptable levels of microbiological activity.						×			Support from SP
	Prepare and submit a Water Quality Analysis Report before carrying out any work.						×			Support from SP
	Submit a record statement describing when, how and by whom each part of each system was chemically treated.						×			Support from SP
	Submit O&M information specifically for water treatment systems to enable the Employer's maintenance staff to maintain, test and control the water conditioning programme. Indicate the type of tests, methods and test intervals required. Describe corrective action required if any test is unsatisfactory. Fully describe chemicals used.						×			Support from SP
	Demonstrate water quality is satisfactory by taking and submitting a final set of water samples immediately prior to Practical Completion.						×			Support from SP
	Maintain water quality throughout the duration of the Contract Period.						×			Support from SP
	Mechanical design									
	Carry out Detailed Design of pipework gradients for Builders Work and co-ordination, including domestic and waste drainage and condensate runs.						×			
	Carry out Detailed Design of anchors, guides and other provision for movement of services and systems due to thermal expansion and contraction and building movement.						×			

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Ref	Design activity in connection with building services	Allocated to ...								Comments
		(one party only)								
		CL	AR	SV	QS	PC	SC	SP	CS	
	Modify distribution systems and equipment capacities as may be required as a result of final detailed spatial co-ordination.						x			
	Check fan and pump system resistances based on the final equipment selection and Coordinated Installation Drawings.						x			
	Check system water capacities and quantities of chemical additives based on the final equipment selection and Coordinated Installation Drawings.						x			
	Design all necessary temporary facilities for flushing, and commissioning.						x			Support from CS
	Size, select and determine final locations of commissioning sets based on the final equipment selection and Co-ordinated Installation Drawings.						x			Support from CS
	Specify final location of access panels.						x			Support from AR and SV
	Carry out final detailing of drain and vent points.						x			
	Carry out final selection of all terminal devices.						x			
	Carry out final selection of systems pressurisation units and expansion vessels based on the final equipment selection and Co-ordinated Working Drawings.						x			
	Detailed design and sizing of refrigerant pipework between items of equipment provided under the contract works based on the final equipment selection and Co-ordinated Installation Drawings.						x			
	Carry out final sizing of sections of ductwork between terminal units and diffusers to ensure the specified acoustic criteria and duct velocities.						x			

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Ref	Design activity in connection with building services	Allocated to ...								Comments
		(one party only)								
		CL	AR	SV	QS	PC	SC	SP	CS	
	Select and confirm location of control dampers, and control valves, to achieve the specified function and to suit the characteristics of items served and final system configurations as based on the final equipment selection and Co-ordinated Installation Drawings.						x			
	Carry out final detailing and confirm the location and sizes of duct connections to external louvres.						x			
	Carry out final selection of control valves to suit pipework and authority of controls based on final Installation Drawings.						x			
	Carry out final selection of all anti-vibration mountings.						x			
	Carry out final detailing and confirm the location and sizes of plant connections and interfaces.						x			
	Carry out final selection and detailing of pipework and ductwork insulation and cladding systems.						x			
	Design Review.						x			Support from SV
	Electrical design									
	Public health design									
	Modify distribution systems and equipment capacities as may be required as a result of final detailed spatial co-ordination.						x			
	Carry out final detailed coordination of above and below ground drainage with superstructure and substructure.						x			
	Design Review.						x			Support from SV
	Commissioning									
5.8.1	Comment on the adequacy of systems for commissioning as detailed on specialists' drawings and manufacturers' shop drawings						x			Support from CS

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Ref	Design activity in connection with building services	Allocated to ...								Comments
		(one party only)								
		CL	AR	SV	QS	PC	SC	SP	CS	
	prior to actual manufacture at works.									
	Identify and incorporate into system designs the essential components and features necessary to enable the proper preparation and commissioning of building services.						x			
5.8.2	Attend commissioning meetings as necessary.						x			Support from SV
5.8.3	Arrange and chair commissioning meetings as necessary.						x			
5.8.4	Monitor the progress of commissioning and testing of all systems and plant, including assessment of whether installations meet the original (or amended) design intent.						x			
5.8.5	Conduct mock-up performance tests.						x			
5.8.6	Conduct pre-commissioning works (verification of installation works and static tests).						x			
5.8.7	Commission all systems to agreed method, logic and programme, and in accordance with the commissioning specification. Record the results.						x			
5.8.8	Attend witness testing and commissioning of off-site manufactured assemblies at manufacturers' premises.						x			Usually during manufacture. Support from SV
5.8.9	Demonstrate that the overall and complete systems perform correctly in the required manner and as intended by the specification.						x			
5.8.10	Record all plant settings from commissioning.						x			
	Examine results of commissioning.			x						
5.8.11	Accept completed systems.			x						Support from CS
	Deliverables – including drawings, specifications, reports									

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Ref	Design activity in connection with building services	Allocated to ...								Comments
		(one party only)								
		CL	AR	SV	QS	PC	SC	SP	CS	
5.9.1	Provide final installation details, including dimensions, of electrical switchgear to ensure that cable entry is acceptable in the selected location and that safe operating and maintenance clearances are provided.						x			
5.9.2	Provide final installation details, including dimensions, of automatic control panels to suit the detailed requirements of the agreed supplier of the controls equipment.						x			
5.9.3	Provide detailed BMS point schedules, wiring schematics, control panel labelling details and equipment schedules for the complete works.						x			
5.9.4	Provide detailed electrical wiring diagrams of all equipment supplied showing all interconnections between equipment to enable all necessary wiring to be undertaken.						x			
	Prepare final Installation Details, including dimensions, of automatic control panels to suit the detailed requirements of the agreed supplier of the controls equipment.						x			
	Prepare Contractors Documents required in the Pre-Construction Stage as described in the Building Services Documents.						x			
5.9.5	Provide installation model.						x			
5.9.6	Provide installation drawings.						x			
	Prepare final Co-ordinated Reflected Ceiling Plans based on latest architectural information for all components.		x							Support from SC
5.9.7	Provide builders' work details.						x			
5.9.8	Provide shop and fabrication drawings.						x			
	Produce a commissioning specification.						x			Support from CS

Ref	Design activity in connection with building services	Allocated to ...								Comments
		(one party only)								
		CL	AR	SV	QS	PC	SC	SP	CS	
	Evaluate and report upon the Specialist Designer's Proposals within the Main Contract.						x			
	Prepare a report in consideration of any alternative plant, equipment, and component selections.						x			
5.9.9	Provide a final commissioning report detailing the results of the commissioning and commenting on the performance of systems signed by a competent person.								x	Support from SC
5.9.10	Provide schedule of activities/works required for handover.						x			
5.9.11	Provide all necessary calculations, drawings, information and logs for the Health and Safety File.						x			
5.9.12	Provide a schedule of all spare parts required for the works including recommendations of any others not stated in the specification.						x			
5.9.13	Provide a schedule of all tools required for the works including recommendations of any others not stated in the specification.						x			
5.9.14	Provide specialist author for production of operating and maintenance manuals.						x			
5.9.15	Provide as-built model.						x			
5.9.16	Provide record drawings.						x			
5.9.17	Provide log book(s) in accordance with the requirements of the specification and the Building Regulations.					x				Including system completion certificates and Building Regulations Report. Support from SC
5.9.18	Provide planned preventative maintenance schedules.						x			
5.9.19	Provide operation and maintenance information in accordance with the specified requirements.						x			
5.9.20	Provide technical guide for the facilities management team.						x			

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Ref	Design activity in connection with building services	Allocated to ...								Comments
		(one party only)								
		CL	AR	SV	QS	PC	SC	SP	CS	
5.9.21	Provide recorded water, gas and electricity meter readings on completion of the works.						x			
5.9.22	Provide building users' guide, including instructions on controls, energy saving and water saving features.						x			Support from SV and AR
	Prepare accredited as constructed calculation of Building Emissions Rate for Part L and (if relevant) the actual EPC.					x				Support from SC
5.9.23	Provide pre-handover defects schedule.		x							Support from SV

2.9.4 RIBA Plan of Work Stage 6: Handover and Close Out

Ref	Design activity in connection with building services	Allocated to ...								Comments
		(one party only)								
		CL	AR	SV	QS	PC	SC	SP	CS	
	General obligations, external liaison (stat bodies, utilities)									
	Client liaison (briefing, handover, and surveys)									
6.2.1	On site attendance by aftercare team during first eight weeks of occupation.						x			
6.2.2	Hold meetings/workshops with end-users/occupiers during the first eight weeks of occupation.			x						
6.2.3	Hold regular meetings with user representatives during Year 1 of occupation.			x						Specify frequency, e.g. every 3-4 months in Year 1
6.2.4	Review building performance against energy targets during Year 1 of occupation.			x						Specify frequency, e.g. every 3 months
6.2.5	Hold end-of-year reviews of the general and environmental performance of the building.			x						
6.2.6	Visit site to train and/or transfer information about the use of the						x			

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Ref	Design activity in connection with building services	Allocated to ...								Comments
		(one party only)								
		CL	AR	SV	QS	PC	SC	SP	CS	
	building services to the facilities management team and the building occupiers.									
	Team liaison (builders' work, spatial coordination, energy targeting)									
6.3.1	Review project health and safety performance.					x				Support from SC
6.3.2	Organise lessons learned workshop for the project with design team, main contractor, significant specialist contractors and FM team.					x				Support from SC
	Selection of plant and specialist designers									
	Mechanical design									
	Electrical design									
	Public health design									
	Commissioning									
6.8.1	Carry out seasonal commissioning from practical completion including environmental testing and monitoring.						x			Define timetable
6.8.2	Attend seasonal commissioning activities carried out by others.						x			
	Deliverables – including drawings, specifications, and reports									
6.9.1	Provide a reviewed and updated list of defects identified during post completion audit.		x							Support from SV
6.9.2	Provide COBie-UK-2012 tables for Information Exchange 6.						x			
6.9.3	Provide written reviews of energy use and system performance (as defined in the Soft Landings framework).			x						
6.9.4	Provide outturn cost analysis.						x			

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Ref	Design activity in connection with building services	Allocated to ...								Comments
		(one party only)								
		CL	AR	SV	QS	PC	SC	SP	CS	
6.9.5	Provide updated as-built model incorporating defect rectification and any changes resulting from Year 1 aftercare.						x			
6.9.6	Provide updated record drawings incorporating defect rectification and any changes resulting from Year 1 aftercare.						x			
6.9.7	Provide lessons learned report.						x			Support from SV

Abbreviation Meaning

- CL = Client/Employer
- AR = Architect (Lead Consultant)
- SV = Steensen Varming (Building Services Consultant)
- QS = Quantity surveyor/Cost Consultant
- PC = Principal Contractor
- SC = Building Services Contractor
- SP = Specialist Building Services Contractor
- CS = Commissioning Specialist / Commissioning Manager

3.0 Existing Building Contract Requirements

3.1 Survey Works

The Contractor shall undertake a site survey prior to submitting the tender to verify all matters that could affect post tender costs or works. No variations will be accepted post tender for any omission of works or cost arising from information available at the time of tender. The Contractor shall make arrangements through the principal's representative to visit the site in the first week after receipt of the invitation to tender.

The specialist surveys may include but not limited to the following:

- Contaminated ground survey (by mechanical installer, to decide piping materials for buried cold water service);
- Acoustic environment survey (by mechanical installer);
- Water main flow and pressure capability (by mechanical / sprinkler installer for sprinkler system supply, fire hydrants, etc.);
- Location of existing underground services (by mechanical / electrical / sprinkler installer, to determine exact locations for avoidance / connection)
- Sewer, drainage CCTV survey (by mechanical installer);
- Incoming water main quality analysis (by mechanical installer);
- Other survey as identified within the Head Contract.

3.1.1 Special Surveys

The Contractor shall arrange and provide for all specialist surveys to be undertaken if required over and above those undertaken by the Principal, and forward the results of these to the principal's representative prior to submitting "for comment" the associated Contractor drawings and technical submittals.

3.1.2 Dilapidation Schedule

Prior to commencement of work on site, the Contractor shall prepare and agree with the principal's representative a schedule of dilapidations including the existing services systems and buildings. This schedule will be used throughout the contract to identify and agree any remedial work that is necessary.

3.2 Interruption of Existing Services

Where the work under the contract affects the continuity of existing services the Contractor shall arrange to have the work carried out at the least inconvenient time to the Principal as advised by the Principal's Authorised Person. The work shall be organised to minimise the duration of inconvenience. This will mean out of hours work will need to be undertaken for elements of the Work.

No existing services are to be interrupted, disconnected or removed until a new replacement service has been fully installed and commissioned, unless specific approval has been given by the Principal's Authorised Person.

The Contractor is deemed to have understood that the Works are to be carried out within an existing building and as such all care shall be taken to avoid disruption to the facility or its systems.

All work involved in the interruption of existing services will be carried out by arrangement with the Principal's Authorised Person.

The Contractor shall submit for review a detailed program of the Works contained in this specification indicating all testing, installation, shut downs, cut ins, changeovers, commissioning periods and anything else affecting the continued operation of the building and its systems.

3.3 Redundant Equipment

The Contractor shall remove from the site all equipment and services which are to be made redundant as part of the works. The redundant equipment shall be disposed of by the Contractor. All effort shall be made to recycle redundant equipment associated with this Contract. The Contractor shall provide a waste management plan together with records of relevant disposal and recycling activities.

All redundant mechanical, electrical and vertical transportation services shall be stripped out to the extent indicated on the drawings. Redundant mechanical electrical services and control services shall be stripped back to source and associated ways in MCCs / distribution panels and shall be labelled as 'spare'.

3.4 Archaeological and Heritage Requirements

The existing building and site have archaeological and heritage value. This is a key design and construction consideration for the Principal and the design. The Contractor is required to fully inform themselves of the heritage and archaeological requirements and to carry out the works in accordance with these requirements, including incorporation of the requirements in protocols, procedures and management methods.

4.0 Codes and Regulations

4.1 Conformity with Codes and Regulations

The works shall be manufactured, installed and tested in accordance with Australian and AS/NZ Standards referenced in the National Construction Code of Australia or with other approved standards where the Australian Standards are not applicable.

All works shall be in accordance with this specification and the current Australian Standards and standards detailed within.

Except where the specification required a higher standard, the work is to be carried out in strict conformity with the provisions of all relevant Acts, Ordinances, Regulations, Codes, etc. of:

- The Insurance Council of Australia;
- The Standards Association of Australia;
- The National Construction Code of Australia.

Authorities and Councils such as:

- The local Council;
- The local water and electricity supply authorities;
- NSW Fire Brigade;
- Environmental Protection Authority;
- Metropolitan Waste Disposal Authority;
- WorkCover;
- Any other Authority having jurisdiction over the installation to ensure that the machinery and installation will comply with the Rules and Regulations.

On completion of the installation and prior to final payment being made the Contractor is to arrange for each Authority having jurisdiction to inspect and check the contract works and where required by the Superintendent to obtain certificates from such Authority to the effect that the equipment, machinery and installation complies with that Authority's requirements. These certificates are to be provided to the Superintendent.

4.1.1 Mechanical:

AS 1428 - 2010
AS 1530.4

AS 1657 - 2013

Design for access and mobility
Methods for fire test on building
material, components and structures
Fixed platforms, walkways, stairways
and ladders – Design, construction and
installation

AS 1668.1 - 2015	The of mechanical ventilation and air-conditioning in buildings Part 1 Fire & Smoke Control
AS 1668.2 - 2012	The of mechanical ventilation and air-conditioning in buildings Part 2
AS 1682.1 - 2015	Mechanical ventilation in buildings
AS 1682.2 - 2015	Fire , smoke and air dampers - Specification
AS 1940 - 2017	Fire , smoke and air dampers - Installation
AS 2243	The storage and handling of flammable and combustible liquids
AS 2476 - 2008	Safety in laboratories
AS 2913 - 2000	General fumigation procedures
AS 3666 - 2011	Evaporative air-conditioning
AS 4254	Air handling and water system of buildings Microbial control
AS 4284 - 2008	Ductwork for air handling systems in buildings
AS 4332 - 2004	Testing of building facades
AS 4426 - 1997	The storage and handling of gases in cylinders
	Thermal insulation of pipework, ductwork and equipment – Selection, installation and finish

4.2 Workplace Health and Safety (WH&S), Service Aisles, Walkways and Access Spaces

The Contractor is to ensure adequate space be provided for servicing of equipment and parts in plantrooms and the general areas. Equipment shall be installed to ensure adequate serviceability without the need for unsafe work practices. Reference shall be made to:

- Manufacturer's installation instructions;
- WorkCover requirements;
- Australian Standards.

In locating equipment, the Contractor shall pay particular attention to furnishing easy access to it, in accordance with OH&S Act. The Contractor shall indicate all aisles, walkways and service areas around all items of equipment on drawings.

In the construction stage, all such aisles shall be preserved; piping, ductwork and cable trays shall be left above head level or along the wall or to the side where they will not interfere with passage.

The Contractor will be required to disassemble and reinstall any piping, supports or assemblies which interfere with the freedom of passage, at no extra cost. Where any

doubt exists as to the adequacy and width of the passage way, verify the condition with the Superintendent before proceeding.

5.0 Drawings and Technical Submittals

The overall target completion date has been specified elsewhere in this Contract. It is the Contractor's responsibility to programme the work in a logical and realistic manner to achieve the target completion date. In this context, it is the requirement of this specification that the logical sequencing of events is maintained:

- Equipment selection, submission;
- Equipment procurement/purchasing;
- Preparation and coordination of workshop drawings;
- Site coordination;
- Installation;
- Cleaning of systems;
- Testing and balancing;
- Commissioning, including dynamic checking and verification of BMCS and automatic control systems.

The above list is not intended to be exhaustive but to emphasise the sequence in which these key items should take place to avoid instances such as equipment being ordered prior to review thus leading to deviations from specification or coordination problems due to change in dimensions. Any unnecessary acceleration on the submission and review process due to events occurring out of sequence or delaying of some from the Contractor's initiative will not be accepted.

5.1 Contractor's Deliverables Register

Following Contract award, the Contractor shall prepare a register of all necessary Contractors' deliverables. This register shall be maintained as a "live" document throughout the contract until all items have been delivered. The register shall be issued on a regular basis (at least monthly). This will include items such as technical submittal, sample review submissions and co-ordinated workshop drawings. The register will show planned dates for delivery of submissions for review by the consultants. The Contractor acknowledges that certain equipment / co-ordinated workshop drawings / sample reviews require more time to review than others. Therefore to enable the consultant to ensure resources are available to carry out reviews at the necessary time, the Contractor shall ensure that the planned review dates are advised with sufficient notice to enable the consultant to plan ahead. Any delays in reviews as a result of the review date information not been provided in time will be the Contractor's responsibility

5.2 Inspections and Hold Points / Tests

There are a number of hold points and witness points during the construction phase of the project which require inspection and verification. The Contractor shall provide sufficient notice (at least 2 weeks) to all relevant parties to attend inspections or for the review of submissions. Works shall not proceed without relevant authorisation. Refer to the relevant sections of this specification for details on submissions, inspections/witness, testing and commissioning.

Hold Points Include:

- Submission and Review of Samples and Mock Ups;
- Submission and Review of Workshop Drawings;
- Submission and Review of Technical Data;
- Inspection and Review of Installation works as detailed below:
 - Completion of in-ground services survey (e.g. Dial before You Dig);
 - Authority approvals to proceed with works have been obtained;
 - Work Method Statements for specific works considered sensitive or works that may have an impact on the functional operation of the facility or adjacent facilities;
 - Prior to back filling or enclosure of in-ground services;
 - Prior concrete pour;
 - Prior ceiling and wall sheeting;
 - Inspection before removal of scaffolding or when certain areas are not to be accessible any more for other reasons;
 - Off-site inspection of large equipment items such as Switchboards, Generators and Chillers;
 - Commissioning, Calibration, Testing and Certification of all systems prior to Completion and Occupation.

The above list is not intended to be exhaustive but to emphasise the sequence in which these key items should take place to avoid instances such as equipment being ordered prior to review thus leading to deviations from specification or coordination problems due to change in dimensions. Any unnecessary acceleration on the submission and review process due to events occurring out of sequence or delaying of some from the Contractor's initiative will not be accepted.

5.3 Contractor's Drawings

The Contractor is to provide complete manufacturing and installation Shop Drawings and all necessary technical data covering the Work under the Contract.

All drawings shall adhere to the following requirements:

Drawings are to be prepared in Revit or CAD and submitted to the Principal's Authorised Person in CAD and PDF in accordance with the following requirements:

- Prepare on Revit or CAD base from architectural layouts of the latest agreed revision number;
- Provide drawings to the actual service and equipment layouts;
- Drawings shall include the set-out dimensions from columns and the architectural boundaries;
- Penetration sizes shall be actual and include correct clearances and the allowance for insulation, flanges cable trays and the like;
- Nominate the building element and material being penetrated;
- Submit all penetration layouts to the Principal's Authorised Person;
- Overlay penetrations with duct work, electrical cabling, fire services and water piping drawings for full coordination of ceiling services before submitting drawing for review;
- All Contractor's drawings for distribution shall be submitted by the Contractor in reproducible electronic format to the Principal's Authorised Person;
- All drawings shall be in accordance with the project specific and client guidelines, the version of which is current at the date of acceptance of this contract;
- Unless noted to the contract elsewhere, the Contractor's drawings shall be 1:50 scale for floor plans and 1:20 scale for plant rooms and equipment details.

Where necessary further copies of drawings shall be submitted to the appropriate authorities.

Drawings are required for:

- Manufacturer's drawings of purpose made equipment;
- Details of labelling and engraving;

Revised Contractor's drawings shall be submitted by the Contractor, if requested.

Refer to the Contractors Drawing Definitions section for further information on what is required for each drawing submission.

5.4 Samples

The Contractor shall submit for the review of the Principal's Authorised Person prior to commencing installation samples of all accessories, fitting and apparatus proposed to be used in the work and only such items as are approved may be installed.

Samples to be submitted include but are **not** limited to the following:

- Supply, return, transfer and Exhaust Air Fittings including plenums;
- Room Sensors, Control Stations and Switches;
- Items of equipment exposed to the public view / line of sight;
- Others to be notified by the Principal.

To facilitate a full understanding and visualisation of the proposed works some equipment will be required to be 'mocked up' to clearly demonstrate its installation method and coordination with other elements.

The Contractor shall make an allowance for amendment and resubmission to be made and ordering, fabrication or manufacture to commence in accordance to satisfy the Contract Program.

5.5 Electronic Submittal Procedures

All Contractors' submittals shall be transmitted in electronic (PDF) format. The intent of electronic submittals is to improve environmental impact and expedite the construction process by:

- Cost – reduced cost of paper, printing, time, and couriers;
- Time – reduced turn around and transfer time;
- Environmental – reduced use of paper, toner and transport.

The procedure can be further developed around the following proposal:

Sub-Contractors and Suppliers provide eligible electronic (PDF) submittals to Contractor via the agreed communication protocol. The Contractor shall review and apply electronic stamp certifying that the submittal complies with the requirements of the Contract Documents including verification of manufacturer / product, dimensions and coordination of information with other parts of the work. The Contractor shall transmit each submittal to the Architect/ Engineer via email/ web based project management system.

The Consultant / Principal's Authorised Person shall review the drawing / document providing feedback to the Contractor. When responding the consultant shall advise on the status of the document i.e.

- Status A: Contractor may proceed – No adverse comments from the consultant;
- Status B: Contractor shall note and incorporate the consultant's comments. The Contractor is however not required to resubmit the drawing / document;
- Status C: The Contractor may not proceed – Contractor to resubmit addressing the consultant's comments.

The electronic submittal process is not intended for colour samples, colour charts, or physical material samples.

See Acrobat Insider details for AEC Professionals for use of Stamps. Stamps shall be used to identify each party's comments.

File Size

Electronic attachments to an email shall total no more than 8 MB and shall be submitted unzipped. For electronic attachments greater than 8 MB, send them in multiple emails with specific identification in the subject lines after other required

subject-line information. Ensure that all email recipients can receive files of this size before sending them. Ensure that your own server storage can accommodate multiple email deliveries of this size.

5.6 Contractor's Drawing Definitions

5.6.1 Design Drawings

The contractor shall do a full detailed design drawing set including schematics at a scale of no less than 1:100 for review by the Principal.

5.6.2 Coordinated Workshop Drawings

Coordinated workshop drawings shall show the inter-relationship of two or more engineering services and their relationship to the structure and building fabric. The main features of coordinated working drawings shall be as follows:

- Plan layouts shall be to a scale of at least 1:50 and be accompanied by cross sections to a scale of at least 1:20 for all congested areas;
- The drawing shall make allowance for installation working space and space to facilitate commissioning and maintenance;
- The drawings shall be spatially co-ordinated and there shall be no physical clashes between the system components when installed, critical dimensions, datum levels and invert levels shall be provided;
- The spaces between pipe and duct runs shown on the drawing shall make allowance for the service at its widest point. Insulation, standard fitting dimensions and joint widths shall therefore have been allowed for on the drawing;
- The drawing shall indicate positions of main fixing points and supports where they have significance to the structural design or spatial constraints.

5.6.3 Installation Drawing

This is defined as a drawing based on the detailed design drawing or coordinated workshop drawing with the primary purpose of defining that information needed by the tradesmen on site to install the works.

The main features of installation drawings shall be as per co-ordinated workshop drawings plus:

- Allowances shall be made for inclusion of all supports and fixings necessary to install the works;
- The drawing shall make allowances for installation details provided from manufacturers' drawings;
- Allowances shall be made for plant and equipment. This includes any alternatives to the designer's original specified option that have been chosen;

- Ensuring that the required test points are incorporated to allow satisfactory testing, regulating and commissioning.

5.6.4 Manufacturer's Drawing

This is defined as a drawing prepared by a manufacturer, fabricator or supplier for a particular project, and which is unique to that project. Examples include drawings for ductwork, pre-fabricated pipework, control and switchgear panels and associated internal wiring, pre-fabricated plant, customized plant and equipment.

5.6.5 Builders' Work Information

This is defined as a drawing to show the provisions required to accommodate the engineering services which significantly affect the design of the building structure, fabric and external works. Also, drawings (or schedules) of work to be carried out by building trade and are required to be costed at the design stage, such as plant bases.

The critical criterion with builders' work information is that it includes all openings (or other provisions) which significantly affect structure, fabric or external works. Builders' work details Drawing to show requirements for building works necessary to facilitate the installation of the engineering services.

Builders' work details carry forward and confirm or refine the structurally significant items from the builders' work information, and also introduce new items that are not structurally significant, such as plinth dimensions for the actual plant items ordered.

5.6.6 Works as Executed Drawings

This is defined as a drawing showing the building and services installations as installed at the date of practical completion. The main features of the 'Works As Executed Drawing' shall be as follows:

- The drawings shall be to a scale not less than that of the installation drawings;
- Locations of all the mechanical, electrical and hydraulic systems and components installed including ducts, pipes, cables, busbars, plant items, pumps, fans, valves, dampers, control devices, strainers, terminals, electrical switchgear and components, security and fire sensors and control equipment;
- The drawing shall be labelled with appropriate pipe, duct and cable sizes, pressures and flow rates;
- The drawings shall have marked on them positions of access points for operating and maintenance purposes;
- The drawings shall not be dimensioned unless the inclusion of a dimension is considered necessary for location.

5.7 Operating and Maintenance Manual

Prior to the production of the 'Operating and Maintenance manuals', the Contractor responsible for providing the drawings shall allow for adequate time on site to liaise with the Client to reach an agreed documentation standard.

The Contractor shall submit to the Principal prior to Completion Operating and Maintenance Instruction Manuals which shall comprise a description of each installation, its operation and the regular operating and maintenance routines to be adopted.

Two (2) electronic sets of Operating Instruction Manuals shall be provided, adequately sectioned and annotated into volumes and referenced.

Where specialised reading software is required, the reading software shall be provided without charge – this shall be Adobe Acrobat of the latest and current version.

The Content of O&M Manuals:

- The purpose of the installation;
- Installation records;
- Description of the installation;
- How the installation is to be used;
- How to keep the installation operational;
- Maintenance schedules;
- How the installation may be changed;
- Disposal of the installation.

The following sections set out a presentational sequence for an O&M manual, describing what is required under each heading.

Contractual and Legal Guides:

The contractual and legal records of an installation shall include:

- The name and address of the installation;
- Details of local and public authority consents;
- Details of the design teams, consultants, installation contractors and associated sub-contractors;
- Dates for the start of the installation, for handover (practical completion) and for the expiry of the defects liability period;
- Information on all guarantees affecting components, systems and plant items, together with expiry dates and names, addresses and telephone numbers of relevant contacts.

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

- Test certificates;

- Manufacturers' guarantees and warranties;
- Insurance inspection reports;
- Safety and fire certificates.

A clear statement shall be made in this section concerning hazards and safety precautions of which the operators and maintainers need to be aware. This shall include:

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

Overall Purpose

This section shall provide a general overview of the original design intent (available in outline from the design brief and in detail from the specification). It shall include a summary for each engineering system installed, giving:

- The parameters and conditions within which it has been designed to operate a system;
- The type of each service (gas, electricity and water) required to operate a system;
- The intended method of control. The section shall be kept as brief as possible.

Description

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

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

Equipment Schedule

The type, model number and serial number of all component items within the system shall be listed, together with the names of their respective manufacturers or suppliers.

Parts Identification and Recommended Spares

This shall comprise a parts identification list detailing and identifying replaceable assemblies, sub-assemblies and components. It shall include suppliers' recommendations for both spares and running spares (parts required for replacement due to wear or deterioration).

Items normally held in stock by a supplier, or for which a refurbishment service is available, shall be identified separately.

Spares Policy

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

Commissioning Data

The results of all commissioning work and associated tests shall be given. This shall include:

- Measured data;
- Measurement points;
- Test equipment used;
- Details of calibration certificates;
- A statement of whether design requirements were achieved.

Operation

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

- A recommended strategy for operation and control;
- An outline of the general operating mode;
- Control data (location, effect, object, sequence, limits of capability, modes, set-points);
- Standard operating and emergency operating procedures, and sequences for start-up, miming and shut-down, under normal and emergency conditions. These shall be accompanied where possible with photographs or video recordings of the standard operating and emergency operating procedures;
- Interlocks between plant items;
- Operating procedures for stand-by plant;
- Precautions necessary to overcome known hazards;
- The means by which any potentially hazardous plant can be made safe;
- Target figures for both energy consumption and energy costs;
- Forms for recording plant running hours, energy consumption and energy costs.

Maintenance Instructions

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

- The isolation and return to service of plant and equipment;
- Adjustments, calibration and testing;
- Dismantling and re-assembly;

- The exchange of components and assemblies;
- Dealing with hazards that may arise during maintenance;
- The nature of deterioration and checks for defects;
- Special tools, test equipment and ancillary services.

Maintenance Schedules

Maintenance schedules shall be provided for all preventive maintenance tasks. These shall be based on both manufacturers' recommendations and other authoritative sources (such as statutory or mandatory requirements). The schedules shall include:

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

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

The source of the schedules shall be stated, and necessary periodic inspections and tests for instance, local authority or supply authority purposes shall also be noted.

Modification Information

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

Information on permitted plant or system modifications allowed for by manufacturers or system designers shall be included for each system. Space shall be provided in the manual for the recording of all modifications and changes as they occur (this would initially comprise a series of appropriately headed blank pages).

Furthermore, it is essential that a procedure is devised and incorporated to ensure that all modifications are noted in every copy of the manual, wherever they are located.

Fault Finding

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

Lubrication

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

Disposal Instructions

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

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

Names and Addresses of Manufacturers

Details of all manufacturers and suppliers of equipment listed in the manual shall be provided, including name, address, telephone and fax number, e-mail contact and website. Any additional information likely to help the building operator make contact with, or obtain advice from, a manufacturer or supplier shall also be included.

Where appropriate, details of local stock lists of spare parts, replaceable assemblies or complete units shall also be provided. Details shall be arranged in alphabetical order of manufacturer or supplier name to provide a logical information-retrieval procedure.

Index of Plans and Drawings

An index shall be provided of all 'Works As Executed Drawings' supplied during the installation process, identified by number and title. The index shall also include a schedule of all drawings issued by manufacturers and suppliers during the course of the installation work, such as control panel wiring diagrams.

Emergency Information

An important feature of any manual is the emergency information. This information shall be located at the end of the document for ease of reference, and shall include name, address, telephone and fax number, and e-mail addresses of the appropriate contacts in the event of fire, theft or burglary, and gas, electricity or water failures, and leaks. It shall also list firms or staff to contact in the event of the failure or breakdown of plant, such as lifts, boilers or pumps.

Where applicable, the location of fire-fighting equipment, hydrants and rising mains shall be described. Special attention shall also be given to hazards particular to the building. Depending on client policy, a note of security installations may also be included.

Handover O&M Manuals

A complete set of all manufacturers' literature shall be provided for the plant and equipment installed, and assembled for each building services system.

This literature shall provide the following information:

Manufacturers Literature

- Description of the product as purchased;
- The cost and date of purchase;

- Performance-behavioural characteristics of the equipment in use;
- Applications (suitability for use);
- Operation and maintenance details;
- Labour, plant, materials and spatial resources required;
- Methods of operation and control;
- Cleaning and maintenance requirements;
- Protective measures;
- Labour safety and welfare associated with the equipment;
- Public safety considerations.

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

5.7.1 Training and User Guide

The Principal's nominated staff shall be fully instructed by the Contractor in the operation and maintenance of the installed services, and this shall commence with the commissioning of engineering services.

This instruction shall extend over the whole of the commissioning, running-in and maintenance periods and shall include "hands on" instruction to provide familiarity with the whole system. At the same time "class room" type instruction shall be given to cover major components.

The instruction shall be carried out by specialist engineers to the satisfaction of the Principal. Provide all certificates necessary to occupy and operate the building.

Perform all necessary training to ensure satisfactory operation of the system by the users of the system.

The training shall take the form of two (2) days on-site with six nominated end-users of the system covering all aspects of the operation of the installed System.

At the completion of the project and after the completion of commissioning, the Contractor shall provide the client with a set of clear instructions and operational procedures of using and running the systems.

The Contractor shall:

- Arrange a meeting with the client and other stakeholders to present the systems, how they function and how the instruction and operational procedures will enable the client to occupy and operate the systems successfully and efficiently, including any trouble shooting procedures;
- After the meeting, conduct a tour of the building to plant rooms or other relevant areas to familiarise the client and other stakeholders of equipment/system locations and access routes for operation and maintenance;
- At the end of the Defects Liability Period, arrange a meeting with the occupants, client and the Principal's Authorised Person to present how the systems have

functioned, illustrate that all defects have been rectified and maintenance have been carried out;

- After the meeting, arrange a tour to all plant rooms and other relevant areas to show that these have been maintained properly as per records and have been kept in a manner commensurate with the age of equipment (12 months old);
- Provide a User Guide for the building occupant.

5.8 Preventative Maintenance

The contract works shall be maintained in a complete and satisfactory working order during the twelve (12) months following Contract Completion Date. The Contractor shall be responsible for the supply and cost of all parts and expendable items during this period.

The Contractor shall maintain the plant in accordance with the duties listed in the Operating and Maintenance Manual.

5.8.1 Warranties

Refer to the main contract documents for the extent of the Defects Liability Period. In addition to the warranties required under the Defects Liability Period provide warranties on all services and systems, including installed reticulation systems, wiring systems and communication systems. Include the details of such warranties within the Operation and Maintenance Manual. All warranties shall include parts, labour, delivery, any re-testing and/or commissioning, removal and disposal of faulty parts. All warranty periods shall commence on the date of handover, the Contractor shall make any necessary arrangements with equipment suppliers to ensure of this requirement is met.

5.8.2 Certification

Prior to Contract completion, the Contractor shall provide to the Principal's Authorised Person one copy of a file containing all Certification required under the Contract, including but not limited to:

- All construction Certification provided by the Contractor's installers, including all support material as above;
- A covering certificate from the Contractor confirming the works comply with all relevant Codes, regulations and requirements;
- The file of Certification shall commence with a detailed list of contents, followed by the Contractor's Certificate, and then followed by general Certification;
- Annual Fire Safety Statement. At the end of the 12 months defects liability period the Builder/Contractor shall provide the Principal's Authorised Person with an Annual Fire Safety Statement for essentials services nominated in the Final Fire Safety Certificate.

6.0 Management of Works

6.1 Work Method Statement and Risk Management

The Contractor shall submit Work Method Statements for comment and review for each of the proposed sections of work. Detailed risk assessments shall form part of the work method statements. For each activity in the work method statement the risks shall be identified and control measures developed. The work methods, activities, identified risks and control measures shall be presented in a table format for easy examination by the Consultant and the Principal. A sample of the Contractor's work method statement shall be provided at the time of tender.

The work method statements shall address all necessary issues such as:

- Equipment deliveries and handling;
- Noise and Vibration;
- Clean and Clear work space;

6.2 Type and Manufacture of Equipment

Specific manufacturers or trade names or figure numbers mentioned in the specification are for the purpose of defining the required class of materials, quality, design or workmanship and thus alternatives may be submitted for consideration.

Where specific manufacturers or trade names or figure numbers are included in the specification the Contractor shall be responsible for the specified performance of the plant, equipment and materials and of the installations of which they form part. The Contractor should therefore obtain from such manufacturers or suppliers adequate guarantees in respect of such plant, equipment and materials.

Equipment manufacturers shall be as specified or approved equal in every aspect. If the Contractor wishes to submit alternatives, it is his duty to submit well documented evidence comparing the alternatives with that specified to substantiate the equality of the alternative.

Details of plant, equipment and materials of equal quality, workmanship, design and performance but of alternative manufacture may be submitted for the Principal's Authorised Person's review. Each such submission shall be entered in the appropriate schedule at the time of tendering and shall indicate:

- Alternative manufacturer;
- Type and/or figure number of alternative submitted;
- Other relevant details as to type, design and performance;

- The adjustments, if any, which would be affected due to the tender price if the alternative were approved.

The Contractor shall not order or install alternative plant, equipment and materials prior to the Principal's Authorised Person's written authority.

The new plant and equipment for the project shall be of similar configuration, component manufacture and control sequence to each other.

6.3 Location of Equipment

All equipment and services shown on the drawings are diagrammatic. The drawings shall not be scaled and actual locations shall be determined on site. The Construction drawings shall be consulted for actual spaces available and for building details before installing all equipment and services. The Contractor shall be responsible for site measurements.

Any modifications and deviations to equipment and services from those shown on the drawings shall be made where necessary to accommodate the services within the actual space conditions.

All equipment which shall be serviced, operated or maintained shall be located in fully accessible positions. Access doors shall be furnished as required for this purpose. If any equipment cannot be so located the same shall be brought to the attention of the Principal's Authorised Person.

The Contractor will at all times be fully responsible for the correct positioning and installation of all work and equipment installed by him in accordance with the specification and in consultation and co-operation with all other trades. No extras of any kind will be allowed if work and equipment has to be removed and replaced.

6.4 Pre-Assembly and Standardization

It is a key project initiative that consideration shall be given to pre-assembly and standardisation of the plant room's, risers and the like.

Standardisation is the extensive use of components, methods or processes in which there is regularity, repetition and a background of successful practice.

Pre-assembly is the manufacture and assembly of buildings or parts of a construction ahead of the time that they would traditionally be constructed on site.

The main benefits from pre-assembly are:

- Enhanced quality;
- Lower costs;
- Increased efficiency and speed;
- Improved predictability;

- Increased social and environmental benefits (safer and healthier working environment); and
- Ease of maintenance and replacement.

Volumetric pre-assembly/modularisation - This is a particular form of pre-assembly, which produces a complete volumetric unit, usually fully fitted out before it is placed in its final position in the building. Often units such as plantrooms lift shafts or service risers are installed within the buildings, but do not themselves form the building structure or fabric. This is the type of pre-assembly required on this project to be applied to the plant described within this documentation including associated equipment / pipework / fittings and the like to be frame mounted for transportation and fitting into place. All pre-assembled modules shall be tested and insulated at the works.

The Contractor is encouraged to adopt this approach in the procurement and construction methods.

The Contractor shall provide drawings, full method statements and proposals prior to commencement of assembly.

6.5 Off-Loading, Storage and Installation

The supply, delivery and supervision of off-loading, hoisting, transporting about the site, positioning and installation of all equipment and materials detailed in this Specification and indicated on the drawings shall form part of this Section of the Works.

Timely indication shall be given to any difficulties likely to be encountered in accommodating plant or equipment in the spaces available.

The Contractor shall:

- Deliver, off-load, store and transport about the Works all materials and products in the manner recommended by the relevant manufacturers;
- Provide adequate safe, covered storage and protection for all new materials and products;
- Store pipework, ductwork, conduits and similar products on properly made racks and adequately support to prevent bending and distortion;
- Close ends of pipework and ducts and the like, and protect threads by means of purpose made caps; and seal opens to prevent ingress of debris and dust
- Store gaskets carefully to avoid damage. Rubber gaskets shall be stored in a cool place, free from draughts or placed in boxes containing powdered chalk and stored in a cool dry place; and
- Protect electrical cables from physical damage and seal ends.

They shall be protected from damage by frost, water and building work with covers or other appropriate means. Materials and products shall not be stored by placing directly on earth or any other damp or corrosive surface.

Materials and products shall be adequately coated to prevent damage by oxidation etc., and this coating shall be maintained until ready for final finishing. Where materials and products cannot be stored in dry buildings, they shall be raised clear of the ground and supported.

Before heavy loads are to be moved across floors adequate notice of the proposed routes shall be given to the Principal to enable checks to be made on the strength and suitability of the floors for the proposed movement. Any such notice shall be given in sufficient time so that shall the strength of the floor be inadequate, arrangements for supporting the load can be made without delaying its movement.

Plant and materials shall not be deposited on roadways or footpaths, in corridors or rooms unless prior permission has been obtained in writing.

It shall be the Contractor's responsibility to provide adequate protection to all plant, equipment and materials during storage and installation; and subsequently in the period between installation and Completion.

Protection shall safeguard against such items as dirt, dust, weather including frost, damage by others, etc. The Contractor shall provide any temporary heating, ventilation or dehumidification necessary to discharge the protection requirements.

The Contractor shall ensure that the open ends of all items of plant, pipework, ductwork, conduits etc. delivered to site are suitably capped/blocked off to prevent the ingress of dirt.

In addition to the standard conditions of tender insofar as protection is concerned (i.e. protection of the whole of the installation during storage and during execution of the works) the protection of all items of plant, specialist equipment and machinery finishes and primer from damage by other trades on site and from frost or other weather conditions up to the time the building is handed over shall be included as part of the Works and shall include the following minimum provisions:

In the case of factory finished cubicle type equipment, all top and side edges shall be protected with timber battens forming angle sections with industrial felt packing between the timber and the plant. These protective angles shall be cross braced with further timber battens to form an open crate with additional protection over any particular fragile section, i.e. instruments, mimic panels, etc. The top surface of any such crate exceeding 0.30m² shall be completely boarded in. In addition, a strong transparent plastic sheet or bag of not less than 500 gauge thickness shall be arranged over or under the protective timber to provide a dust and damp proof membrane.

In the case of electrical control panels and like equipment, the Contractor shall allow for the provision and maintenance of temporary internal electrical heaters and for the cost of electricity and wiring thereto, in circumstances where the Principal considers that such equipment would otherwise deteriorate due to damp conditions prior to handing over.

Electric motors, starters, power boards and the like shall be enclosed in a plastic sheet or bag, as described above. All stainless steel equipment shall be covered with a non-PVC wrapper until handover. All ferrous parts shall be coated with grease.

When necessary to remove, or partly remove the protection for installation, or making connections to the plant, allow for replacing protection to the standard specified under this heading, immediately after the said operation is completed.

Allow for providing dustsheets as and where required. All bright parts of the plant which are liable to rust shall be covered with tallow for protection during the progress of the work. Upon completion this tallow shall be cleaned off and the parts polished. Accessory plates shall be protected up to the time of handover by a suitable plastic envelope.

6.6 Inspection and Testing at Works

The Contractors shall:

- Arrange for the inspection and testing of plant and equipment at the manufacturer's works;
- Provide test certificates and delivery to the Principal;
- Within a month of being awarded the contract, provide a full programme of all inspections required;
- Provide two weeks' notice to the Principal of the time of inspection and testing of each piece of plant or equipment.

6.7 Operation of Plant, etc.

The Contractor shall:

- Prior to the Certificate of Completion, ensure that working plant is doing so correctly;
- Provide skilled personnel to attend the plant etc. while working, together with such specialist personnel as are necessary for each circumstance.

6.8 Lifting and Cranage

The Contractor shall be responsible for the cost and coordination of all necessary ancillary work and arrangements associated with lifting new plant into the building and removal of old plant from the building.

6.9 Foundation Bolts and Alignment

Foundation bolts of the correct diameter and length, of the straight shank type, threaded at each end unless otherwise specified, shall be provided with a nut and square mild steel holding down plate at the lower end.

An approved type of self-securing lock nut at the upper end shall also be supplied for each item of equipment fixed to a concrete floor or base. The foundation bolts shall be carefully positioned and grouted into the floor or base of each item of equipment shall be aligned and levelled using steel shims.

6.10 Secondary Steelwork and Fixings

The Contractor shall provide and erect all secondary support steelwork for mechanical and electrical services. The Contractor is to comply with the following requirements concerning fixtures and fixings:

- Drilling of holes in structural members of roof-trusses, columns and beams will not be permitted;
- Welding of supports, hangers etc. will not be permitted without prior review of the Principal, where permission is granted full details are to be submitted to the Principal for comment prior to commencement of the works. The details are to indicate loads, method of support and stresses due to thermal expansion/contraction;
- Fixing to metal roof decking will not be permitted;
- Details of proposed fixings into the Structural Reinforced concrete brickwork and blockwork are to be submitted for comment to the Principal prior to installation. The details are to indicate the type of fixing, load being imposed and the forces exerted due to thermal movement of the services;
- Details of proposed fixings into Precast Pre-stressed Floors are to be submitted to the Principal for comment prior to installation;
- The load on the fixings is to be identified along with their locations. All fixings are to be located to avoid pre-stressing tendons;
- Details of all fixings and loadings whether covered by the above or not are to be submitted to the Principal for comment prior to work commencing;
- Mechanical fixings such as Lindaptors will be permitted. However, the location of these is to be submitted for comment to the Principal prior to fixing. The load being carried by the fixing is to be identified.

6.11 Seismic Provisions

The Contractor shall design the services supports in accordance with AS1170.4, using the methodology described in Section 8.

In carrying out the design of the supports, the Contractor shall:

- Refer to the NCC consultant report to obtain the building Importance Level;

- Where the Importance Level is 4, design all services supports with an Importance Factor of 1.5;
- Where the Importance Level is 1, 2, or 3:
 - Design general component supports with an Importance Factor of 1;
 - Design all components critical to life safety, which includes parts and components required to function immediately following an earthquake, those critical to the containment of hazardous materials with an Importance Factor of 1.5.

The Contractor shall obtain the following information from the Structural Engineer in order to carry out the design:

- The probability factor;
- The hazard factor;
- Site sub-soil class;
- Earthquake design category;
- Structural ductility factor;
- Structural performance factor.

6.12 Flora and Fauna

The Contractor is to:

- Consider the important Flora and Fauna at the site in the process of the demolition and construction; and
- Provide and adhere to approved work method statements that take into account the local natural environment.

6.13 Cleaning

The site and precincts shall be kept clean and tidy throughout the course of the Works and all rubbish shall be removed regularly. Outside air and return air plenums shall be kept clean at all times and shall be provided with construction filters, changed regularly throughout the duration of the Contract.

Prior to Practical Completion and at the conclusion of the Works, all debris and rubbish shall be cleared away and removed from the site and the completed installation shall be left thoroughly clean.

Where construction dust, dirt and debris has impacted on existing equipment, these shall be regularly and thoroughly cleaned throughout the course of the work to ensure no detriment to operation will occur.

7.0 Testing and Commissioning

7.1 Strategy

General

All testing and commissioning shall be carried out to conform to the particular requirements of this specification as well as the following:

- BSRIA Commissioning Guides;
- CIBSE Commissioning Codes covering;
- Manufacturers Recommendations;
- Standards, Regulatory and Authority Requirements.

The Contractor shall be fully conversant with the requirements of these codes and apply them to this activity. The Contractor shall allow full co-operation and provide a service online with the requirements of this section to complement this role.

Any equipment which is connected to essential power and is to operate under emergency power conditions shall be commissioned utilising emergency power. This will require close liaison, co-ordination and co-operation with other trades.

The commissioning process shall pass through a number of stages in parallel with the construction of the building and the procurement and installation of equipment. These stages in summary shall include planning, coordination of many different suppliers, manufacturers and installers, preparation of documentation, on and off site testing, pre-commissioning, commissioning, providing training, post-handover re-certification checks and post-handover maintenance and defects attention.

7.2 Programme and Method Statement

Following Contract award, the Contractor shall produce a commissioning method statement. This shall include named commissioning management structure, number of personnel and overall sequence of events. It shall also include a detailed programme that shall be co-ordinated with the main construction programme.

The Contractor shall produce a subsequent more detailed Programme/Method Statement based on the overall construction programme. This method statement shall be agreed with the Principal's Authorised Person prior to work commencing on site. Any comments made by the Principal's Authorised Person / Consultant shall not relieve the appointed Contractor of his obligation to satisfactorily complete the works in conformity with the overall construction programme.

The Contractor shall present its final commissioning programme listing all activities for each area element, system and sub-systems in complete detail for comment by

the Principal's Authorised Person / Consultant and other parties concerned.
Programme is to be on Microsoft Project or similar approved software.

The Contractor shall carry out a major review and update of the commissioning programme at each monthly thereafter, until services installation commences when updating shall be on a weekly basis, and if necessary revise and amend its programme to suit the progress of the works. Revised copies of the commissioning programme shall be provided for the consideration of the Principal's Authorised Person / Consultant.

The Contractor shall give adequate notice in writing of the date on which a test or the commissioning of any item or installation shall be carried out. The Contractor shall witness the satisfactory performance of plant and systems after its sub-Contractors have established the correct operation to its complete satisfaction. On completion of final commissioning the Contractor shall conduct all commissioning checks to confirm plant systems, building and equipment performance.

The Contractor shall ensure that all testing and commissioning records and documentation are handed to the main Contractor for compilation into the operating and maintenance manuals.

The Method Statement shall comprise a number of logical commissioning stages, showing the inter-relationship between various elements, systems, equipment, with critical dates being highlighted. A guide to the various stages of commissioning is as follows:

- Preparation and planning;
- Equipment tests at works;
- Tests on site;
- Ensure primary services such as power, water, fuel availability;
- Pre-commission checks;
- Clean and flush out systems;
- Clean Building;
- Permit to enter in place (Protective clothing);
- Preliminary plant run tests;
- Systems balancing etc.;
- Run tests;
- Final commissioning;
- Acoustic and lighting checks;
- Compatibility run tests with other systems (all systems);
- Emergency Shut Down and Start Up simulations;
- Principal demonstrations/witness/training;
- Reliability and Proving;
- Documentation transfer.

7.3 Commissioning Documentation and Procedures

The purpose of this section is to provide a framework for the testing, pre commissioning and commissioning procedures to be employed for the services installations, including specialist plant and systems, and other relevant building elements, taking due account of the overall work content and programme for the works.

All equipment, installations and elements shall be identified and cross-referenced with commissioning and test record sheets at the time of witness testing.

All applicable drawings shall be at a "Preliminary Records" stage for submission and use at the time of witness testing. (Full documentation associated with record drawings and operating and maintenance manuals are referred to in other sections of the overall specification).

The Contractor shall be required to provide both a management and operational input to ensure a smooth coordination of the efforts of all sub-contractors including specialist sub-Contractors.

The Contractor shall monitor the progress of the Contract works including changes to any items of specified equipment throughout the contract period and shall be responsible for ensuring that all required test points incorporated to allow satisfactory testing, regulating and commissioning.

The Contractor's duties in relation to this part shall include but not be limited to the following:

- Witnessing and confirmation reporting to the Principal's Authorised Person / Consultant that testing, pre-commissioning and final commissioning has been completed;
- Functional tests of all controls in collaboration with the controls specialists;
- Conduct environmental tests including monitoring of plant and systems;
- Functional tests on all room and enclosure integrity proving in collaboration with building and specialist trades;
- Compilation, preparation and presentation of operating manuals and record drawings;
- Off-site witnessing of tests and pre-commissioning of plant at manufacturer's works including all specialist plant and systems;
- Provide training and demonstration/operations;
- Maintain an on-site presence after Completion.

Specialist commissioning of plant and systems, shall be undertaken by the manufacturer's specialist commissioning engineer under the direction of the Contractor. The Contractor shall make due allowance for attendance and commissioning of plant items (and subsequent assistance during instruction and training of the building staff) by the manufacturer's specialist commissioning engineer under this Contract.

The work content and programme shall be based on the recommended procedures set out in the relevant documents. Reference copies of these documents (in duplicate) shall be held on site by the Contractor for use by all concerned.

It is emphasised that the work described here and elsewhere in this Specification shall in all respects comply with the spirit and intent of these documents.

In particular it shall be clearly accepted by the Contractor and the other trades that such procedures by their very nature are inherently repetitive and that in many cases repetition of tests will be required in order to achieve a standard compatible with that contained in the documents and acceptable to the Contractor/ Consultant. All parties shall be deemed to have priced their tenders accordingly.

The relevant documents to be used as a guide are:

- Those previously quoted;
- All relevant manufacturers' literature, in particular recommendations for testing, regulating, setting to work etc. In unusual cases where such methods are at variance with the basic principles of the quoted documents above, the approval of the Principal shall be obtained in writing regarding the exact procedure to be employed. In general however, the manufacturer's literature and recommendations shall be considered as complementary and/or supplementary and shall be incorporated into the basic methods set out in the CIBSE commissioning codes, BSRIA application guides, Statutory documentation etc.;
- During the commissioning contract period it shall be the duty of the Contractor to monitor changes to any of the above documents and to notify the Principal in writing within one month of such changes indicating the effect, if any, which such changes may have on the works if implemented.

7.4 Detailed Design for Commissioning

The Contractor shall take account of the requirements for all test points for equipment and controls and shall:

- Check that the provisions included in the installation/fabrication drawings and documents are satisfactory in type and quantity. In the event of deficiency this shall be notified in writing to the Contractor/ Consultant;
- Ensure that the location and manner of installation of all such items are satisfactory and in accordance with requirements and recommendations in the commissioning documents.

In particular the Contractor shall collaborate closely with other trades to ensure that the detailed design of all ductwork, all pipework (mechanical, hydraulic and fire trade), cable trays etc. as shown on the Contractors co-ordinated workshop drawings includes the necessary test points and access doors etc. to facilitate testing, regulating and commissioning and that these provisions are incorporated prior to submission of the Contractors Installation drawings.

Obtain necessary details of plant, equipment and controls from the trades and verify the details directly with the manufacturers or suppliers if necessary to ensure that adequate provision is made at the installation stage for testing, regulating and commissioning.

In cases where adequate provision is not so included, the Contractor will be responsible for notifying the Principal's Authorised Person / Consultant in writing giving his detailed proposals based on the commissioning documents, in adequate time prior to installation, for the consideration of the Principal.

All tests shall be made in the presence of the Principal's Authorised Person / Consultant or his representative.

Only certified and calibrated instruments shall be used for testing and commissioning. The Contractor shall also ensure that a representative of the equipment supplier is also present for all commissioning and testing.

When the Contractor is ready to commence tests, ten (10) working days' notice shall be given to the Principal's Authorised Person / Consultant or his representative to enable him to be present at such tests. Tests need not necessarily be commenced on the one day may be completed separately at the direction of the Principal's Authorised Person / Consultant.

All necessary labour, maker's representatives, instruments, manufacturer's literature and fuel shall be made available. Record manufacturer's name and model number of each instrument used in all tests and last date of calibration.

Electronic copies of all test results shall be submitted form to the Principal's Authorised Person / Consultant within two (2) weeks of completion of tests. Submit draft for review.

Tests which are to be carried out under certain atmospheric conditions may be submitted later. All test data will be tabulated with design requirements. All test data shall be signed and dated by the Contractor's representative, with details of his official position.

Note: The Contractor shall carry out the Testing and Commissioning as specified. The Contractor shall be expected to liaise with the relevant stakeholders throughout the construction, commissioning and defects liability periods.

7.5 Measurements

Shall be recorded and a report for inclusion in the "Operation and Maintenance Manuals" shall be provided to include at least the following:

- Date and time of test;
- The item tested the test procedures;
- The type of instruments used complete with NATA certification;
- The ambient and other relevant conditions;

- Instrument readings, control settings, valve position and the like;
- The nameplate rating and the like.

7.6 Seasonal Checks

The Contractor shall allow for carrying out a number of performance checks of the system (1 month after completion then every 3 months, 5 No in total). These checks will include full interrogation and analysis of set points and fine tuning/adjustment where deemed beneficial to ensure the control and building services systems operate appropriately and to their maximum efficiency. Reports shall be provided which indicate control set points and parameters as well as energy use of all systems. The external environment and weather station set points and control functions shall be given particular detailed analysis to ensure the building responds appropriately to the external environmental conditions of rain, temperature, wind speed and direction. Logs shall be taken of all internal and external conditions and included within the report. The Contractor shall liaise with the electrical / controls Contractor and seek guidance/direction where required to ensure the systems respond/function as per the design intent.

The Contractor shall allow for site attendance in order to carry out the analysis necessary to generate the reports. The Contractor shall liaise with the electrical / controls sub-contractor to coordinate all necessary work on site.

7.7 Final Checks

Prior to the issue of the 'Final Certificate' verify the performance of all safety and control functions of each system by way of certified report from the respective manufacturers or suppliers. Such checks shall be undertaken not earlier than one (1) month before the schedule expiry date of the Maintenance Period.

SPECIFICATION

STEENSEN VARMING



177025 High Court of Australia New Security Centre B. System Description - Mechanical



Engineering services enable architecture.
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1.0 Introduction

This system description document of the overall specification forms part of the contract documents and has been developed to outline to the Contractor the specific details of the building. It describes such information as the building description, design criteria, systems description, building performance requirements and extent of works. Its intention is provide general descriptions of the system design intent and provide an understanding of the systems documented on specification and drawings with an outline of what is required of the contractor in their interpretation of the documents, their implementation and construction of the works and the outcomes required in completing the project.

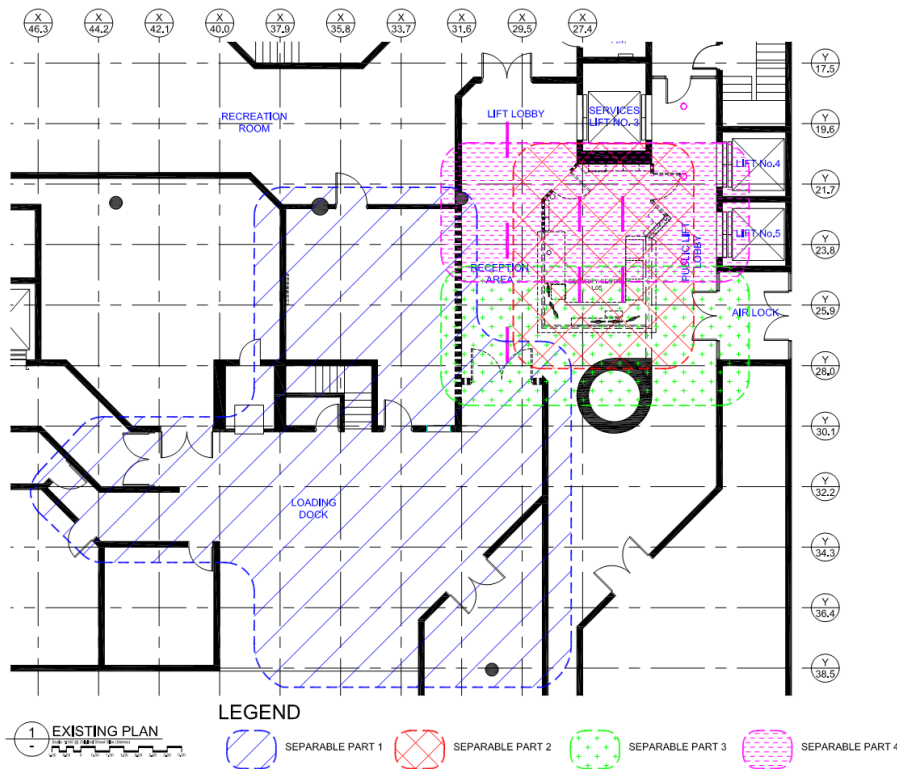
This system description document must also be read in conjunction with the accompanying:

- Section A. Preliminaries;
- Section C. Material and Equipment Clauses;
- Associated Drawings.

2.0 Project Description

The High Court of Australia is undertaken a refurbishment of its security centre located on the ground floor of the building. The existing security centre shall be demolished, and it is intended to be relocated in the proximities on the same floor. The refurbishment and relocation involve a new architectural partition in the existing recreational area (Gym) to accommodate the approximated 33m² security centre.

The proposed works are being staged so that the new security centre shall be operational prior to decommissioning the existing security centre. The lift lobby and new reception area fit out will commence once the existing security centre has been demolished. The image below shows the separable portions of the intended works.



The existing security centre ventilation system is provided by Air Handling Unit (AHU) AHU-4b located within plantroom 5 on the ground floor next to the new proposed security centre. The new security centre will remain served by the same AHU, however, the mechanical ductwork arrangement and ventilation shall be modified to satisfy the new security centre layout.

AHU-4b is a new unit and makes part of a mechanical upgrade carried out in 2018. This unit not only serves the existing security centre but also other zones between level 0 and level 1 (3640 L/s). A partition branch within this AHU runs down and

across the compactus area on level 0. At the end, branches out and rises back to level 1 adjacent to lift No.3 and into the existing security centre. The 425 L/s of supply air provides ventilation for the existing security office (325L/s) and the lift No.4 lobby (100 L/s).

It has been proposed during these works to remove any existing ductwork, mechanical fittings and replace them with new ones. The extent of mechanical services works is from the plantroom 5 existing wall opening delivering 400 L/s towards the new security office and from the floor slab opening next to lift No'5 into the new reception area and secure lobby.

The contract works include the supply, delivery, installation, commissioning, testing, certification and warranty of the mechanical services systems as described in the specification and the contract drawings

3.0 Mechanical

3.1 System Descriptions

3.1.1 Air Handling Systems

The proposed location of the new security office is adjacent to two existing fire walls to the north-west side. This comprises the back wall which separates the security office to plantroom 5 and escape fire stairs No.11. The existing supply air ductwork comes through an existing penetration circa 900x300mm on the plantroom wall.

The current design involves the use of 400 L/s from the available 605 L/s branched from the supply air duct in plantroom 5 redistributed into the security office and the use of the total 425 L/s available from the supply air branch rising from the compactus area into ground floor. The return air to the AHU-4b is through the existing return air grille located in the recreational area (gym). The return airflow requires the use of transfer grilles within the security office, the reception area and the secure lift lobby by means of non-vision door transfer grilles.

3.2 Systems Design

3.2.1 Design Parameters

Climate Zone

The site is deemed to be located in Climate Zone 7, in accordance with the National Construction Code.

Outdoor Design Conditions

Location:	Canberra, ACT
Elevation above Sea Level:	560m
Latitude:	South 35°17'
Latitude:	East 149°07'
Summer (non-critical areas):	35°C DB, 20°C WB
Winter (non-critical areas):	0°C DB, 0°C WB

Indoor Design Conditions

Summer:	22°C +/- 2°C dry bulb, 55% RH(Note: relative humidity is not controlled actively, but will mostly fall within a range of 50% - 70% as a result of air conditioning)
Winter:	22°C +/- 2°C

Internal Building Services Noise Levels and Duct Design

Recommended Duct Airflow Velocities, metre per second.

Services Noise Rating	Plant Room Riser Duct Velocity m/s	Main Duct Velocity m/s	Branch Duct Velocity m/s	Run Out Duct Velocity m/s	Internal Duct Velocity m/s
NR 50	12	g10	9.5	7	Not Required
NR45	10	9.5	8	6	Required
NR40	10	8	6	4	Required
NR35	9	7	5	3	Run-Out
NR30	8	6	4	2.5	Branch + Run-Out
NR25	8	5	3	2	All

Generally, the above takes precedence over pressure drop, however as a limiting factor pressure drops in the supply systems must not be greater than 1Pa/m and in return/ extract must not be more than 0.8Pa/m.

Vibration

Vibration levels in occupied spaces arising from the operations of the building services must be limited so as to ensure that consequent re-radiated noise does not cause the above internal building services limits to be exceeded.

Surface vibration velocity levels in occupied areas due to the operations of building services plant must not exceed 0.4 mm/s Root Mean Squared (RMS). Surface vibration velocity levels in plant rooms due to the operations of building services plant must not exceed 0.8 mm/s RMS.

Noise Breakout to the Community

Noise from all building services operating normally and together, when measured at the façade of the nearest noise receiver to the site must not exceed local authority and EPA requirements.

3.3 Mechanical Contractors Extent of Works

The extent of works involves the installation of new galvanised sheet metal ductwork at high level in the new security centre. Ductwork shall be jointed using drive slip (DS) joints and tight to the soffit. The new ductwork and fittings are to be painted matt white to match the ceiling and connected to the existing supply air ductwork within plantroom 5. Works will include installation of double deflection supply air grilles with adjustable blades and opposed blade dampers (OBD) for fine tuning mounted on the ductwork serving the security office.

Installation of a new wall mounted fire damper to maintain the integrity of the fire compartment and installation of an access panel to service the fire damper and new volume control damper (VCD). In addition, installation of required non-vision transfer grilles as specified in the attached drawings.

The existing security office DX split system shall be decommissioned, dismantled and safely removed from site including the removal and safe storage of the refrigerant. Disposal of the refrigerant shall be in line with the requirements of current regulations.

Removal of the existing floor slab fire damper, installation of a new fire damper to maintain the integrity of the fire compartment and installation of an access panel to service the fire damper. This opening was used to provide ventilation to the demolished security office and now will be used to supply air into the new supply air plenum serving the reception area and the lifts lobby. The supply air plenum shall be painted black in colour internally. No modifications are required for the ductwork running on the level below towards plantroom 5. Installation of one bar grille serving the reception area and one double deflection grille serving the lifts lobby. All new supply air grilles shall have OBD's, be balanced and be of ceiling and/or wall finish colour or as specified by the architect.

Installation of a new temperature sensor for monitoring/control in the security office and connection to the BMS. Relocation of existing temperature sensor serving the demolished security room in the new reception area. Before works commences in the reception area – separable portion 4, carefully take down and set aside the existing temperature sensor to be reinstated when required.

Builders works within the security office are part of the initial stage of works and need to be coordinated to provide operational conditions as per project schedule (e.g. weekend works). Construction and fitting of mechanical services in the reception area are part of the last stage. The existing air conditioning system is to be operational during construction of previous stages of work.

3.3.1 Mechanical Works

Where an item is usual or necessary and is reasonable or proper to be included in the type of work referred to in this Specification, but not specifically mentioned, it must be deemed to be included in the Contract.

The extent of work includes but is not limited to the following:

1. The contractor shall arrange to visit the job site during the tender period to familiarise themselves with the site conditions and to establish that there are sufficient clearances to allow the works to commence and to highlight any possible issues.
2. Staged de-commissioning, removal, replacement and commissioning approach to ensure downtime to the security centre is minimised.
3. Decommissioning and removal from site all redundant equipment.

4. Contractor to provide on a weekly basis an update of contractors' deliverables registers outlining information such as technical submittals, sample submissions, workshop drawings and Inspection and Hold points.
5. Sheet metal work including flat oval ductwork, dampers, motorised control dampers (as specified), hangers, flexible ducting, flexible connections, access panels, plenum box, clean-out panels in ducts, fire dampers, access for installation of smoke detectors in ductwork.
6. All ceiling diffusers, variable air volume flow regulators, pressure dampers, return air grilles, acoustic transfer grilles, exhaust grilles etc. (including all secure fixtures in high risk areas).
7. Supply of all door grilles, wall mounted grilles and wall mounted pressure stabilisers.
8. Protective painting and identification of all plant room equipment and all exposed pipework and ducting visible in public areas etc... Internal ductwork to be painted matt black where visible through grilles. All paint must be of low VOC type as required in Green Star IEQ-12.
9. All adhesives and sealants use must be low VOC.
10. Supply and installation of sleeves in penetrations in the building structure where required for the passage of pipes, ducts, conduits etc.
11. Acoustic treatment to penetrations through sound rated full height walls for ducts, grilles, air diffusers, conduits, pipework, sleeves, etc. as per the acoustic consultant's details and as designated (penetrations by building trade).
12. Fire/ Smoke seals to all mechanical penetration and penetration of mechanical services through fire, smoke rated walls.
13. Provision of return air transfer grilles and cross-talk attenuators between rooms and corridors (where shown on the architectural plans).
14. Balancing and commissioning of all mechanical systems including the provision of commissioning management services.
15. Full testing, commissioning and demonstration of performance of all systems to the satisfaction of the Superintendent. Provision of all test figures and test information derived from acceptance test. Qualified technicians to be included for the testing and commissioning period.
16. Provision of all types of insurance required under this contract.
17. Coordination with other trades.
18. A Defects Liability Period of 12 months, during which all defects arising must be rectified free of charge and at the most expeditious manner.
19. Workshop Drawings, and 'as installed' drawings. Full operating and maintenance instruction manuals prior to Completion a manual must be provided for mechanical services and a separate one must be provided for BMS.
 - i. System submission for consultants review
 - ii. Equipment submission for consultants review
 - iii. Working drawing submission for consultants review
 - iv. Completion and rectification of defects
 - v. Testing and commissioning, final testing and witnessing by the Superintendent and their representative
 - vi. The Superintendent and (or their representative) will require 10 working days to check any submissions.

3.3.2 Work Associated with Mechanical Services

These lists are for assisting the Mechanical Contractor and their trades at interface points and do not form part of the Mechanical Contractor's scope unless noted otherwise.

3.3.3 Building Trade

1. Provision of penetrations through floors, ceiling, walls and roof for ductwork, pipework conduits, sleeves, etc. and make good around all penetrations after installation.
2. All permanent access openings and removable access panels in ceilings, walls, shafts etc. Panels to be fire rated where part of a fire wall, fire stopping, Sealing around acoustic penetrations.
3. Provision of clean, air tight bulkheads for the passage of air, complete with suitably sized access for regular cleaning.
4. Installation of door grilles, Wall mounted return air and transfer grilles and undercutting of doors (door grilles supplied by Mechanical Contractor).
5. Provision for rubbish collection and dumping from all working floors and for regular rubbish removal from site.
6. Provision of 230 volts power for mechanical trade for his use in operation of hand tools, welding equipment etc.
7. Provision of 400/230 volts, 4 wire power for balancing and testing of the plant, also outlets for temporary lighting.
8. Making good after chasing, drilling and placing of sleeves etc.
9. All building services risers, plantrooms and systems must have adequate passive fire and smoke segregation. Ensure all services plantrooms, penetration risers and cupboards are provided as required by the relevant codes and fire engineer's report.

3.3.4 Mechanical Contractor Requirements

The mechanical contractor shall provide the following information to the services Consultant/Client to incorporate in the Building Users' Guide.

- Completed Ventilation Schedule as shown below. Temperature, time schedule and temperature set points must be noted for each season i.e. summer, winter and mid-season;

HVAC	Summer	Winter	Mid-season
Temperature control	[natural ventilation/BMS]	[natural ventilation/BMS]	[natural ventilation/BMS]
Time Schedule	[00:00 – 24:00]	[00:00 – 24:00]	[00:00 – 24:00]
Temperature Set points	[Temp degrees C]	[Temp degrees C]	[Temp degrees C]

- Provide a key/legend referencing symbols shown on the floor plan.

3.3.5 Interfaces with Other Disciplines

The installation of a new temperature sensor in the security office and relocation of the existing temperature sensor shall be linked to the existing BMS network. The temperature within the security office is determined by the average reading of its temperature sensor and the temperature sensor located in the recreational area (Gym). This will not only be used for monitoring but also to determine the heating required through the heating coil for this zone.

The existing sensor that is to be relocated maintains its control/programming set-up unchanged.

The operating hours of the security office are 6:00am to 10:00pm during weekdays and Sundays from 11:00am to 4:00pm. Only during these hours, the security office will be conditioned. It is understood the schedule operating hours for all mechanical plant it is as follows:

Start	End	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
6:00 AM	6:00 PM	√	√	√	√	√		
12:00 PM	4:00 PM							√

Therefore, the system shall be controlled to enable the CHW and HHW pumps to recirculate water from 6:00pm to 10:00pm during weekdays. By doing so, all the residual energy in the system it is used to provide cooling or heating without the need to start chillers and/or boilers.

3.3.6 Building Communications Systems

The BMS must supply and install all cabling, panels, control devices, transducers software and hardware to all field points, DDC panels and supervisor terminals. The Building Communications subcontractor will retain an area on a wall in each telecommunications room/ closet for a field point panel.

When I'm working on a problem,
I never think about beauty. I think
only how to solve the problem. But
when I have finished, if the solution
is not beautiful, I know it is wrong.
Richard Buckminster Fuller

Mechanical Engineering
Lighting Design
Sustainable Design
Electrical Engineering

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SPECIFICATION

STEENSEN VARMING



177025 High Court of Australia New Security Centre C. Material and Equipment - Mechanical



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STEENSEN VARMING

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STEENSEN VARMING

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1.0 Introduction

This material and equipment document of the overall specification forms part of the contract documents and has been developed to outline the Contractors the specifications of the equipment that is to be installed, including the maintenance requirements.

This material and equipment document must also be read in conjunction with the accompanying:

- Section A. Preliminaries;
- Section B. System Descriptions;
- Associated Drawings.

1.1 Overview

Each item of equipment must be of approved make, design and construction, complete with all accessories and fittings as indicated in drawings and specification or as required for satisfactory performance of equipment.

All equipment must be constructed and installed to comply with this specification and/or any other governing authority and/or specification, and the Superintendent's requirements.

All relevant equipment must comply with the latest Minimum Energy Performance Standards (MEPS) Regulations.

All motors must be high efficiency to AS 1359 and comply with NCC Section J.

All fans (including associated drives, motors and other ancillary connections/accessories) whether standalone or part of an air handling unit, if required to be part of a smoke hazard management system, must be fire rated to perform all duties to the requirement of relevant Australian and NCC requirements.

1.2 Warranty Period

The Warranty Period shall commence at the date of Practical Completion and run for a period of twelve (12) months. All items of equipment installed shall be covered by Warranty for the whole of the period mentioned above.

Replace any item of equipment or part thereof, in the shortest possible time to ensure minimal inconvenience to the Principal.

1.3 Testing and Commissioning

In addition to the testing and commissioning section as outlined in the Preliminaries section of the overall specification the Mechanical contractor shall conform to the additional commissioning specification requirements.

1.3.1 Commissioning of Air Handling Systems

The air handling systems, including packaged air conditioning units, mechanical ventilation and exhaust systems and toilet exhaust systems must be cleaned and tested.

Each complete system must be commissioned by carrying out an approved systematic routine of procedures to bring each system into full operation in accordance with 'Air Balance' subsection.

All flow rates must be finally adjusted through all equipment.

All automatic volume dampers must be set for the minimum air quantities and recorded.

Sound testing must be carried out to achieve design sound levels as specified in the mechanical general section of specification.

1.3.1.1 Air Balance

Ambient conditions of temperature and humidity must be recorded together with the test results for each day.

Perform the tests and balance the system in accordance with the following requirements:

Procedures:

- Air balance procedure must be submitted and approved by the Superintendent prior to commencement;
- Check direction of rotation of fan;
- Test and adjust for design air flow from fan within +10%, -0%;
- Test and adjust for design recirculated air flow within +10%, -0%;
- Test and adjust for design outside air volume within +10%, -0%;
- Adjust all main supply and return air ducts to design air volume within +10%, -0%;
- Adjust all zone supply and return air ducts to design air volume within +10%, -0%;
- Test and adjust each diffuser, grille and register to within +10%, -0% of design requirements;
- Test and record supply air temperature (WB and DB heating and cooling);
- Test and record leaving air temperature (WB and DB heating and cooling);

- Adjust each outlet to provide proper throw, distribution and terminal velocities in the working zone in excess of 0.375 m/second are to be reported to the Superintendent;
- Test and record system static pressure, suction and discharge;
- Ensure that setting has been carried out for automatically operated dampers etc., to operate as required in conjunction with the automatic controls installed;
- Prepare a report of air volumes from all inlets and outlets together with comments on any aspects of the installation or operation requiring attention.

1.3.1.2 Commissioning of Volume Control Dampers

Each volume control damper must be set and sealed.

Manual dampers must have the air balance position marked in red paint.

Verify and sign off on test sheet.

1.3.1.3 Commissioning of Fire Dampers

Each fire damper must be checked to ensure the fusible links are set. Check access panels.

1.3.2 Commissioning of Automatic Controls

All controls must be calibrated in accordance with approved Contractors equipment supplier's documents.

All equipment must be set and adjusted as follows:

- All set points must be verified by measurements of the controlled medium;
- All valves and dampers motors must be adjusted for correct sequence and spring range operation;
- All switches must be calibrated for correct set point and switching differential;
- All safety and alarm circuits must be proven by operation or simulation of an alarm or unsafe condition;
- All points to be individually tested;
- All points must have alarms attached;
- All pressure reducing stations set for the correct pressures;
- Each system must be demonstrated to operate as specified.

All control instruments must be finally adjusted, set and sealed in conjunction with manufacturer's recommendations.

Verify and sign off on data sheet.

1.3.3 Instruments

Each thermometer, pressure gauge and temperature gauge must be commissioned by checking the calibration against NATA certified instruments, setting all pointers and marking the set point.

Each pressure differential gauge across each filter bank must be commissioned by setting and sealing the bezels. Verify and sign off on data sheet.

1.4 Sheet Metal Work / Ductwork

Sheet metal work must include ducts, drain pans, sumps, supports, flashings, and all items to complete the installation whether actually indicated or not in the specification or drawings.

The complete installation must be to the Superintendent's Review. If any work does not comply with the requirements of the Superintendent; the Mechanical Contractor must remove, alter, amend and re-instate the sheet metal work as determined by the Superintendent.

Sheet metal work must be constructed with new Lysaght "Galvabond" galvanised steel sheet or other metals if approved.

All ductwork construction must be in accordance with the requirements and recommendations of the latest editions of the appropriate Duct Construction Standards of the ASHRAE Guide and Sheet Metal Construction Manuals issued by the Sheet Metal and Air Conditioning Contractors National Association Inc., USA, (SMACNA) except where specified otherwise. All ductwork must be constructed and installed as per the requirements of AS4254.

All ductwork including casings, housing, plenums and chambers for low or medium pressure systems with greater dimensions in any direction between 1,000mm and 1,500mm must be not less than 1.6mm thick.

1.4.1 Delivery and Protection During Installation

Ductwork sections must be delivered to site with ends taped and sealed to prevent ingress of dust and other contaminants. Ends of partially installed ductwork lengths must remain capped and sealed during the construction process.

1.4.2 Standard

- Ductwork: AS4254.

Proprietary and Non-standard Systems

- Standard: Conform to functional criteria in AS4254.

Fire Hazard Properties

- General: Submit evidence of conformance with the following:
- Fire hazard indices for all materials when tested in conformance with AS/NZS1530.3:
- Spread of flame index: 0.
- Smoke developed index: ≤ 3 .
- Facing materials when tested to AS1530.2:
- Flammability index: ≤ 5 .
- Assembled duct systems: Pass the UL181 burning test.
- Fire protection of duct systems: Achieves the required FRL to AS1530.4.

Sealants and Tapes

General: Submit type-test certificates showing conformance with the following standards:

- Sealants: To AS/NZS1530.3;
- Tapes: To AS4254 clause 2.2.1.

1.4.3 Materials and Components

Corrosion Resistance

General: Conform to the Corrosion Resistance Table for the relevant Corrosivity Category as applicable to the site. Alternatively, provide proprietary products with metallic and/or organic coatings of equivalent or higher corrosion resistance.

Corrosivity Category	Situation	Fire, smoke and motorised dampers	Ductwork
Low	Internal	Metallic-coated sheet Z275/AZ150	Metallic-coated sheet Z275/AZ150
	External	Metallic-coated sheet Z275/AZ150	Metallic-coated sheet Z275/AZ150
Medium	Internal	Metallic-coated sheet Z275/AZ150	Metallic-coated sheet Z275/AZ150
	External	Stainless 316	Metallic-coated sheet Z275/AZ150
High	Internal	Stainless 316	Metallic-coated sheet Z275/AZ150
	External	Stainless 316	Stainless 316

External Situation Includes:

- Ductwork outside the building;
- Fire, smoke and motorised dampers in ductwork outside the building;

- Fire, smoke and motorised dampers located in the discharge air path within 3 m of the point of discharge from the building;
- Fire, smoke and motorised dampers located in the outside air or mixed air/recycle air path up to the filters.

Internal Situation Includes:

- Ductwork inside the building not included in external situation.

Adhesive Duct Tapes:

- Marking: Label 'Compliant with AS4254' at least every 200 mm;
- Adhesive: Non-toxic, high tack, synthetic pressure-sensitive type;
- Liner: Silicone coated paper;
- Backing: Aluminium foils laminate.

Sheet Metal Ductwork:

- General: Galvanized steel duct and mild steel components ← 3 mm thick: Prime quality lock forming galvanized steel, Grade G2 or G3 to AS2338 with Z275 coating to AS 1397;
- Thickness: To AS 4254.

Components for stainless steel and aluminium ductwork: Use materials with corrosion resistance not less than that of the duct wall material.

Fasteners:

- Rivets: Expanding solid end type, aluminium base alloy for galvanized duct, stainless steel for stainless steel duct, minimum size as follows:
 - For sheet metal to sheet metal: 3 mm;
 - For sheet metal to supports, brackets and rolled steel angles: 4.8 mm.
- Self-tapping screws: Zinc-plated for galvanized duct, stainless steel for stainless steel duct;
- Self-drilling and tapping screws: Zinc-plated for galvanized duct, stainless steel for stainless steel duct. Provide only if base material into which they screw is thicker than 1.5 mm and they are unlikely to be removed or replaced;
- Bolts, nuts, washers and drop rods: Zinc-plated steel, service condition number 2 for galvanized duct, stainless steel for stainless steel duct. Parts on stainless steel duct not in contact with air stream or corrosive conditions may be zinc-plated as for galvanized duct. Provide washers under nuts and bolt heads.

Duct sealing:

- General: Seals must be in general accordance with AS4254 and the Duct seal class table, but must include all openings in the surface, transverse joints and longitudinal seams to prevent air leakage;
- Duct seal class: Not lower than Class B to AS4254 regardless of duct pressure or location.

Sealant Materials

Use only sealants that:

- Do not foster microbial growth;
- Have a smoke developed index 3 and a spread of flame index 0 when tested to AS/NZS 1530.3;
- Will maintain their sealing performance for the life of the duct system;
- Bond to the surface of application without primers;
- Are resistant to oils, refrigerants and water after curing;
- Are non-toxic;
- Have high elastomeric properties over the range of operating temperatures after curing;
- Are suitable for application by gun or hand tools.

Adhesive duct tapes: Use only as a secondary sealant on joints sealed by other means such as mastic, liquids or gaskets. Do not use duct tapes for non-sealant purposes.

Machine rolled flanges: Use mastic at corners.

Duct Seal Class Table

Duct location	Seal class to AS4254 Table 2.2.1			
	Supply ducts		Exhaust ducts	Return ducts
	(Static pressure classification Pa)			
	<500	> 500		
Outdoors	A	A	A	A
Unconditioned spaces	B	A	B	B
Conditioned spaces (concealed ductwork)	B	B	B	B
Conditioned spaces (exposed ductwork)				
- Office-type spaces	A	A	B	B
- Factory-type spaces	B	B	B	B

Protection of Ductwork

Sprayed Coatings

- Type: Fire resistant sprayed coating to achieve the required FRL when tested to AS1530.4. Provide additional cement hard set finishing coat in locations requiring protection against damage or water.

Composite Systems

- Type: Wraps or modular duct systems to achieve the required FRL when tested to AS1530.4.

Access

- Fire damper access: Where access is required to the duct interior such as at fire damper access panels, damper quadrants etc. provide easily removable panels of FRL equivalent to the required FRL of the duct.

For items such as smoke exhaust and kitchen exhaust fans that are too large or heavy to remove through access panels provide a fire rated enclosure around the item with fire rated doors or removable fire rated panels large enough to permit removal of the item.

Certification

General completion submit certification that the installed ductwork fire protection meets the required FRL for their parts in the building when tested to AS1530.4 and AS1668.1

1.4.4 Flexible Connections

General

- General: Isolate fans and conditioner casings from ductwork, by means of airtight flexible connections;
- Materials: Heavy duty, waterproof;
- Length: Provide sufficient slack to ensure free movement and vibration isolation under operating and static conditions;
- Alignment: Align openings of connected equipment;
- Fixing: Fix to attachments with metallic-coated steel strip. Seal joints. Do not paint flexible material;
- Fire protection: To achieve the FRL of the attached duct when tested to AS1530.4;
- Maintenance: Arrange to permit easy removal and replacement without disturbing ductwork or plant;
- Restriction: Do not protrude connections or frames into the airstream where this would be detrimental to the air flow.

1.4.5 Installation

Arrangement

Arrange ductwork neatly. Provide access to ductwork components which require inspection, entry, maintenance and repairs. Where possible arrange duct runs adjacent and parallel to each other and to building elements.

Ductwork runs shown on the drawings are diagrammatic only and the complete installation must be neatly erected and spaced. All work must be laid out at the building, taking all measurements the construct the work to meet the actual building conditioning.

Crossovers, transitions, offsets and changes in duct shapes must be installed to avoid interference with other services and obstructions. In all cases equal air flow resistance of all ducts must be maintained.

A minimum clearance of 150 mm between duct joints, flange or duct insulation and the underside of all hung false ceilings must be maintained to provide access for installation and relocation and servicing of light fittings unless shown otherwise on the drawings.

All ends of ductwork must be covered during construction and ductwork must be inspected internally prior to erection to remove all dirt, dust and any foreign matter.

Ductwork must not be penetrated by any other service unless deemed absolutely necessary. In such cases 'tear drop' sheet metalwork fairings must be installed carefully shaped around the service and the ductwork sealed at the penetrations.

Floor of roof slabs of waterproof construction must not be penetrated by retaining bolts or inserts. The approved method of securing will be checked by the Superintendent.

Sheet metal work with spot welds must be wire brushed and treated with cold galvanised paint.

Stainless steel sections and drain points must be provided in any duct where water from outside may accumulate.

Ducts connecting to external louvres must be fully sealed to rear of louver and sloped to drain to waste.

Spacing

Provide minimum clear spacing, additional to duct insulation, as follows:

- 25 mm between adjacent ducts;
- 25 mm between duct flanges or upper surfaces of ducts and undersides of beams and slabs;
- 50 mm between ducts and electric cables;
- 150 mm between ducts and ground, below suspended floors.

Motorised Dampers

- Maintenance access: Locate dampers and damper motors in accessible positions, for blade and motor maintenance and blade seal replacement;
- Mounting: Sufficiently rigid to prevent flexing or distortion of the frame or ductwork during operation;
- Operation: If 2 sets of dampers are connected to a single motor, provide linkages which allow either damper to be adjusted without affecting the other.

Cleaning

During installation progressively remove construction debris and foreign material from inside ducts.

Drainage

Provide drainage to AS/NZS3666.1 at locations in ductwork where moisture may accumulate including at outside air intakes.

1.4.6 Ductwork Supports

Sheet metal work must be adequately supported using hanger, brackets etc... And fixings suitable for the building structure. All ductwork must be supported off structural beams.

Supports must be straight, true and aligned and located where possible away from fittings.

Exposed Round Ducts: Where round ducts are exposed to general view, provide an internal half round band 75mm wide and 4.5mm thick with stiffening bars of the same material. Locate bands at support points. Provide a support passing through the top of the band with lock nuts inside the duct and a nut on the top external surface of the duct.

Concealed Round Ducts: Support horizontal ducts by stirrup type or split ring type supports with 10mm cadmium plated bolts and hanging rods.

Types of supports and fixings must be approved before installation.

All rectangular ductwork under 750mm in width must be supported by 25mm x 1.5mm flat iron brackets extending underneath the full width of the duct.

Ducts passing through walls, partitions and floors, except those with spring hangers, must be secured to angle iron frames by rivets or screws.

For fixing of supports and spacing's, refer to SMACNA Sheet metal Constructions Manual.

Under-Flashing and Over-Flashing

Under-flashing for roof will be carried out by the building trade. Mechanical trade must furnish and install over-flashing consisting of 0.8mm thick zinc which must be brazed all around and lap over the flashing a minimum distance of 100mm.

1.4.7 Ductwork Joints, Seams, Fittings, etc.

All round elbows in rectangular ducts must be full radius. Throat radius must be equal to 3/4 of the duct dimensions in the direction of the turn.

All square elbows must have short chord turning vanes. The vanes must be 40mm maximum radius and be spaced at a distance equal to half the radius. Turning vanes must be Barber Coleman 'Air turns' or approved equal.

All damper quadrants, control instruments or any other device mounted on insulated ducts, plenums or casing must be provided with sheet metal stools so that the device is flush with outer surface.

All transverse joints and longitudinal seams must be sealed with 'Isoclad' duct sealer as per manufacturer's recommendation. Prior to application of sealer, clean all joints with 'Emer Clean' as manufactured by Emery Chemical Pty Ltd or approved equal.

Preferred jointing method is Drive Slip (DS). A sample must be submitted for review.

All ducts over 450mm in either direction must be cross-broken excepting those to which rigid board insulation is applied.

1.4.8 Balancing Points

Balancing points (pressure tapping points for system balancing) must be located downstream of any main branch from the main duct where flow balancing is required. For duct pressure up to 0.6kPa, 25mm diameter holes sealed with rubber gaskets must be provided. For duct pressures over 0.6kPa, 25mm screwed sockets must be provided.

All balancing points must be provided in readily accessible position upstream of any volume control damper but not less than seven (7) duct widths down-stream of a volume control damper or bend.

Balancing points must be distributed evenly across the duct side as follows:

Largest side of duct	230mm	1 opening
	231mm - 380mm	2 openings
	381mm - 600mm	3 openings
	601mm - 1200mm	4 openings
	Above 1200 mm	5 openings

Access

Provide suitable access doors and panels where shown on the drawings, where specified by Code requirements and where required for maintenance access or operation.

Coordinate all access through architectural elements to these points with the building trade.

1.4.9 Access Panels

Sizes

Access panels: Minimum clear opening:

- Personnel access: 450 x 600 mm;
- Hand access: 200 x 300 mm.

Construction

Construct access panel in accordance with SMACNA.

- Type: Double panel, deep formed, zinc-coated steel construction, insulated to match the duct;
- Cold bridging: Arrange to prevent condensation on cold surfaces;
- Frames: Provide rigid matching galvanized steel frames securely attached to the duct. Do not protrude any part of the panel or frame into the airstream;
- Seals: Silicone rubber or soft neoprene gaskets mechanically fixed to either the panel or the frame to ensure an airtight seal against the operating pressure when latched in the closed position. For fire rated seals, provide woven ceramic fibre material;
- Latches: Wedge type sash latches.

Number of latches:

- For personnel access: 4;
- For hand access: 2.

Handles: Provide a 'D' handle on access panels for personnel access.

Location

Provide access panels in the following locations:

Next to each component located inside the duct requiring regular inspection and maintenance including, but not limited to:

- Fire and smoke dampers;
- Smoke detectors;
- Motorised dampers;
- On the air entering side of electric duct heaters and duct mounted heating coils;
- In air handling units where unit size is insufficient to fit an access door;
- Where specified in Kitchen Exhaust Ductwork;
- In the vicinity of moisture producing equipment, to AS3666.1 clause 2.11.3;
- In other locations specified and/or shown on the drawings.

1.4.10 Access Doors

Provide an access door in each section of ductwork and air handling unit where access is required for maintenance, inspection or removal of components. Removable panels may be used instead of doors where access is required only for removal of coils.

Provide access doors also where shown on the drawings and as specified by Code requirements

Access doors must be exactly located with respect to their respective equipment.

The Mechanical Contractor must submit locations, size and design of all access doors in finished surfaces and exposed areas to the Superintendent for review based on approved workshop drawings in good time to enable them to be incorporated into the construction.

The Mechanical Contractor must ensure that all necessary access doors are provided and whilst it is anticipated that sufficient access doors have been detailed, the Mechanical Contractor must install any and all doors which will be required for the efficient installation and maintenance of the work.

Sizes

- Minimum clear opening: 1,350 mm high x 600 mm or larger to permit safe removal of equipment inside the section.

Construction

Provide rigid, reinforced access doors, in accordance with SMACNA.

- Thickness: 50 mm.

Construction, provide either:

- Sandwich panel: As specified for wall and ceiling panels. Form door edging with a heavy gauge aluminium extrusion with double web seal to both skins. Mitre corner and firmly secure to panel with countersunk head screws.
- Folded: Two-piece press formed or machine folded from ≥ 1.6 mm zinc coated steel.
- Door swing: Against air pressure. Doors on the inlet side of the fan to open outwards. Doors on the discharge side of the fan to open inwards.
- Cold bridging: Arrange to prevent condensation on cold surfaces.
- Jamb, stiles and head: Rigid matching ≥ 2.5 mm zinc coated steel, or ≥ 3.0 mm fibreglass securely mounted.

Door hardware:

- Catches: Provide ≥ 2 heavy duty proprietary clamping-type latches with permanently attached handles that can be operated from both the inside and the outside of the door. Provide satin chrome plated finish to exterior components;
- Hinges: Hang doors on edge-mounted, rising butt type self-closing hinges capable of holding the door fully open. Construct from chrome plated brass or heavy duty aluminium alloy. Provide stainless steel hinge shaft and nylon bearing surfaces;
- Installation: Securely bolt hardware to the door and frame by a method which minimises cold bridging and prevents the forming of condensation on the outside of the conditioner;
- Seals: Silicone rubber or soft neoprene gaskets mechanically fixed to the door to ensure an airtight seal when latched closed. Fix to the door using a method that permits easy replacement. For fire rated seals, provide woven ceramic fibre material;
- Insulation: Construction, thickness and insulation properties to match the insulation of the duct, plenum or casing in which the door is located.

1.4.11 Volume Control Dampers

Location

Provide for any size supply and for all return and exhaust ducts. Locate for balancing in each branch duct or tee.

Manually operated volume dampers must be of the opposed blade type for rectangular ducts and butterfly type for circular ductwork. All dampers must be complete with an approved lockable quadrant for infinite adjustment with adjustment positions of open-half-shut clearly marked on the quadrant.

Multi-blade dampers must have frames of aluminium, with blades of zinc-coated steel, aluminium or stainless steel.

Damper size must not be less than the duct size. Where external insulation occurs, the dampers must have extended shafts and mounting lugs on the quadrant and sheet metal stools to make the damper control flush with the insulation. On completion of the air balance, the damper control position must be marked with red paint and locked at such position.

Dampers must be installed in all branch take-offs from the main duct, all branch ducts to registers without integral opposed blade dampers and all locations necessary to achieve the correct air balance.

- General: Provide dampers which are free of rattles, fluttering or slack movement and capable of adjustment over the necessary range without excessive self-generated noise or the need for special tools. Select dampers with the appropriate authority for each system served. The specification requires submission of fan head calculations and these calculations must identify the system pressure including the pressure loss to each component and the authority therefore of the volume control dampers, including motorised volume control dampers;
- Face dimensions: Duct size;
- Connections: Mating angle flanged cross joints;
- Frames: 1.6 mm minimum thickness metallic-coated steel or 2 mm minimum thickness aluminium folded to form channel sections at least 150 mm wide and welded at corners;
- Dampers required to provide tight shut-off: Leakage ≤ 25 L/s.m² at 1.5 kPa pressure differential;
- Dampers in smoke-spill systems: Metallic-coated steel or stainless steel blades and frames.

1.4.11.1 Blades

- Material: Metallic-coated steel, aluminium or stainless steel;
- Form: No sharp edges. Sufficiently rigid to eliminate movement when locked.

Minimum thickness:

- Metallic-coated sheet steel and stainless steel:

- Single thickness blades: 1.6 mm;
- Double thickness blades: 1.2 mm.
- Aluminium:
 - Single thickness blades: 2.4 mm;
 - Double thickness blades: 1.8 mm.

Maximum length: 1200 mm. If necessary provide intermediate mullions.

Single blade dampers:

- For single thickness blades: 600 mm maximum length, 600 mm maximum width or 600 mm maximum diameter;
- For single thickness blades with 6 mm minimum edge breaks: 1200 mm maximum length x 175 mm minimum width;
- For double thickness blades: 1200 mm maximum length x 300 mm minimum width.

Multi-blade dampers:

- For single thickness blades with 6 mm minimum edge breaks: 1200 mm maximum length 175 mm minimum width.

Bearings

- Type: Oil impregnated sintered bronze bearings, sealed-for-life ball bearings or engineering plastic sleeve bearings. If the operating temperature is > 50°C, do not provide nylon;
- Lubrication: Provide access for lubrication;
- Housings: Rivet to damper frames.

Spindles

- Material: Stainless steel in stainless steel dampers, zinc-plated steel or stainless steel otherwise;
- Construction: Securely fix to damper blades.

Minimum diameter:

- Blade lengths ≤ 600 mm: 10 mm;
- Blade lengths > 600: 12 mm.

Linkages

Fix securely to blades so that the blades rotate equally and close tightly without slip.

Damper adjustment

Provide for adjusting the damper and locking it in position. Locate in an accessible position. Label the open and closed positions clearly and permanently.

1.4.12 Motorised Dampers

Motors for volume control dampers, smoke dampers and fire dampers must be provided where required for control and as shown on the drawings.

Construction

Comply with **Volume Control Dampers** and the following:

- Side seals: Aluminium or stainless steel;
- Blade tip seals: Neoprene or silicone rubber;
- Leakage: ≤ 25 L/s.m² at 1.5 kPa pressure differential;
- Bearings: Sealed-for-life ball bearings only;
- Drive shafts: Keyed, square or hexagonal.

Control Characteristics

Flow characteristics: Linear flow relative to damper motor drive shaft rotation.

Type:

Outdoor air/return air mixing dampers: Parallel blade type with air streams directed towards each other.

Face and bypass dampers: Parallel blade type with air streams directed towards each other.

Other modulating dampers: Opposed blade type.

Two position shutoff dampers: Parallel or opposed blade type.

1.4.13 Fire Dampers

All fire dampers must comply with the requirements of AS 1682 and AS 1668 Part 1. The fire dampers must have a 4 hour fire rating determined in accordance with AS 1530, Part IV.

Unless noted otherwise, fire dampers must be of the black steel, gravity operated, approved type with fusible links. All fire dampers must have certified fire ratings as certified by the Commonwealth Building Research and Testing Station, Ryde, NSW to meet the application. The dampers must have a smoke leakage rating of not more than 2.5% of the air handled by the damper.

Dampers On The External Wall and/or For Outside Air Application Must Be Stainless Steel.

Fire damper blades on multi-leaf construction dampers to have their blades outside of the air stream.

Fire dampers must be installed where ducts pass through any fire rated masonry or concrete walls and floors and fire partitions and wherever required by the Authorities having jurisdiction. Position and mount for easy replacement and provide access panels for maintenance of dampers and replacement of links.

Fire dampers must be set in openings so arranged that there is provision for expansion of the damper when heated; clearance being at the rate of 3mm for each 450mm length of damper blade with a maximum clearance of 15mm. Expansion space so formed must be filled with 'Kaowool' or approved equal material so that the passage of fire and smoke through it is prevented.

Damper frames must be not less than 2.5mm thick galvanised steel and damper blades must have a maximum width of 300mm. On ducts deeper than 300mm, multi-blade dampers must be used.

Fire dampers must be sized to prevent any increase in static pressure or velocity to prevent any noise generation in the duct. Provide oversize damper and enlarge duct both sides of damper if necessary to achieve this. Transformation duct pieces must be provided to connect to the fire damper.

1.4.14 Splitter Dampers

- Limitation: Only use splitter dampers for supply branches up to 600 mm wide and with velocity in main < 10 m/s. Do not use on return or exhaust ducts. Provide volume control dampers otherwise;
- Construction: Fabricate to AS4254 Figure 2.3 (H) with a minimum length 1.5 times the width of the larger branch.

The blade must be controlled by a rod or rods firmly fastened with a hinged or ball type joint near the leading edge of the blade.

The rods must be adjusted through guiding bosses, riveted to the duct and sealed with 3 mm felt pad gaskets. After adjustment, the rods must be securely clamped to the bosses with set screws. All rods must be clearly marked with a mustow filed groove to indicate the final set position after balancing.

Rod hinges must be zinc or cadmium plated.

Push rods must be 5 mm in diameter on 600 mm centres with screw locking bushes to fix position.

Blades must be constructed from galvanised sheet steel of the following minimum thickness:

- Double thickness - 1.0mm,
- Single thickness - 1.6mm.

1.5 Air Registers, Diffusers and Grilles

All air registers, grilles and diffusers must be designed and selected fit for purpose, as necessary for supply, return air, exhaust air and transfer air systems and must be suitable for the air distribution application.

When I'm working on a problem,
I never think about beauty. I think
only how to solve the problem. But
when I have finished, if the solution
is not beautiful, I know it is wrong.
Richard Buckminster Fuller

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STEENSEN VARMING

All registers, grilles and diffusers must have concealed fixings of the spring clip type; exposed screw heads must not be used.

Secure, but removable cores must be provided except for linear fittings, swirl diffusers and frame styles and sizes must be approved by the Superintendent to suit the ceiling and construction.

The Mechanical Contractor must submit samples of each type of diffuser, grille, register and damper including plenum box, if applicable for review by the Superintendent before ordering this equipment.

Each air register, grille or diffuser must be provided with a means of adjusting the air quantity, either by means of an integral opposed blade volume damper, or remote opposed blade damper or splitter damper. In all cases dampers must be readily accessible from outside patient bedrooms.

The exact position of all registers, grilles and diffusers must be co-ordinated with the ceiling structure, the lighting layout and the floor plan layout and to the review of the Superintendent, before fixing in position. The Contractor must be fully responsible for ensuring that the registers etc. will fit in with the ceiling and lighting layout without additional cost.

Where overall dimensions are to match lighting fittings and ceiling grids, co-ordination with the electric light fittings manufacturer and false ceiling installer must be undertaken to ensure that the overall dimensions and trim width match the requirements.

Where flexible connections are indicated, they must be a maximum of 3000 mm long and must be adequately supported.

Face and neck sizes, length and number of slots, etc.. must be as indicated on the construction drawings.

Samples of all products must be provided for review.

Each diffuser located in a plasterboard ceiling must be fixed using a concealed method with mounting frame in accordance with manufacturer's recommendation. Diffuser in tiled ceiling must have face dimensions and frame style to lay in the standard tile width where possible.

Each diffuser must be complete with an acoustic insulated plenum box, mounting frame for concealed fixing and all accessories to complete the installation.

Air Grilles in Suspended Ceilings

Physical compatibility: To AS 2946.

Side Wall Registers

- General: Double deflection type with horizontal front louvre blades and vertical rear blades at 19 mm nominal centres, capable of field adjustment of air throw over the range $\pm 45^\circ$;
- Construction: Extruded aluminium with mitred corners and aerofoil section blades which rotate in non-metallic bearings in the support frame. Hold blades firmly so they do not rattle or flutter;
- Core: Provide a removable core (support frame and blades);
- Blades ≥ 600 mm long: Support at midpoint on a notched support bar;
- Dampers: Provide a stream splitter or opposed blade type damper behind each register, to provide even air flow across the register face.

Linear Bar Grilles

- General: Fixed blades at 0degree;
- Construction: Extruded aluminium with mitred corners and blades. Hold blades firmly so they do not rattle or flutter;
- Core: Provide a fixed core;
- Dampers: Provide a stream splitter or opposed blade type damper behind each register, to provide even air flow across the register face.

Non-vision Door Grilles

- General: Overlapping inverted 'V' blades;
- Construction: Extruded aluminium with matching frame, mitred corners and blades. Hold blades firmly so they do not rattle or flutter;
- Core: Provide a fixed core.

1.5.1.1 Opposed Blade Dampers

Type: Multi-blade type with blades linked for ganged operation. If located at the air grille provide adjustment accessible through the grille face. If visible through grille paint the damper matt black.

Location:

At the at end of duct spigot take-offs.

Location: To Dampers controlling a single diffuser and grille attached to flexible duct.

Behind supply diffusers and grilles attached to flexible duct if the spigot at the rigid duct is not accessible through the ceiling.

Behind return and exhaust air grilles connected to ducts.

1.5.2 Execution

1.5.2.1 Installation of Air Grilles

Protection

Wrapping: Leave protective wrappings in place until final mounting.

1.5.2.2 Mounting

General: Provide a matching escutcheon to close gaps between the grille and its surrounds. Provide grilles with flanges to cover penetrations and irregularities in surrounds.

Tiled ceilings: Locate grilles and diffusers to minimise cut tiles. Otherwise, locate grille symmetrically in the tile.

Appearance: Install square.

1.5.2.3 Fixing

Visibility: Provide concealed fixings.

Accessibility: Provide fixings which allow removal without damage to surrounds or outlets.

Gaskets: Provide foam type gaskets under outlet flanges or flanged supports.

1.6 Identification

1.6.1 Painting

All items of equipment, including air handling units, pumps, MCC's and all piping and ductwork in the plant rooms and outside the building must be painted. External insulation must be sheathed before painting.

Do not paint baked enamel finishes, rubber hoses, flexible mountings, lubricated surfaces or name plates.

All paint must be of low VOC type as required in Green Star IEQ-12.

All supports, hangers, structural steel frames, lintels, access panels, tank stands, fan casing, machinery bases, dampers, filter housing, etc. in the plant room and outside the building must be included.

All exterior metal surfaces except copper and stainless steel, all exterior support steel, all exterior pipework and all exterior ductwork and supports must be coated with two (2) coats of asphalt aluminium paint or equivalent. All metal surfaces must be cleaned of all rust, oil, dirt, etc.. before painting.

Paint materials must be best quality trade name brands delivered to the building in their original labelled and sealed cans or containers with their labels intact and seals unbroken.

Brand names, colours, samples and types must be submitted for review before use.

No exterior painting must be done in rainy, damp or dusty weather or on damp surfaces.

Finish paint all items in the building (less factory finished items) with two coats of enamel gloss paint.

All galvanised surfaces must be prime etched before painting; all non-galvanised surfaces must have a prime shop coat of grey rust inhibitive paint.

1.6.2 Sheet Metal Work

Paint the inside of all ducts adjacent to the diffusers, registers, grilles and louvres with two (2) coats of matt black paint. Paint all exposed ducts inside and outside the building with etch primer, one (1) coat of zinc rich paint and two (2) coats of finishing paint to a colour approved by the Superintendent.
condition.

1.6.3 Identification of Equipment

Supply and install identification labels for all items of equipment which must include where applicable but not limited to, all equipment, pipework and fittings, sheet metal work, automatic controls and electrical equipment, conduits and wiring.

All items of equipment must be suitably identified with Traffolyte labels of an approved size and type. All thermometers, pressure gauge tappings, remote sensing points and the like, must be similarly labelled to indicate their function.

Comply with specific labelling requirements of AS 1668 and other statutory/ inspecting authorities.

Supply and install all valve and lubrication charts.

All identification label types and charts to be submitted for review.

1.6.3.1 Nameplates

Nameplates must be installed on or adjacent to all items of equipment.

Nameplates must clearly identify each item of equipment with the nomenclature as used throughout this contract. They must be of Traffolyte type, not less than 65mm x 20mm x 3mm thick with bevelled edges and with black cored letters on a white background. They must be secured with either suitably plated brass screws or suitable adhesive depending on the application.

1.6.3.2 Pipe and Duct Markers

Equipment Identification

All items of equipment must be suitably identified with Traffolyte labels of an approved size and type. All thermometers, pressure gauge tapings, remote sensing point and the like, must be similarly labelled to indicate their function.

Pipework

All pipes must be identified in accordance with AS1345 - Identification of Contents of Piping, Conduits and Ducts, and AS1318 - SAA Industrial Accident Prevention Signage Pipework whether exposed in plant rooms or concealed in risers and ceiling spaces.

"Safetyman" adhesive labels are acceptable for identification of pipework and must be applied at not more than 8m intervals on straight runs, both sides of any wall, floor or other partition through which the pipe passes, adjacent to valves, branch line, control point and any outlet.

Flow direction arrows must be provided to all pipework and the Flow and Return pipes must be identified with labels that say "Chilled Water Flow" and "Chilled Water Return" or "High Temp Hot Water" as applicable.

Colour standards must be in accordance with AS2700.

Directional flow arrows must be provided on all pipes. Arrows must not be less than 150mm in length and must be spaced at not greater than 3 metre centres in plant rooms and not greater than 8 metre centres elsewhere.

Arrows may either be painted onto the pipe or be of vinyl markers of the pressure sensitive self-adhesive type similar and equal to 'Safetyman'.

Directional flow arrows must be adjacent to, but must NOT be superimposed on supplementary colour bands. The arrows must have the name of the particular system printed on it.

Duct markers must be similar to pipe markers with the direction of flow arrow having the system designation number.