PROJECT NAME	**SABC Gymnasium Upgrade**

RFQ DESCRIPTION	**HVAC Installation**
ISSUE DATE	**7th April 2021**
RETURN DATE	**19th April 2021**
PREPARED BY	**Andrew West**
APPROVED BY	**Graeme Jardine**

REVISIONS	PREPARED BY	DESCRIPTION	DATE

CONTRACTOR NAME	NAME	DATE	SIGNED

Table of Contents

PART ONE

Contents

1. Company Details & General Notes

A comprehensive Company CV is to be included with your submittal.

1.1. Company Details

1.1.1. Contact Details

Name of Company _____
Address _____
_____
_____
_____

Telephone _____
Email _____

Contact Person _____
Telephone _____
Email _____

1.1.2. Employees

	Number	SAQCC Registered Wireman's Licence
Directors	_____	_____
Managers	_____	_____
Engineers	_____	_____
Refrigeration Technicians	_____	_____
Electricians	_____	_____
Assistants	_____	_____
Admin / Office Staff	_____	
Total Full-Time employees	_____	

1.1.3. BBBEE Status

BBBEE Level _____

1.1.4. Previous Experience

Contractor is to list below the details of similar projects completed.

	Project Name	Date	Value	Reference & Contact Number	
1.	_____	_____	R_____	_____	_____
2.	_____	_____	R_____	_____	_____
3.	_____	_____	R_____	_____	_____
4.	_____	_____	R_____	_____	_____
5.	_____	_____	R_____	_____	_____
6.	_____	_____	R_____	_____	_____

1.1.5. Sub-Contractors

Contractors are to list any work or service which they intend to sublet and name the firm to whom they propose subletting the work to.

	Name	Address	Portion of Work
1.	_____	_____	_____
	_____	_____	_____
2.	_____	_____	_____
	_____	_____	_____
3.	_____	_____	_____
	_____	_____	_____
4.	_____	_____	_____
	_____	_____	_____

1.2. Contract Notes

1.2.1. Contact Details

This contract covers the supply, delivery, installation, testing and commissioning of the HVAC system as per the specification. This will be done as a sub-contract to the main contractor.
The contractor shall examine all of the contract documentation and shall acquaint themselves with the contents thereof.

1.2.2. Uncertainties

Uncertainties and doubts as to the meaning and interpretation of items in this document shall be referred to *CCS,* for explanation and, if necessary, corrections before RFQs are submitted.

1.2.3. Acceptance of RFQ

The lowest or any RFQ will not necessarily be accepted. Any RFQ, which does not comply with the requirements stated in these documents, will be considered invalid. Contractors may include with their RFQ any descriptive matter, which, if referred to in the RFQ, will form part of the RFQ. In case of any discrepancy, however, the issued RFQ and contract documents and information completed herein by the contractor, will be considered as the valid and binding RFQ.

1.2.4. Electronic Submissions

Electronic RFQs are permissible providing that Sections 1, 2 & 8 of the document are transmitted and that all the relevant schedules are completed.
The BOQs part 2 is to be returned in it's original format, excel.
It is an express condition of this contract that should the contractor submit their quotation electronically, the successful contractor shall submit the original documentation signed on every page and drawing to our offices before appointment can proceed.

1.2.5. Validity of RFQ

RFQs shall hold good for 45 (forty five) days from the closing date stated in this contract. During the validity period prices shall remain firm.
The period for which RFQs must remain valid is calculated from the closing date, but does not include it, and in the event of such period expiring on a Sunday, Public Holiday or another day on which the offices are closed, such RFQs must remain valid until the closing time of the first day of the office following such expiry date.
Contractors are hereby advised that the adjudication of RFQ submissions will be based on the joint criteria of cost, time and quality of product to be delivered. Submissions must therefore be complete in all respects.

1.2.6. Alternative Offers

If the contractor wishes to submit alternative offers in addition to any of the provisions of the design offer(s) for the requirements for pricing, conditions of contract, specification, drawings or schedules, they shall set out details of their proposals in an accompanying letter.

1.2.7. Law of The Land

This agreement, all annexures and amendments hereto, shall be governed in all respects by the laws of the Republic of South Africa and the parties, by their signature hereto, agree and consent to the jurisdiction of courts situated within the Republic of South Africa.

1.2.8. Security

The responsibility to ensure that the works are secure at all times vests with the winning contractor. Under no circumstances may any personnel be accommodated on the site.

1.2.9. Occupational Health & Safety

Contractors must note and make provision for the fact that the successful contractor will be required to execute the contract works in strict compliance with the relevant clauses of the Occupational Health and Safety Act, including any special clauses or requirements as may be stipulated by the main contractor as well as those of the Health and Safety Consultant, pertaining to contractors and contract works. All safe operating procedures are to be identified and recorded, as per Health and safety requirements.

A safety file will be required and is to be issued to relevant Health & safety official prior to starting on site. An amount for this is to be allowed for in section 2.3.1.13.

1.3. Pricing Details

1.3.1. Price

This RFQ is based on a fixed price contract and is not subject to price adjustments.

1.3.2. VAT Certificate & Company Registration

Contractors are to include, with the return tender document, a copy of their VAT Certificate and Company Registration Certificate.

1.3.3. Price Schedule

The inclusion of a Price Schedule / Breakdown in this RFQ is done to assist in administration matters of the contract only. The contractor shall be deemed to have included for all material and labour necessary for the satisfactory completion of the works, noted or otherwise.
The rates and prices inserted in the contract documentation shall be deemed to include, but shall not be limited to the following:

- Materials, workmanship and utilization of plant and equipment,
- Transport, unloading, storing and hoisting to all levels of all materials,
- Temporary works,
- Cutting and waste,
- Overhead charges and profit,
- Stoppage for inspection purposes by the principal agent or engineer,
- Overtime working necessary to complete the works within the time for completion.

Value Added Tax shall not be included with the rates and prices, but shall be shown separately in the Summary.

1.3.4. TAX

Contractors shall allow for all applicable tax (including withholding tax where applicable). Should the percentage tax be adjusted during the contract the increase or decrease will apply only to such materials as have not been purchased at the date of the change.
The tenderer should familiarize themselves with the taxes applicable to the country of installation as well as sourcing of equipment. The RFQ must be all inclusive. No subsequent claims for tax variations will be entertained.

1.3.5. Import / Export Duties

Tenderers shall allow for all import and export duties.

1.3.6. Foreign Exchange Rates & Escalation

Any imported materials / equipment that maybe subject to fluctuating exchange rates must be declared in the Provisional Bill of Quantities Part 2.6. at time of submission.
No claims for additional sums due to exchange rate fluctuations will be entered into should this section not be completed.

1.3.7. Sufficiency of Contractor

The contractor shall be deemed to have satisfied themselves before submitting their offer as to the correctness and sufficiency thereof for the works and of the rates and prices they have stated in the schedules which rates and prices shall cover all their obligations under the contract and all matters and things necessary for the proper completion of the works.

1.3.8. Claims for Payment

A detailed breakdown supplied by the HVAC contractor is to be used as the basis for controlling costs and substantiating claims for payment.

Percentage completion is to be reflected on the claim. No payment will be approved for claims which are not accompanied by an updated measurement of work completed.

For projects less than 30 days, an invoice for the completed works is to be submitted at the completion of the project.

For projects longer than 30 days, interim invoices may be submitted on a monthly basis for equipment on site and work completed.

It must be noted that a maximum 90% of the project value will be approved for payment while the contract is on-going. The final 10% will only be released once the project is deemed complete by the engineer.

The project will only be considered complete once all snags are completed to the satisfaction of the engineer, and O&M manuals are submitted and approved. A completion certificate will be issued to the contractor, a copy of which must be included with the final invoice.

1.3.9. Penalties

Upon the contractor issuing a detailed program of works and upon agreement by all parties involved, a penalty amount of R5 000.00 per calendar day will be enforced should any of the agreed upon milestone dates not be met.
The adjudication and enforcement of the above penalty will be the sole responsibility of CCS.

1.4. Inspection of Site

The contractors shall familiarize themselves with the site and surroundings. The contractors shall satisfy themselves before submitting their RFQs as to the nature of the site, the quantities and nature of the work and materials necessary for the completion of the works and the means of access to the site, the accommodation they may require and in general shall obtain all necessary information as to risks, contingencies and other circumstances which may influence or affect their offer.

This is to certify that _____ has / have today

(Company Name)

inspected and examined the site of the proposed works to which the RFQ relates.

THUS DONE and SIGNED at Johannesburg

on this_____day of_____2021

Name _____ Name _____

(CCS Engineer) *(Contractor)*

Sign _____ Sign _____

PART TWO

Contents

CCS

THE JOINT BUILDING CONTRACTS COMMITTEE

JBCC SERIES 2000

FORM OF TENDER

This document is for use with
JBCC PRINCIPAL, NOMINATED/SELECTED AND MINOR WORKS AGREEMENTS
Published prior to the introduction of the "Contract Data" forms

PROJECT	SABC Gymnasium Upgrade
PRINCIPAL AGENT or AGENT	Elliot Ngxola Architects
EMPLOYER	SABC
TENDERER	
WORKS DESCRIPTION:	
HVAC Installation	FILE CODE **CCS078**
TENDER CLOSING DATE **19/04/2021**	TIME **12H00**

prepared by the JOINT BUILDING CONTRACTS COMMITTEE Inc

RECOMMENDED BY THE JBCC CONSTITUENTS
Association of Contract Project Managers
Association of South African Quantity Surveyors
Master Builders South Africa
South African Association of Consulting Engineers
South African Institute of Architects
South African Property Owners Association
Specialist Engineering Contractors Committee

CODE 2115 © August 2007

FORM OF TENDER in terms of a:

Principal Building Agreement	*(yes/no)*	
N/S Subcontract Agreement	*(yes/no)*	Yes
Minor Works Agreement	*(yes/no)*	

Principal Agent: **Elliot Ngxola Archtects**

Street address: **16, Acorn Village. Bond & Kent av. Ferndale, Randburg JHB.**

Tel: **087 073 5845** Fax: **086 562 8288** E-mail: _____

Employer: **SABC**

(N/S only) Contractor: **TBA**

Tenderer: _____

Postal address: _____

Tel: _____ Fax: _____ E-mail: _____

Project: **SABC Gymnasium Upgrade**

Works: **HVAC Installation**

1.0 CONDITIONS OF TENDER

1.1 PRINCIPAL, NOMINATED/SELECTED AND MINOR WORKS AGREEMENTS

1.1.1 The successful tenderer will be appointed in terms of the JBCC Principal Building Agreement, JBCC N/S Subcontract Agreement or JBCC Minor Works Agreement.

1.1.2 Additions and alterations to such agreement are clearly detailed in the schedule of the agreement.

1.1.3 All pre-tender information is set out in the Schedule. Variables requiring selection by the tenderer are to be clearly marked for later inclusion in the Schedule.

1.1.4 Any conditions or qualifications that are appended by the tenderer, which are at variance with the conditions in this or the tender enquiry document, may invalidate the submitted tender.

1.1.5 Details of the amount of item 2.4.2 of tender sum are to be clearly segregated in the tender documentation provided by the principal agent or agent.

1.1.6 This tender is to be submitted to the principal agent or agent at the street address stated above before the tender closing date and time stated on the cover hereof.

1.1.7 Tenders will be opened in public directly after the stated closing time. Only the total tender sum as stated in 2.4.5 of each tender will be announced.

1.1.8 The lowest or any tender will not necessarily be accepted.

1.2 NOMINATED / SELECTED SUBCONTRACT AGREEMENT *ONLY*

1.2.1 The contractor has been or will be appointed in terms of the JBCC Principal Building Agreement.

1.2.2 Where the tenderer is advised of the appointment of the contractor after submission of this tender, the tenderer shall be entitled to make reasonable objection to being appointed by the contractor.

1.2.3 This tender is submitted to the principal agent or agent who is authorised in terms of the Principal Building Agreement to instruct the contractor to appoint the successful tenderer as a nominated/selected subcontractor.

2.0 THE TENDER

2.1 By the submission of this tender to the employer the tenderer offers and agrees to contract for, execute and complete the works and other works for the tender sum as stated below

2.2 This tender shall remain in full legal force for forty-five (45) calendar days from the tender closing date in the case of Principal or Nominated/Selected Contracts and thirty (30) calendar days for Minor Works Contracts. The tenderer accepts liability for damages as may be suffered by the employer should the tender validity period not be honoured

2.3 This tender takes into account the documents listed hereunder or as per the attached schedule by the principal agent or agent for the purpose of preparing and submitting this tender

Document list or addendum identification

2.4 TENDER SUM COMPILATION — **Amount**

2.4.1	Tenderer's work including Prime Cost and Provisional Amounts	
2.4.2	Budgetary allowances *(amount stated by the principal agent / agent)*	
2.4.3	SUB TOTAL	
2.4.4	*Add* as per 2.4.3	
2.4.5	**TOTAL TENDER SUM inclusive of tax**	

Tender Sum in words: _____

_____

2.5 **TENDERER'S SELECTIONS** *(Mark Yes, No, N/S as appropriate. Do not leave blanks)*

Selection Item			PBA	N/S	Minor	Addendums, N/s, Marked
Preliminaries	Payment	Alternative A				
		Alternative B				
	Adjustment	Alternative A				
		Alternative B				
Security	Variable construction guarantee					
	Fixed construction guarantee					
	Retention (Payment reduction)					
	# Advance payment guarantee					(Amount)
	# Payment guarantee					(Amount)

 # These guarantees are not applicable to State appointments

This done and signed at _____ on _____

_____ _____

Name of signatory — Capacity of authorised signatory

_____ _____

As witness — for and on behalf of the tenderer who by signature hereof warrants authorisation hereto

2.2 Bill of Quantities & Rates

The Bill of quantities document is an Excel spreadsheet attached separately to the main RFQ document.

The Bill of Quantities is to be completed in full by the contractor.

Should the contractor wish to submit an option to the main RFQ. A second Bill of Quantities spreadsheet must be completed in full and clearly labelled OPTION 1.

CCS

PART FOUR

Contents

4. Standard Specifications Workmanship & Materials.

This section out-lines the standard specifications pertaining to the workmanship and material requirements for the supply and installation of the HVAC systems. Should any details in part four contradict those laid out in part six then part six will take precedence.

4.1. Contract Admin Mechanical Installations

The Sub-contractor will be required to provide all labour, materials, equipment and services and perform all operations required for the complete installation of all Heating, Ventilating & Air Conditioning Work as shown on the relevant drawings and in accordance with all applicable requirements of the Sub-Contract Documents.

Definitions of terms used herein:

"Provide"	To supply, install, connect and hand over complete and ready for sale and regular operation of particular work referred to unless specifically indicated otherwise.
"Install"	To erect, mount and connect, complete with all related accessories.
"Supply"	To purchase, procure, acquire and deliver, complete with all related accessories.
"Work"	All labour, materials, equipment, apparatus, controls, accessories and other items required for correct and complete installation.
"Piping"	Pipe, tube, fittings, flanges, valves, controls, strainers, hangers, supports, accessories, drains, insulation and all related items.
"Wiring"	Conduit, fittings, wire, junction and outlet boxes, switches, cur-outs, socket outlets and all related items.
"Concealed"	Embedded in masonry or other construction, installed in furred spaces, within double partitions or hung ceilings, in trenches, in crawl spaces or in enclosed spaces.
"Exposed"	Not installed underground or concealed as defined above.
"Indicate, Shown Or Noted"	As indicated, shown or noted on drawings and/or specifications.
"Similar or Equal"	Of approved manufacture, equal in weight, size, design and efficiency of performance of the product specified or mentioned by name.
"Approved, Satisfied, Accepted"	As approved, satisfactory or accepted by the Architect and/or Consulting Engineer.
"SANS"	South African National Standards.
"BSI"	British Standards Institution.
"ASHRAE"	American Society of Heating, Refrigeration and Air Conditioning Engineers.
"ASME"	American Society for Testing Materials.
"ASA"	American Standards Association
"NBS"	National Bureau of Standards (U.S.A.)
"NEMA"	National Electrical Manufacturers Association

4.2. Gauges, Masses & Measure, Material

4.2.1. Material

New, high quality and free from defects; listed by SANS, BS, DIN, NEMA or bearing their label or mark and/or listed by Underwriters' Laboratories, Inc, or bearing their label.

Materials and/or equipment used for this project to be of the same manufacture wherever possible.

The sub-contractor must obtain approval from all authorities as required for materials and/or equipment used on the project.

4.2.2. Gauges of Wire & Metal

Wire and cable sizes : as per SANS "Code of Practice" in mm^2

Sheet Metal Ductwork: Conform to SMACNA or SANS

Sheet Metal : 2mm unless otherwise noted

4.2.3. Masses & Measure

All masses and measure shown or mentioned shall be taken to the Metric system

4.3. Drawings

4.3.1. Definition

"Drawings" as referred to under this clause shall include all of the following as well as additional details which may be deemed relevant to the executions of the contract.

- Component or equipment manufacturing details
- General arrangement and installation drawings
- Plant room layouts and builders work requirements
- Schematic and isometric layouts
- Control and electrical drawings for mechanical equipment
- Sketches and enlarged details
- Co-ordination drawings

4.3.2. Services

These clauses are relevant to all of the following engineering disciplines:

- Mechanical HVAC Installations

4.3.3. Engineering Drawings

The consulting engineer's drawings are not to be used for manufacturing or installation purposes. .

4.3.4. Sub-Contractor's Responsibility

The sub-contractor shall produce, at his own expense, all required drawings for the execution of the contract, including any additional details which may be requested by the Engineer, Architect or Main-contractor.

He shall be responsible for the design, location and dimensioning of the installation.

Verification that the positioning or location of equipment, opening sleeves, penetrations, trunking, etc., do not clash with other services is the responsibility of the sub-contractor.

4.3.5. Standards

General arrangement, installation and plantroom layout drawings will be prepared to a scale of 1:50.
Enlarged details prepared for clarification shall be drawn to a scale of 1:20 or 1:10.

The smallest drawing sheet size consistent with clarity and unambiguity selected from the following shall be used: A0 / A1 / A3

4.3.6. Approval

The sub-contractor shall not issue any original or revised drawings, to any parties, for information, manufacture, installation or for any other reason, unless such drawing has been checked by and stamped with the Engineer's mark of approval.

The Engineer will check drawings for correctness and compliance with design only. Physical sizes and correct location of equipment and components shall remain the responsibility of the sub-contractor.

Correction or comments made on drawings by the Engineer does not imply a change in the "Scope of Work". The sub-contractor shall inform the Engineer immediately, in writing prior to modifications to the original drawings, whether in his opinion such corrections and comments will result in a change to the "Scope of Work".

The sub-contractor shall furnish as many prints of the approved drawings to the architect, main-contractor, or any other party specified for general issue.

4.4. Painting & Finishes

4.4.1. General

All equipment, materials and fasteners installed under this contract shall be protected against rust, oxidisation and corrosion by the application of an approved protective coating.

Such protective coatings shall be compatible with the materials applied to and shall at all times conform to the application instructions of recommendations of the manufacturer.

The appropriate and recommended primers shall be applied after descaling, cleaning, washing, drying or wiping as may be required and before finishing coats are applied.

Only the highest quality approved finishing, priming, etching and cleaning materials shall be used.

4.4.2. Piping, Valves, Fittings & Equipment

Uninsulated piping, valves and fittings shall be coated with one coat specified primer, field applied after erection, and finished with two coats high gloss enamel.

Insulated piping shall be prime coated and inspected by the Engineer prior to insulation being applied.

Black steel or iron work shall be treated as for uninsulated piping.

Fire dampers, unless galvanized, shall be painted with a factory applied primer and finished with two coats corrosion inhibitive paint. Equipment supplied painted or coated by the manufacturer shall not be repainted unless so specified. Minor damaged areas may be spot coated with identical coatings supplied by the manufacturer.

Severely damaged equipment shall be re-coated to factory specifications.

4.4.3. Support & Galvanised Items

Galvanized pipe and duct support rods shall not be painted unless specified.

All supports, brackets and fasteners shall be primed with recommended primer and finished with two coats high gloss enamel.

Galvanized items will be treated with an approved etching primer, before finishing coats are applied when so specified.

4.4.4. Other Coatings

All coating materials not mentioned above such as Electroplating, galvanizing, chroming, varnishing and rubberising and others shall be applied strictly in accordance with the manufacturer's specifications.

4.4.5. Colour Schedules

Unless otherwise indicated, the following colour schedules shall apply:

Note 1
All equipment, ducts, pipework, metal parts and insulated and plastered surfaces shall be thoroughly descaled, cleaned and painted with a priming coat and two coats of oil paint.

Note 2
Paint shall be of the highest quality super enamel as manufactured by Plascon or equal, and shall be applied strictly in accordance with the manufacturer's recommendations and directions. Colour derived from PLASCON COMPUTACOLOUR are denoted (c.c.)

Note 3
All colour bands shall be 250mm long. In cases where banks of parallel pipe runs occur, the colour bands shall be of a uniform length and grouped together wherever possible.

Note 4
Colour bands, where specified for exposed services shall be applied at all entries to junctions, connections to appliances, bulkhead and wall penetrations and both sides of valves.

Note 5
Colour bands, where specified for concealed services shall be applied at all access points to ducts, shafts, ceilings, etc.

Note 6
In concealed accessible areas the branding shall be applied to the pipework or trunking at 2 000mm centres.

Note 7
Where chilled water, hot water or domestic hot water is clad with sheet metal it is to be painted continuously. Where unclad, it is to be banded.

4.4.5.1. Piping – Airconditioning

Chilled water flow & return	Midnight Blue G.116	Continuous	Continuous	-
Chilled water F & E	Midnight Blue G.116	Continuous	Continuous	-
Condenser water flow & return	Magic Green G.406	Continuous	Continuous	-
Condenser water F & E	Magic Green G.406	Continuous	Continuous	-
Computer boosted water supply	Sunlight Yellow G.12	Continuous	Continuous	-
Treated water	Verda (c.c.) M037-4	Continuous	Continuous	-
Drains	Black G.2	Continuous	Continuous	-
Refrigerant (hot gas)	Copper polish & varnish	Continuous	Continuous	-
Refrigerant (liquid)	Copper polish & varnish	Continuous	Continuous	-
Refrigerant (suction)	Eyerest Grey G.72	Continuous	Continuous	-
Bleed water	P.W.D. Brown G1.18	Continuous	Continuous	-

4.4.5.2. Cable Racks, Trays & Trunking

Air conditioning power	Calypso G.127	As note 7	As note 7
Air conditioning controls	Seashell G.830	As note 7	As note 7
Audio Visual	Medium Yellow G.6	As note 7	As note 7
Building monitoring	Windsor Green G.33	As note 7	As note 7
Data	Light Blue G.16	As note 7	As note 7
Fire detection & evacuation	Claret G.822	As note 7	As note 7
G.P.O.	Cream G.3	As note 7	As note 7
General power (emergency)	Signal Red G.7	As note 7	As note 7
General power (normal)	White N.Y.1	As note 7	As note 7
Lifts	Bahama G.113	As note 7	As note 7
Lighting control	Karoo G.105	As note 7	As note 7
Security	P.W.D. Brown G.18	As note 7	As note 7
White sound	Deep Blue G.25	As note 7	As note 7

4.4.5.3. Miscellaneous

Bases – steel/steel edge	Black G.2	-	-
Bases – concrete brackets	Black G.2	-	-
Drive guards (pump, fan, etc)	Calypso G.127	-	-
Motor fan guards	Calypso G.127	-	-
Handrails and walkways	Aluminium	-	-
Motors	Manufacturer's Standard	-	-
Valve wheels & handles – fire services	Medium Yellow G.6	-	-
Valve wheels & handles – other services	Signal Red G.7	-	-
Plantroom floors	Pale Grey (Gehopon) G.W.3762	-	-
Airtight access doors	Medium Yellow G.6	-	-

4.4.5.4. Switch Boards & Distribution Boards

Air conditioning	Calypso G.127	-	-
General power & lighting	White N.Y. 1	-	-
Emergency power & lighting	Signal Red G.7	-	-
Security	Autowash Brown BPF.57	-	-

4.4.5.5. Equipment

Chilling & package factory assembled equipment	Manufacturer's Standard	-	-
Cooling towers	Manufacturer's Standard	-	-
Exposed ducts, dampers & sound attenuators, air handling units and centrifugal fans	Tropic Sand (Mobil Corp) CG.0420	-	-
Axial fans (as part of site assembled duct systems)	Light Brown G.32	-	-
Fans (miscellaneous vent/exhaust units)	Manufacturer's Standard	-	-
Filter frames and housings	Light Brown G.32	-	-
Plenums (site assembled air handling units)	Tropic Sand (Mobil Corp) CG.0421	-	-
Pumps (chilled, condenser, hot water, fire)	As respective piping service	-	-
Pumps (sump, spray, etc)	Manufacturer's Standard	-	-
Tanks (expansion/storage, etc)	As respective piping service	-	-
Water treatment plant	Manufacturer's Standard	-	-

4.5. Contract Management of Mechanical Sub-Contracts

4.5.1. Co-operation with Principal Contractor & Other Contractors

Render full co-operation to the Principal Contractor and to other Sub-contractors. Provide any information necessary to permit work of all trades to be installed satisfactorily and without interference of delay.

Where work is to be installed in close proximity to other trades, or where there is evidence that work may interfere with work of other trades, assist in resolving co-ordination issues to make satisfactory adjustment prior to preparation of shop drawings.

The programme and progress of Principal contractor will largely dictate the programme and order of work to be followed by the mechanical sub-contractor. The mechanical Sub-contractor is therefore required to collaborate closely with the Principal Contractor and other sub-contractors and in many instances will have to subordinate his preferred order of work or programme to suit the requirements of the Principal Contractor and the contract as a whole.

4.5.2. Supervision

In addition to the requirements of the Conditions of Tender and Conditions of Sub-contract the Sub-contractor shall supply the services of an experienced and competent Contract Supervisor to be in constant charge of work at site.

4.5.3. Handling of Equipment

Investigate each space through which equipment must be moved or handled. Where necessary, equipment shall be transported from manufacturer in crated sections of size suitable for moving through restricted spaces available.

4.5.4. Temporary use of Equipment

No equipment intended for permanent installation shall be operated for temporary purposes without the written permission of, and in complete agreement with stipulations as set for the Architect and/or Engineer.

4.5.5. Storage of Materials

In addition to the requirements of the Conditions of Tender and Conditions of Sub-contract the following shall apply:

Materials permitted to be stored within building shall be safely stacked and shall not overload floor construction beyond the legal permissible floor loading.

Combustible materials shall not be stored on premises longer than minimum period necessary for execution of work. Provide fire protective measures as directed by Principal Agent and/or Principal Contractor.

4.5.6. Handover Inspections

The Sub-Contractor must allow for reasonable assistance to the Engineer during the following inspections:
The installation will be inspected by the Engineer on a regular basis during the course of the contract to ensure compliance with this specification. A written record will be kept of all defects noted.

The Sub-Contractor shall provide a competent person to accompany the Engineer or his representative during inspections. This person shall know the Installation, shall be in a position to accept and carry out instructions and shall take notes during the inspections so that the remedial work can commence immediately and is not held up while waiting for the inspection certificate.

On completion of the Sub-contractor works, final physical inspections will be carried out as commissioning proceeds. Any deviation from specification or below standard workmanship is to be rectified to the satisfaction of the Engineer by the Sub-Contractor, prior to requesting a Certificate of Partial Completion.

The Sub-Contractor must replace any portion of the installation that does not meet with the requirements of this Specification as may be imposed thereon by test or inspection. Such replacements shall be done at his own cost.

A Certificate of Partial completion will be issued when the sub-contract works are to all intents and purposes complete, commissioned and available for beneficial use by the Owner. (The date of this Certificate will determine the commencement of the guarantee period.)

A Certificate of final Completion will only be issued when all defects listed at the time of partial completion have been complied with. The issue of this Certificate will coincide with certification of payment of the full contract sum (excluding retention).

The Sub-Contractor must ensure that the installation is correct, complete and to specification before calling for acceptance inspections.

The cost of any abortive inspections, where the Engineer is called to site, but finds the Sub-Contractor ill-prepared for it, may be deducted from the Contract Price by Variation Order.

The Engineer can request that any part of the system of the complete system be retested, recorded and measured as part of the acceptance Inspections if there exists reasonable doubt about the accuracy of the test.

4.5.7. Guarantee

The Sub-Contractor shall guarantee the material, apparatus and workmanship delivered by him for a period of twelve months. The guarantee must be valid for a period starting on the date when the Sub-contract is accepted by the Engineer as complete and in working condition as defined in Clause 4.5.6. The complete installation must be guaranteed against defects as a result of patent and latent defects of the design and apparatus, (save design defects made of specified by the Engineer), as well as against faulty materials and workmanship. The guarantee must provide that all parts, spares and appurtenances that become defective during the guarantee period be replaced free of charge.

The costs of labour and transportation required to replace such part of a defective installation shall be borne by the Sub-Contractor and shall be included in his guarantee. The Sub-contractor shall cede to the Employer the remainder of any equipment guarantee which he has received from his suppliers which extend beyond the period of twelve months mentioned herein.

In the event of the project being phased, guarantee on installation and equipment shall commence on the date on which it is put into operation for beneficial use to the satisfaction of the Engineer.

4.6. Testing & Commissioning of Mechanical Installations

4.6.1. General

The Sub-Contractor shall test, balance and commission the installation as required to achieve specified performance and efficient operation of the system and record all details of measurements taken. A responsible Commissioning Engineer employed by the Sub-Contractor shall be present to supervise the operation and adjustment of the equipment during the entire commissioning stage.

The Sub-Contractor shall carry out all of the above before requesting acceptance and witnessing of performance by the Engineer. Commissioning data shall be fully tabulated in conjunction with the design data and submitted to the Engineer prior to the inspection being carried out by the Engineer.

Commissioning of equipment and systems shall not be undertaken if damage to the equipment, systems or the building could result due to incomplete and incorrect installation work.

Commissioning procedures as stipulated by the suppliers of equipment shall be strictly adhered to.

The commissioning of equipment such as refrigeration machines, boilers, air compressors, et., shall be undertaken by the suppliers under the supervision of the sub-Contractor.

Calibrated instrumentation required to measure flows, pressures, temperatures, etc., shall be provided by the Sub-Contractor.

The entire control system shall be adjusted and commissioned by the control system specialist contractors, where applicable.

All safety protection systems shall be fully commissioned and set points properly checked out and adjusted, before equipment shall be allowed to run for commissioning purposes.

4.6.2. Pressure Testing

4.6.2.1. Refrigerant Piping

The vacuum test shall follow the pressure test. Charging of the equipment with refrigerant shall follow the vacuum test. After charging and prior to capacity tests. Joints in refrigerant piping and apparatus shall be checked with a leak detector. If leaks are found, the system shall be pumped down and the leaks corrected. The test must be witnessed by the Engineer.

4.6.2.2. Air Ducts

All medium and high pressure air ducts shall be tested in accordance with SMACNA ("High Velocity Duct Construction Standards").

The Sub-Contractor shall include for blank-off plates to isolate the main supply duct system from the branch ducts for test purposes. The complete main supply duct systems shall be tested.

The Sub-Contractor shall provide the required test fan and approved instrumentation and the tests shall be witnessed by the Engineer.

The first completed branch duct from the main supply duct to the supply air diffusers shall be pressure tested while witnessed by the Engineer. The Sub-Contractor shall allow for the closing off of spigots.

Ducts classified as "low pressure ducts" shall be smoke tested and only be visually inspected by the Engineer.

4.6.3. Air Handling Systems

Air duct systems shall be adjusted and balanced so that air quantities at outlets are as specified, uniform over the face of each outlet, and the distribution is free from drafts.

Air quantities specified for fans include for duct leakage of 2,5%. The sum of air quantities of all outlets would normally be acceptable at a tolerance of ±5% of that specified for the fans.

The individual outlet air quantities would normally be acceptable at a tolerance of ±10%, as long as the total air supplied to that space is within a tolerance of ±5%.

Airflow quantities shall be measured and cross checked by an agreed combination of the following:

- Air velocity reading over filter banks or dampers
- Air velocity reading over coil
- Pressure differential across fan
- Main supply air duct pitot tube traverse
- Air quantities measured with an adaptor fitted over the inlets or outlets
- Fan power consumption

Water and airflow quantities shall not be reduced by artificially increasing the system's resistance by more than 5% of the total system resistance.

4.6.4. Water Circulating Systems

Water circulating systems shall be fully commissioned and adjusted to the design flow requirement, shall be free of air and excessive dirt.

Chilled water, hot water and condenser water systems shall not remain in operation for a period of more than five days without the water treatment systems being in a proper

functioning condition. Should the Sub-Contractor fail to comply with the above requirement, then the Sub-Contractor shall open up all heat exchange equipment and clean out to the satisfaction of the Engineer.

Water circulating systems shall be adjusted and balanced so that water quantities circulated through condensers, chillers, coils, cooling towers, boilers, etc., shall be as specified. Tolerances of -5% and +10% would normally be acceptable, depending on the nature of the installation.

Waterflow quantities shall be measured and cross checked by an agreed combination of the following:

- Pressure differential across heat exchangers
- Pressure differential across orifice plates
- Calibrated balancing valves
- Pressure differential across pump
- Pump power consumption

4.6.5. Performance & Capacity Tests

Where the Engineer is to witness tests, the Sub-Contractor shall ensure that the Engineer receives reasonable notice that such tests will take place. Tests required to demonstrate specified capacity and general operating characteristics of all systems and equipment, shall be undertaken by the Sub-Contractor under the direction of the Engineer at time of final inspection.

Where required by the Engineer, test instruments shall be tested for accuracy by an approved laboratory of by the manufacturer and certificates showing degree of accuracy shall be made available.

4.6.6. Noise Testing

Should the installation, in the opinion of the Engineer, be excessively noisy, i.e. exceed the specified noise levels) acoustic tests shall be carried out by a nominated Acoustic Consultant.

Should the results of the initial acoustic test prove to be unsatisfactory, the Sub-Contractor shall carry out modification to the equipment so that further tests can be made until the plant complies with the Specification. The cost of all such further tests and the necessary modifications to the plant shall be met by the Sub-Contractor.

4.7. Maintenance of Mechanical Installations

The Sub-Contractor shall include in his Tender for the maintenance of the entire installation during visits at regular monthly intervals, for a period of ONE year after written acceptance of the plant by the Consulting Engineer and the issuing of a Certificate of completion.

During such visits the Sub-Contractor shall perform the following duties, all his work being arranged during such normal working hours as will not unduly disturb the functions of the occupants of the areas concerned.

- Report to an official nominated by the Owners on arranging and again at leaving their premises on the occasions of each visit. Such person, who has been nominated by the Owners, shall sign a monthly Service Report prepared by the Sub-Contractor giving details of any defects made good, temperature readings taken, etc. A copy of such a Service Report is to be submitted to the Engineer.
- Check and clean filters as necessary. Where called for in Part Six of this document, allow for the replacement of one complete set of filters before the end of the maintenance period. The spare set is to be handed over before acceptance of the installation, and is to be

installed when the efficiency of the original set has fallen below acceptable levels, or one month before the expiry of the maintenance period, whichever occurs first.

- Check all refrigeration systems for leaks, dryness and general performance and rectify defects.
- Check the function of each plant item including all automatic controls and safety devices for correct operation and make good any defect.
- Check electrical switchgear for dust, arcing or loose connections. Replace any pilot lamp bulbs which have failed.
- Clean and inspect the system generally and lubricate all rotating equipment requiring such service.
- Make good any defects as required in terms of the guarantee given for the plant in terms of the specification.
- Check operation of water treatment systems, take samples for testing by water treatment system supplier, check level of chemicals, adjust dosage as necessary. Check bleed of rates.
- Attend to any complaints made, with respect to the relevant mechanical plant, by the authorized person mentioned in the foregoing. The Sub-Contractor will not be obliged to act on the complaints or requests of any other person.
- Check wet and dry bulb temperatures in the conditioned spaces in at least four different locations, by means of a reliable sling psychrometer and record such readings in the Service Report previously mentioned herein.

4.8. Operations & Maintenance Instructions of Mechanical Installations

4.8.1. Manuals

A Condition of the final acceptance of the works will be the provision of three copies of an approved comprehensive Maintenance & Operating Instruction Manual.

Each copy of the manual is to include the following:

- General description of the system and it's operation
- Details of the method of operation of the plant and controls
- An equipment and controls list giving the following:

  Description
  Quantity
  Make
  Model Number
  Location

- A schedule of the servicing to be done on each item of equipment and controls and the frequency
- A log sheet giving the design parameters and provisions for the logging of these parameters by plant operator
- Description of automatic control system, accompanied by control schematics (where necessary)
- Step-by-step instructions for starting / stopping each item of equipment
- A record of relevant readings taken during final commissioning and hand-over tests
- "As-built" drawings, wiring diagrams, piping schematics

4.8.2. Manuals

The Sub-Contractor, in additions to the operating and maintenance manuals, shall give detailed explanation of and instructions to the Owner on the operation of the complete installation, as finally commissioned and handed over.

The Sub-Contractor shall operate the whole plant for a period of five consecutive full working days after the plant is handed over.

During this period, the Sub-Contractor shall instruct the Owner in the operation of the plant.

4.9. Fixing Materials

4.9.1. General

The Contractor shall position and secure conduits, ducts, cables and cable channels, switchboards, fittings and all other equipment or accessories as required for the installation. The Contractor shall provide and fix all supports, clamps, brackets, hangers and other fixing materials. Clamps and brackets used to fix or support equipment such as cable trays, ducts, etc. shall be of a purpose made type suitable for the specific application.

4.9.2. Finishing

Supporting steelwork, brackets, rods, clamps, etc. shall be galvanized in accordance with the requirements the South African National Standards (SANS) Code of Practice. Where unavailable, unpainted supporting steelwork installed by the Contractor shall be wire-brushed and given one coat of rust-resisting prime, followed by one coat of high quality enamel paint before any other equipment is

4.9.3. Structural Steel

Support, brackets, hangers, etc. may only be welded to structural steel members were prior permission of the Structural Engineer and/or Principal Contractor has been obtained. Where welding has taken place the Contractor shall make good the corrosion protection coatings by approved local treatment of the welded areas.

Approved fasteners may be used as an acceptable alternative to fix equipment to structural steel members.

4.9.4. Screws & Bolts

Where holes exist in equipment to be fixed, bolts and fixing screws as specified shall be used. Where sizes are not specified, the largest bolt or screw that will fit into the hole shall be used.

4.9.5. Wall Plugs

Where the fixing holes in brick or concrete walls are smaller than 10mm diameter and where the mass of the equipment is less than 10kg, wall plugs may be used. Wooden plugs are not acceptable. Aluminium plugs may be used in face bricks. Plugs installed in joints between bricks are not acceptable. A masonry drill of the correct size shall be used to drill holes for plugs. Round-headed screws of the correct diameter to match the specific plug shall be used throughout.

4.9.6. Anchor Bolts

Where the fixing holes are 10mm and larger or where the mass of the equipment is greater than 10kg, equipment shall be fixed by means of expanding anchor bolts or by means of bolts cast into the concrete or built into walls. Expensive fixings are not suitable for use in certain structural members and in positions close to the edge of the structure.
It is the Contractor's responsibility to obtain permission from the Structural Engineer and/or the Principal Contractor prior to the use of this type of fixing.

4.9.7. Galvanized Equipment

Brass screws, bolts and nuts shall be used to fix galvanized equipment.

4.9.8. Shot-Fired Fixings

Materials such as metal cable ducts or channels may be fixed against wall and concrete slabs by means of shot-fired fixings provided that this means of fixing is acceptable to the Structural Engineer and /or Principal Contractor responsible for the structure.

It shall be the Contractor's responsibility to ascertain whether this method of fixing will carry the weight of the material including conductors, cable and other items of equipment to be installed later. Should it be found that this method of fixing is inadequate and supports tend to loosen, the Contractor will be required to fix the material by an alternative method.

A shot-fired method shall not be used.

4.10. Ducting & Sheet metal Work

4.10.1. General

All sheet metal work shall comply with the requirements of the SANS Standards.
Ductwork shall be constructed as shown on the attached drawings, and as specified herein.

4.10.2. Sheet metal Ducting

The material, construction and dimensions of all steel and aluminium ductwork (together with fittings and dampers) for use in air conditioning and ventilation systems that operate at low, medium and high pressures shall be in accordance with the requirements of South African National Standards (SANS).

4.10.3. Flexible Ducting

Flexible ducting shall be manufactured from aluminium unless otherwise specified and shall be approved by the Engineer.

Joints shall be made airtight and fastened with clamps.

All flexible ducting on supply air systems shall be insulated.

4.10.4. Waterproofing

Where any work pierces waterproofing or external walls, supply all necessary sleeves, lining and flashing required to make openings watertight. Waterproofing and flashing details shall be approved by the Engineer.

4.11. Thermal Insulation

4.11.1. General

All thermal insulation work shall be executed by specialists in the specific field. Recommendations of manufacturers regarding application of insulation materials, insulation, cladding, adhesive, etc., shall be strictly observed. The work shall be executed in a workman like manner and the final surface shall have a neat, smooth and symmetrical finish.

Before the application of thermal insulation, steel surfaces shall be treated and prime coated as specified elsewhere.

No equipment shall be insulated until tested and approved.

Adhesives, sealants and coatings shall be compatible with the insulation material.

Certified test reports for approval by the Engineer shall be submitted by the Sub-Contractor in which the following information is given:

(a) The thermal conductivity of insulating materials at operating temperatures
(b) The surface spread of flame of insulating materials, adhesives and other finishes
(c) The permeance of vapour barrier systems (chilled water systems)

Surface spread of flame for insulation shall be in accordance with British Standards

Vapour barrier permeability on chilled water pipes shall be not more than 0,6 grams.m^2 per 24 hours in accordance with British Standards temperature test.

Insulation, adhesives and finishes shall be resistant to rotting, mould, fungus growth, decay or attach by vermin.

4.11.2. Piping

4.11.2.1. Chilled Water Pipes. Exposed

All supply and return pipes in plantroom or areas exposed to traffic and possible damage shall be insulated as follows:

Pipe Insulation	Phenolic foam, preformed sections "Megaphen" Density 35kg/m^3
Pipe Sizes (Nom ID)	65 80 100 150 200
Insulation Thickness (mm)	20 20 20 25 25
Vapour Seal	Foil wrap glued to insulation in accordance with manufacturers recommendation
Pipe Fittings	Insulated and wrapped as above
Pipe Support	"Megaphen" HD pipe support sections, vapour sealed prior to insulation
Cladding	Galvanized sheet metal, 0.5mm thick to straight lengths. Elbows, valves, etc., to be vapour sealed with an approved supply.

4.11.2.2. Chilled Water Pipes. Concealed

All supply and return pipes in concealed or non-trafficable area shall be insulated as follows:

Pipe Insulation	Phenolic foam, preformed sections "Megaphen" density 35kg/m^3
Pipe Sizes (Nom ID)	20 25 32 50 65 80 100 150 200
Insulation Thickness (mm)	15 15 20 20 20 20 20 25 25
Vapour Seal	Foil wrap glued to insulation in accordance with manufacturers recommendation
Pipe Fittings	Insulated and wrapped as above
Pipe Supports	"Megaphen" HD pipe support sections, vapour sealed prior to insulation
Cladding	Not required

4.11.2.3. Hot Water Pipes. Exposed

All supply and return pipes shall be insulated with plain resin bonded glass fibre insulation with a density of 96 kg/m^3 with factory applied canvas wrap.
Insulation shall be of the following thickness:

Pipes up to 25mm diameter	-	30mm
Pipes up to 150mm diameter	-	40mm
Pipes bigger than 150mm diameter	-	50mm

Insulation shall be clad as for chilled water pipes. The sheet metal covering shall be cut to the size of the support at pipe supports or hangers.

4.11.2.4. Valves & Fittings

Valves and fittings shall be insulated as per the pipes

4.11.3. Duct Insulation

4.11.3.1. General

All supply air ducts shall be either externally or internally insulated with 25mm thick resin bonded glass fibre with a density of 75 kg/m^3 or mineral wool having a density of 96 kg/m^3.

The insulation shall be installed in accordance with the manufacturer's instructions and shall be adequately fixed to prevent dislodgement from the duct.

Hanger pins for the fastening of internal and external insulation shall comply with requirements as specified in "Duct Liner Application Standard" (SMACNA) where applicable with respect to construction, distance between hanger pins and positioning of hanger pins. Hanger pins shall preferably be of the electric stud weld type. Welding time shall be sufficient to ensure a firm adhesion. If the "grip-nail" type is used and the hanger pins show evidence of poor fastening during inspection, the Sub-Contractor may be requested to replace all fastener pins with the electric stud weld type.

The necessary care and caution shall be exercised when handling internally insulated ducts, so that the insulation surface will not be damaged. Any such damage shall be repaired to the satisfaction of the Engineer.

Return air and fresh air ducts shall not be insulated unless otherwise indicated or specified in Part Six, or where exposed to sunlight or weathering in which case the requirements of Clause 4.11.3.5 shall apply.

4.11.3.2. External Insulation to Air Ducts in Plant Room or Exposed

Ducts shall be externally insulated with resin bonded glass fibre of 25mm thickness and with a density of 75 kg/m^3. The insulation shall be cut accurately so as to butt closely at all joints and projections through the insulation. Insulation shall be bonded to the duct surface by a manufacturer approved product.

Inverted and side insulation shall be additionally supported by the use of hangers. Where insulation is cut to provide for a duct hanger, the insulation shall be sealed for the full thickness. The surface of the insulation shall then be brush coated with one application of the same product A canvas shall then be laid into the wet film and smoothed to remove all air pockets and wrinkles. Canvas laps shall be at least 25mm and shall be adhered by an approved adhesive. The canvas surface shall receive one brush coating of sealant

4.11.3.3. External Insulation to Air Ducts in Outside Plant Room or Concealed

Ducts shall be externally insulated with resin bonded glass fibre of 25mm thickness and density of 24 kg/m^3 covered with a factory applied aluminium foil facing. Insulation shall be adhered to the duct surface by means of an approved adhesive.
Inverted and side insulation shall be additionally supported by the use of a hanger. All protrusions and cuts through the insulation shall be sealed for the full insulation thickness by on brush application of an approved sealant, to obviate moisture migration at these points. Duct supports shall not be covered by insulation. Hangers shall be removed when applying external insulation.

4.11.3.4. Internal Insulation

Internal insulation of ducts, where specified, shall be carried out as follows:

Ducts shall be internally insulated with neoprene faced resin bonded glass fibre of 25mm thickness and density of 75 kg/m^3. The insulation shall be bonded with an approved adhesive.

Insulation shall be additionally supported with clip type hangers and washers, which shall be bonded to the duct surface at approximately 500mm centres.

All transverse and longitudinal joints to insulation on low and high velocity systems shall abut tightly and shall be sealed with an approved adhesive to obviate flow at these points.

Free edges of the insulation at terminal points, transverse to the air stream shall be mechanically fixed to prevent damage or detachment.

Lining damaged due to handling shall be repaired before erection of the ducting.

4.11.3.5. Insulation to Ducts Exposed to Sunlight or Weathering

Supply air, return air and fresh air ducting shall be insulated as follows:

Internal insulation – In accordance with Clause 4.11.3.4

External insulation 25mm thick polystyrene boards, adhered to ducting using a suitable adhesive. Polystyrene to be covered with fibreglass matt coated with suitable resin and painted with two coats of enamel, to provide complete waterproof finish.

4.12. Noise & Vibration

4.12.1. General

The noise and vibrating generated by equipment shall be isolated from the structure by means of anti-vibration mountings, spring hangers or flexible pipe connections.

All equipment, piping, etc., shall be mounted on or suspended from approved foundations and supports, all as specified herein.

Unless otherwise specified, all floor mounted equipment shall be erected on a reinforced concrete pad, cast into a channel frame. Where vibration isolation between machine and base is used, the base shall be extended to support the isolating system.

All vibration isolators shall be selected and supplied by the same manufacturer and shall be approved by the Engineer before installation.

Vibration isolators shall have a guaranteed static deflection as specified and the isolators shall be installed in accordance with the manufacturer's recommendations.

4.12.2. Vibration Mountings

4.12.2.1. Neoprene Mountings

Neoprene mountings shall have a minimum rated static deflection of 10mm. All metal parts shall be moulded into the neoprene to prevent corrosion and to provide friction, so that the mounting need not be bolted to the floor.

4.12.2.2. Unrestrained Spring Mountings

This Specification covers three alternatives:

(i) is preferred, (iii) when equipment is mounted on a deep concrete base, being more economical and efficient than (ii). However, (iii) shall be used when additional lateral support is required, to ensure stability during starting and stopping.

(i) Open Spring Mountings

Spring mountings shall be open and free standing, and laterally stable without any housing. The springs must be isolated from the floor by neoprene friction pads or cups. Mountings shall have levelling bolts that can be rigidly bolted to the equipment. Spring diameters shall not be less than 80% of the compressed height of the springs at rated load. Springs shall have a minimum additional travel to solid equal to 50% of the rated deflection. When the load per mounting exceeds single spring capacity, springs may be clustered in units of two or more.

(ii) Housed Spring Mountings

The housing shall consist of cast iron top and bottom elements, separated by neoprene sponge inserts, to provide lateral support. The mounting shall incorporate a height adjusting bolt and a friction pad bonded to the bottom element, which must have provision for bolting down to the floor. Spring diameters shall not be less than 80% of the compressed height of the spring at rated load. Springs shall have a minimum additional travel to solid equal to 50% of the rated deflection. When the load per mounting exceeds single spring capacity, springs may be clustered in units of two or more.

(iii) Open Spring Mountings with Concrete Bases

When equipment is installed on a concrete base (without steel framework) the height of the base shall be at least 250mm and the base shall be cast on a plastic sheet to facilitate separation from the floor. Cast iron or fabricated steel housings shall be cast into the base, so that spring mountings as described in Specification i) can be neatly recessed into the base. The housing shall have an internal height equal to the height of the mounting and shall have a means of locating the adjusting bolt of the mounting in the centre of the housing, so that the mounting can be used to elevate the concrete base

4.12.2.3. Restrained Spring Mountings

Equipment which has an operating mass different from the installed mass, such as cooling towers, chillers and equipment exposed to the wind, shall be mounted on spring mountings as described for unrestrained spring mountings, but installed in a housing that includes restraining bolts to prevent extension when the mass is reduced. The housing shall also swerve as blocking during erection so that the installed and operating heights shall be the same. A minimum clearance of 5mm shall be maintained around the restraining bolts and of 12mm between the housing and the spring, so as not to interfere with the spring performance. The housing shall be hot dipped galvanized.

4.12.3. Vibration Isolation Hangers

4.12.3.1. Spring Hangers

This Specification covers three alternatives:

(i) This is a basic spring hanger incorporating a low profile spring that ensures that the hanger rod does not touch the hanger cage. Vibration isolation hangers shall consist of a steel spring housed in a steel cage. The spring shall fit into a neoprene cup which locates in the cage. To prevent contact between the cage and lower hanger rod.
The cup shall contain a steel washer to evenly distribute the load on the neoprene. Spring diameters shall not be less than 80% of the compressed height of the spring at rated load. Springs shall have a minimum additional travel to solid equal to 50% of the rated deflection. The spring height and diameter, and the neoprene cup containing the spring, shall be so dimensioned as to allow the lower hanger rod to swing through a 30ºarc before coming into contact with the cup. When the load exceeds single spring capacity, springs may be clustered in units of two or more.

(ii) This adds a neoprene element to i) for better efficiency, particularly in eliminating high frequency noise, and is to be used when superior performance is required. Hangers shall be as specified in i) above but shall incorporate a neoprene element with a minimum rated static deflection of 8mm. The element shall locate in the top of the cate in order to prevent contact between the cage and the upper hanger rod.

(iii) This adds a fixed elevation device to i) and ii), to facilitate installation. It also ensures that excessive load is not put onto equipment flanges, and is to be used for the three hangers nearest the inlet and outlet of each item of equipment. Hangers shall be as specified in i) or ii)above shall have provision for the spring to be pre-compressed to the rated deflection so as to keep the piping or equipment at a fixed elevation during installation. The hangers shall be provided with a method of releasing any residual pre-compression after the installation is complete and the hanger is subjected to its full load. Deflection shall be indicated by means of a scale. Pre-compressed hangers shall be used at the three support points nearest the inlet and outlet of each item of equipment.

4.12.4. Vibration Isolation Joints

4.12.4.1. Flexible Rubber Connections

Flexible rubber connectors shall be used in the positions indicated in the drawings, or where otherwise required, to reduce transmission of vibration or noise from equipment to pipework, accommodate pipe expansion and contraction, take up minor misalignment and facilitate connecting up. Where equipment is provided with a shut-off valve, the flexible connector shall be installed between the equipment and the valve.

Connectors shall be moulded in neoprene rubber with nylon reinforcing. Steel rings or wire reinforcement shall not be permitted. Only connectors of the spherical or arch type, allowing Movement and misalignment in all planes, shall be used. Rubber hoses are not permitted.

The neoprene body shall be fitted with loose flanges, free to rotate, so as to facilitate lining up. Flange bolts must be fitted with the heads towards the rubber body. Where desirable for space saving or economy, elbow connectors can be used. For nominal diameters of up to 65mm flexible connectors with threaded ends, instead of flange, may be used.

Neoprene connectors may be used with single arch construction but where large movement or misalignment must be accommodated, or where maximum vibration and noise control is required, double arch connectors are preferred.

Neoprene connectors must be correctly installed in accordance with the manufacturer's directions, proper account being taken of whether pipe anchors are installed on both side of the connector, or whether the piping is unanchored, or whether the piping is connected to equipment, such as pumps, mounted on spring supports.

In cases where the piping is unanchored and the operating pressure (or test pressure or possible pressure surges) could over-extend the connector, rods or cables must be used to restrain thrust. Suitable neoprene washers must be used to isolate the rods or cables from the flanges, to prevent vibration short circuiting the connector.

Neoprene connectors offered must have a guaranteed burst pressure of at least three times the required working pressure. When allowance is made for temperature/pressure de-rating. Connectors must be rated for continuous operation at the required working pressure and temperature. If the pressure and/or temperature are excessive for neoprene connectors, flexible stainless-steel connectors must be used.

4.12.4.2. Flexible Steel Connections

Flexible stainless-steel connectors shall be used in the positions indicated in the drawings, or where otherwise required, to reduce transmission of vibration or noise from equipment to pipework, accommodate pipe expansion and contraction, take up misalignment and facilitate connecting up. Where equipment is provided with a shut-off valve, the flexible connector shall be installed between the equipment and the valve.

This Specification refers to flexible connectors built up from annular corrugated stainless-steel hose, reinforced with an external shroud of stainless steel wire braid, with the ends of the braid locked so as to allow the connector to flex but not stretch. It does not refer to un-braided stainless-steel bellows, generally known as expansion joints.

Flexible rubber connectors are preferred for sound and vibration attenuators, but flexible stainless-steel connectors should be used:

a) When the temperature or pressure is required
b) When maximum flexibility is required
c) When maximum safety is required

Flexible stainless-steel connectors should be fitted with loose flanges, to prevent twisting and facilitate lining up.

Minimum lengths shall be as follows (but longer lengths must be used where necessary for the required flexibility, or to exceed the manufacturer's recommended minimum radius):

DIAMETER (mm)	50	65	80	100	125	150	200	250
LENGTH (mm)	300	325	350	400	450	500	550	600

It must be noted that, unlike flexible rubber connectors, flexible stainless-steel connectors cannot accept axial movement, but only transverse (flexing) movement. If a single connector is used it should therefore be installed parallel to the equipment shaft to accommodate vibration, or at right angles to the direction of movement to accommodate pipe expansion. When the movement is in two planes, two flexible connectors at right angles are to be used.

Flexible stainless-steel connectors offered must have a guaranteed burst pressure of at least three times the required working pressure. When allowance is made for temperature/pressure de-rating, connectors must be rated for continuous operation at the required working pressure and temperature.

4.12.5. Foundations

All rotating equipment shall be provided with concrete foundations with approved vibration isolators for rotating equipment. Refer to section “Noise and Vibration Control”.

The foundations shall be not less than 100mm high and extend not less than 150mm beyond the equipment on all sides. The Contractor shall provide galvanized steel channel forms the size and shape of each foundation. These forms shall be of suitable strength such that they will not distort when concrete is cast therein. Where necessary, the foundations are to be cast on an isolating layer which shall be provided by the Contractor. The forms and the isolating layers shall be provided to the Builder together with any holding down bolts required and drawings giving all necessary dimensions.

These foundations shall be painted by the Contractor once cast in position. A suitable etching primer shall be used on the exposed surfaces of the galvanized steel. Colour of paint to be used to be selected by the Engineer.

4.12.6. Sound Attenuators

Sound attenuating units and sound absorption lining in ductwork shall be provided as required to control the system level within the limits as specified in Part Six.

Sound attenuators shall be supplied by an approved manufacturer. Published data of attenuator performance must be available.

Detailed calculation sheets substantiating the selection of attenuators to achieve the sound levels specified in Part Six of this document shall be submitted for approval by the Engineer prior to ordering.

The sound attenuator’s casing shall be made from galvanized sheet steel at least 1,6mm thick. All joints shall be made airtight for pressures up to 1 kPa.

Connection between attenuator and ductwork shall be by means of matching angle iron flanges.

Flanges shall be at least as follows:

Longest side up to 1000mm	30 x 30 x 3mm angle
Longest side greater than 1000mm	40 x 40 x 4mm angle

The matching flange is to be sized such that it will accommodate the connecting ducting without restriction.

When required, splitters shall be made with a galvanized steel frame and an acoustical fill of mineral wool covered with galvanized perforated sheet.

4.13. Electrical Work for Mechanical Installations

4.13.1. General

All electrical equipment shall be suitable for the declared voltage of the Supply Authority.

Unless otherwise specified, electrical energy will be brought to the Contractor’s main switchboard by the Electrical Contractor. The supply and installation of the Control Boards, Sub-boards, Electrical Equipment and complete wiring therefrom shall form part of this Contract.

Unless otherwise specified the Contractor shall provide and install any necessary for the complete installation.

4.13.2. Wiring Diagrams

Although covered elsewhere, specific mention is made of the provision of wiring diagrams.

Apart from submitting comprehensive wiring diagrams for approval prior to the commencement of control board manufacture, the Contractor is to provide on completion "as-built" wiring diagrams for all electrical work forming part of this Contract.

Copies of these diagrams and those for manufactured equipment are to be included in the Operating and Maintenance Instruction Manuals.

4.13.3. Notices & Fees

The contractor shall give all notices required by and pay all necessary fees, including any inspections fees, which may be due to the Local Supply Authority.

4.13.4. Electricity Supply

All equipment shall be capable of operating continuously under variations in the supply system of ±5% in the voltage and ±5% in the frequency. The system supply data is set out in the details installation specification.

4.13.5. Compliance with Regulations

The complete electrical installation shall satisfy the local Supply Authority and shall further comply with the Code of Practice for the Wiring of Premises as issued by the South African Bureau of Standards, the Local Supply Authority By-Laws and the requirements of the Manpower and Occupation Safety Act. The latter shall take precedence in the case of conflicting requirements. A COC certificate shall be issued by the contractor

Except where otherwise provided for in this specification, all equipment offered shall comply with the requirements of the relevant South African National Standards SANS standard specification, if published and shall bear the mark, otherwise with the relevant British Standards in force at the time of tendering, the specifications mentioned herein or shall otherwise be "approved".

Where equipment offered complies with the recognised standards of the country of manufacture and not specifically with the standards required by this specification, such equipment will be considered at the discretion of the Engineer. In this case, Tenderers shall state fully, all respect in which the equipment offered departs form the standards laid down in this specification.

4.13.6. Protection of Electrical Equipment

No piping shall pass through any Elevator Machine Toom, Transformer Room, Emergency Generator Room, Switchboard Room or Electrical Duct.

In general no piping shall be located in the same room within 1,8m in plain view of any part of any electrical switchboard.

Where the above is not practical, protect electrical apparatus as follows:

Provide watertight drip pans of 1mm galvanized sheet metal, reinforced and properly supported, under all piping near electrical control boards. Provide 32mm drain outlet pipes to spill over nearest floor drain.

4.13.7. Standardization of Materials & Equipment

Wherever possible the equipment offered shall be of one make with the facility to interchange corresponding parts/components.

Materials and equipment used in this contract must, where possible, be of South African manufacture. The Contractor shall submit samples of any materials or equipment, if required, for approval before installation. Such samples will be held for comparison purposes with equipment and materials installed and will be released on satisfactory completion of the contract.

4.13.8. Conduits

Conduits shall enter distribution boards from above, unless otherwise specified.

Mechanical and electrical continuity must be maintained throughout the conduit installation although conduit shall NOT be relied upon for each continuity.

Conduits shall be screwed into outlets of conduit boxes where possible but where fixed to boxes they shall be secured by means of sockets and brass bushes passing through properly sized clearance holes.

All conduit ends shall be cut square to enable the conduits to be butted at all conduit sockets and joints and conduit threads shall not show at the joints or terminations except where running joints are made. All lubricants used to ease screwing shall be wiped off and oil shall not be used. The inside of conduits, the ends of conduits, and all fittings used in the connection therewith shall be smooth and free from burrs and all other defects. All exposed screw threads and parts where the galvanized or paint finish has been damaged shall be thoroughly cleaned and painted with a zinc-rich paint for galvanized or a black bitumastic paint for black enamel conduits.

Conduits shall comply with South African National Standards SANS.

All conduits shall be heavy gauge, screwed, welded seamless, or solid drawn, unless otherwise specified in the detailed installation specification. No conduit with less than 20mm external diameter shall be used.

Concealed conduit shall be finished black enamel but shall be galvanized for use externally for surface installation or where exposed to weather.

All junction used in conjunction with steel conduit shall be of heavy steel or cast iron construction, to South African National Standards SANS. Boxes for external use or in damp situations shall either be provided with gaskets or with machined faces and watertight covers. The use of inspection elbows, solid bends and tees will not be permitted except where shown on the drawings. All fittings used with galvanized conduit shall be galvanized. All screws shall be cadmium plated. All surface conduits shall be supported by cast distance saddles. Conduits shall be supported on both vertical and horizontal runs at 1500 mm centres.

4.13.9. Cables

Single core cables used in the wiring of building shall be 600/1000 Volt grade PVC insulated to South African National Standards SANS. The cables shall be from recent stocks and must be delivered on the site with seals unbroken and bearing the SABS mark.

Cables shall be sized according to the duty they are to perform in accordance with the relevant standards.

Where multiple circuits or single core cables are run in parallel runs, the use of proprietary metallic wiring trunkings with PVC cables drawn in will be permitted. Such wiring trunks shall be totally enclosed, electrically continuous, bonded, provided with returned edges.

Connections to motors shall terminate in a short length of flexible conduit.

Earth continuity conductors shall be installed in all conduits and provided for all cables. Terminals shall be enclosed in purpose made terminal boxes. The terminal boxes shall be generously sized, metallic or approved non-metallic (e.g. dough moulding compound and shall be provided with DIN mounting rail terminal blocks sized to requirements, terminal screws which do not act directly on the conductors, removable cover plates and adequate cable or conduit entries.

Multicore armoured cables shall be PVC PVC SWA to South African National Standards SANS or MICC to BS 6207 Part 1 and shall be fitted with maker's approved glands, and ends shall be properly made off.

Cable glands for PVC cables shall comply with the requirements of South African National Standards SANS and shall bear the mark.

4.13.10. Cable Trays

In most circumstances, it will be permitted to run cable on a cable tray in which case the tray shall be manufactured of galvanized steel of not less than 1,6mm gauge.

Cable trays shall be complete with bends, tees, etc. and be continuous.

Cable trays shall be perforated galvanized steel with upstand 12mm high for up to 250mm wide trays and 50 high for wider trays.

Cable ladders similar and equal to Sankey Strut may also be used.

Trays shall be securely supported from ceilings or brackets and by means of screwed galvanized rods 10mm diameter and cross supporting angle or unistrut section, at intervals of 1500mm

4.13.11. Testing of Electrical Equipment

Conduct such tests and adjustment of equipment as specified elsewhere, and as necessary to verify performance requirements, and as required by all Authorities having jurisdiction. Submit data taken during such tests to the Engineer. The Engineer reserves the right to be present during these tests and shall be notified 48 hours in advance.

Contractor shall give all assistance required and provide such tools, materials, implements and instruments as are necessary for the tests. The Engineer reserves the right to call for such additional tests as he may consider necessary.

Upon completion of work the electrical installation shall be tested for earthing and short circuits in accordance with the Code of Practice. If tests indicate inadequate insulation resistance, corrections shall be made as directed by the Engineer.

Insulation resistance values shall be not less than those specified in the Code of Practice.

Operational tests of electrical equipment shall be performed as directed by the Engineer and as specified elsewhere.

Notify and make arrangements with the officials of the Supply Authority for carrying out all municipal tests. Provide attendance, tools, staging and all other facilities to the Supply Authority as may be required by such test. The Engineer reserves the right to present at the tests and should be notified 48 hours in advance.

4.13.12. Electric Motors

4.13.12.1. General

All electric motors shall be constructed in accordance with the following requirements where applicable.

SANS	Three Phase Induction Motors
SANS	Single Phase Induction Motors
British Standards	Specification for General Requirements for Rotating Electrical Machines

The mounting and coupling arrangement for the motors shall suit the plant Layout, but adequate provision shall be made for ease of replacement of motors.

Motors shall be minimum Class F insulation.

Motor terminal boxes shall be adjustable to allow for cable entry from any one of three directions at 90º i.e. entrance from below or either side (not above) and for all forms of cable connections. It shall be possible to remove the motor. Terminal boxes shall be drilled and tapped to take two cable glands to South African National Standards SANS. Both holes shall be fitted with blank brass plugs.

The colour code for motors, guards, baseplates, pumps, etc, shall be standard manufacturer's ex-works paint finish unless specified otherwise

4.13.12.2. Rating & Types

All motors shall be continuous maximum rated, three phase or single phase squirrel cage induction type, wound for duty on an earthed 380/400 or 220/230 Volt 50 Hz system.

All motors shall be rated for direct-on-line starting unless otherwise indicated. Speeds shall be suitable for the Equipment to be driven. Motors shall be rated at not more than 1,3 times the designed mechanical load.

Rating plates shall be provided on all motors and shall be of stainless steel or a non-corrosive alloy.

4.13.12.3. Requirements for Various Environments

Indoor Wet

Enclosure to IP55 degree of protection.
Windings to be treated with extra impregnation and baking.
Cable entry from below.
Motors with ratings in excess of 50 kW to be fitted with heaters.
Frames shall be aluminium.

Indoor Dry

Enclosure to IP54 degree of protection.
Cable entry from bottom or sides.

Outdoor
Enclosure to IP65 degree of protection.
Cable entry from below.
Motors with ratings in excess of 50Kw to be fitted with heaters.
Frames shall be aluminium.

Caustic
The entire housing, terminal box, fan cover, end shields and mounting foot or plate shall
not be of aluminium construction.
Enclosure to IP55 degree of protection.

Dust Explosive Proof
Enclosure and terminal boxes shall be suitable for CLASS 1 DIVISION 2 are in accordance
with South African National Standards SANS.
Enclosure group, in addition to the above, with be to IP54.

Variable Speed
All motors intended for use in variable speed applications shall be fitted with integral positive temperature co-efficient or resistance type thermistors for the thermal protection of the windings.
One thermistor shall be fitted per phase and shall be wired in series with the ends brought out to the terminal box.
The terminal box shall be large enough to accommodate both the power and control cable glands.

PART FIVE

Contents

5. Standard Specifications Mechanical & Electrical.

This section out-lines the standard specifications pertaining to the mechanical & electrical requirements for the supply and installation of the HVAC systems. Should any details in part five contradict those laid out in part six then part six will take precedence.

5.1. Roof Top Air-Cooled Airconditioning Units

Each unit shall be contained in one casing housing compressor(s), air cooled condenser, direct expansion cooling coil, supply air fan, condenser fans, air filters, integral electric control panel. Discharge configuration is specified elsewhere. Heat pump units to include refrigerant reversing valve.

The unit shall be weatherproof and shall require no additional protection from the elements. All necessary drainage trays shall be provided, and the base shall have drainage holes.

The cabinet shall be galvanised steel with a baked enamel paint finish. Any damage to the paint finish during transportation or installation shall be repaired in a manner approved by the Engineer. If, in the opinion of the Engineer, the finish on the panels has been damaged to the extent that it cannot satisfactorily be made good, then affected panels shall be replaced.

The evaporator fan section shall be fully insulated to prevent condensation and eliminate heat pick-up.

The unit shall have two independent refrigeration circuits where two compressors are fitted. Each compressor assembly shall be provided with the following:

- Each compressor shall be mounted on vibration isolators
- Suction and discharge stop valves
- Pressurised lubrication with an oil filter
- Crankcase oil heater
- Thermostats embedded in the compressor
- Motor winding to be provided with motor overload protection to all three phases
- High pressure and low pressure switches
- Liquid line sight glass
- Filter drier
- Charging valve

An anti-cycling timer which will prevent the compressor motor(s) from being subjected to starting current more than once every five minutes.

The compressor must be protected against liquid slugging.

Integral electric control panel to contain all necessary circuit breakers, contactors, relays and protection devices required for the safe operation of the units.

The direct expansion cooling coil shall be of the fin and tube type with aluminium fins mechanically bonded to the copper tubes. Each cooling coil shall be provided with a galvanised steel drip tray which has all jointed brazed, watertight and externally insulated with sprayed polyurethane. Drain posts shall be sited to ensure complete condensate drainage.

The condenser coils shall be of the fin and tube type with aluminium foils mechanically bonded to the copper tubes.

The unit shall have a minimum of two direct driven propeller type condenser fans discharging vertically. The fan motors shall be totally enclosed, thermally protected and shall be fitted with permanently lubricated ball bearings.

All rotating equipment shall be fitted with suitable safety guards.

The supply air fan (s) shall be fitted with suitable safety guards.

The supply air fan(s) shall be of the centrifugal type with backward or forward curved blade and shall be manufactured in galvanized steel or other suitable corrosion resistant material. The fans shall be statically and dynamically balanced and shall have permanently lubricated ball bearings. The fan motors shall be of the squirrel cage type with belt drive and shall be so mounted that adjustment of belt tension can readily be carried out. The motor shall be thermally protected against overload. The fan/motor assembly shall be mounted on a common baseplate on vibration isolators.

On end discharge installations the supply air discharge outlet shall be above the return air duct.

The filters shall be of the washable media type with efficiency as specified elsewhere.

Electric heaters where specified shall be duct mounted, on cooling only units.

Heat pump (Reverse-cycle), units where specified shall include an automatic reversing valve controlled by a common cooling/heating thermostat. Commencement of the heating cycle shall be automatic without manual changeover to heating mode. Heat pumps shall be equipped with auto-defrost cycle.

A separate control panel shall be provided as specified in Part Six, which shall contain the following:

- Electronic controllers as specified
- Time switch
- Status indication for components as specified

5.2. Split Type Air-Cooled Airconditioning Units

5.2.1. General

The split air conditioning air-cooled units shall be suitable for domestic and light commercial applications. The system shall include an outdoor condensing unit section and an indoor evaporator unit section with interconnection refrigerant pipework and fittings. The plant shall be to the Engineer's approval and shall be complete in all respects with matching equipment are required.

5.2.2. Condensing Unit

A weatherproof galvanized steel cabinet, epoxy power coated, shall house the compressor, condenser, etc., and shall be mounted on anti-vibration mountings. The internal components
shall be easily accessible for inspection and maintenance by removing service panels.

The units shall be of the inverter type un less otherwise stated in part 6.

The compressor shall be of the hermetically sealed type, internally sprung and mounted on rubber vibration isolators.

The condenser coils shall have aluminium fins mechanically bonded to seamless copper tubes.

The condenser coils shall be manufactured from reinforced glass fibre with the complete assembly mounted in a thermoplastic fan shroud.

5.2.3. Evaporating Unit

The evaporator unit shall be made of sheet metal and shall be thermally and acoustically insulated throughout on all panel inner surfaces. Exposed edges of insulation material to be neatly finished and riveted galvanized sheet metal nosing strips. Readily removable panels shall provide easy access to all the internal components.

The evaporator coils shall be manufactured from copper tube with aluminium bonded, unless otherwise specified. In areas of high humidity (e.g. Coastal regions), tubes and fins to be copper.

The evaporator coils shall be manufactured, forward curved centrifugal type and shall be dynamically balance. The fan motor must be mounted on rubber bushes and quiet operation must be ensured.

A drain pan shall be provided beneath the coil, graded to fall towards the drain outlet.

The condensate drain discharge pipe from the drain pan shall be run in nominal 20mm diameter hard-drawn copper galvanised mild steel to a fall of not less than 1:100 and shall be adequately supported to prevent sagging. For pricing purposes an allowance should be made for 15m of drain piping, with 5 elbows and 1 union. No PVC drains shall be permitted.

Electric heaters, when required, shall be of the incaloy sheathed type, suitable for operation in still air. The element shall be properly supported in the air stream.

5.2.4. Refrigerant Piping

Refrigerant piping shall be run in soft drawn copper and insulated with a propriety brand of insulation. Piping shall be installed on cable tray and when exposed to sunlight shall be provided with a galvanized sheet metal protective cover to prevent deterioration of the insulation.

Piping shall be carefully sized and arranged to avoid excessive pressure drops and that under all load conditions gas velocities must be such to ensure entrainment of oil.

Horizontal lines shall be pitched in the direction of refrigerant flow at least 5mm per meter run and shall be installed in a straight and direct manner without sagging.

Where vertical risers exceed 2500m the piping shall be provided with suitable oils traps.

The installation shall be complete with all necessary valves and fittings, etc. and shall be absolutely free of dirt and scale.

All connections must be thoroughly checked before the closing of ceilings and brick shafts etc., and prior to start up, to ensure that there are no leaks.

5.2.5. Electrics

A switched power supply, terminating in an isolator adjacent to the condenser unit, shall be provided by others.

The A/C sub-contractor shall supply all power and control wiring from the isolator to the evaporator unit and from the evaporator unit to the condenser unit.

5.2.6. Controls

Control and safeties shall include but not be limited, to the following:

- Internal overload protection on all motors
- High and low pressure cut-out (automatic reset)
- Automatic defrost
- Thermostat controller (digital) – on/off, min 3 speed, 24 hour timer, temperature control fan only.
- Low ambient temperature protection

5.3. Fans

5.3.1. General

Fans shall be statically and dynamically balanced and shall be free of any objectionable vibrations.

Fans shall be selected to operate as close as possible to the point of maximum efficiency.

Lubrication points for fan bearings shall be readily accessible and shall where necessary be extended to the outside of the fan casing.

Fan openings shall be provided with protective wire guards in accordance with the Manpower & Occupational Safety Act, 1983.

All belt drives shall be designed for a minimum of 25% overload with no less than two matched belts being used. Belts shall be selected and installed in accordance with BS 3790 – 1981.

Belt guards shall be provided and arranged to permit oiling, use of tachometers and other testing and maintenance operations with the guard in place. The guard shall have a front screen of expanded metal.

Fan bearings shall be selected for a minimum of 200 000 hours average life.

Fan shafts and bearings are to be properly protected from rust and corrosion by means of suitable wrapping protective grease coatings prior to commissioning.

5.3.2. Centrifugal

Unless otherwise specified, centrifugal fans shall be backward curved blade type with single thickness, shaped blade, designed to give the fan a continuously rising, non-overloading pressure characteristic.

Fan casings shall be fabricated from heavy gauge steel adequately reinforced and rigidly supported by means of an angle iron support framework. Field joints shall be flanged and bolted with gaskets fitted between flanges to render these air tight. Where necessary casings shall be made in sections small enough to permit installation or removal through opening available in the building.

Shafts shall be steel, with sufficient mass that the critical speed of the wheel and shaft is well above the operating speed of the fan. The wheel shall be tightly fitted and keyed to the shaft. Bearings shall be self-aligning ball or roller type.

Fans shall be driven by an electric motor through a V-belt drive. The motor mounting bracket shall be readily adjustable. Motor nameplate power shall exceed the absorbed power by a minimum of 15% and the motor shall be suitable for the starting method as further specified herein. Motors shall be rated for continuous operation.

The fan and driving motor shall be mounted on a common steel base frame. This frame shall be fabricated from rolled steel section with strength and dimensions to match the fan/motor assembly and shall incorporate properly selected factory designed spring isolators. Fans with wheel diameters above 1000mm shall be provided with access doors fitted to the fan casing.

5.3.3. Axial

Unless otherwise specified, axial flow fans shall be in-line, direct driven type, with motor mounted inside the fan housing. The fan rotor assembly shall be attached directly to the motor shaft.

Fan housings and flanges shall be manufactured from mil steel material either spun construction or with end flanges continuously welded to casings.

Fan rotors shall be cast aluminium construction, blades shall have an aerofoil section, having a varying degree of twist and width from the hub to the tip of the blade to ensure equal air distribution along the length of the blade. Blade pitch shall be manually adjustable.

The fan motor shall be totally enclosed rated for continuous operation and shall be squirrel cage induction type suitable for vertical and horizontal operation with grease lubricated bearings.

Fans shall be of the long casing type, unless otherwise indicated.

Fans installed under free intake conditions shall be fitted with an inlet cone supplied by the fan manufacturer.

5.3.4. Propeller

Propeller fans shall be ring or diaphragm mounted.

Fan rotors shall be statically and dynamically balanced before leaving the factory and shall have at least four pressed steel blades.

Fans shall have rubber in shear type vibration eliminators mounted on their feet.

Fan motors shall be totally enclosed, rated for continuous operation and shall be squirrel cage type with sealed bearings.

Fans shall be provided with a suitable wire mesh guard.

5.4. Air Filtration Systems

5.4.1. General

Filters are to be a standard product of a reputable manufacture regularly engaged in the fabrication of the particular type of air filter or, if imported, the product shall be well represented in South Africa.

Only filters which comply with the test results with regard to filter arrestance efficiency, dust holding capacity, air resistance, etc., all shown to the satisfaction of the Engineer. These results must have been obtained by the manufacturer from an independent institute or bureau, generally accepted as being well equipped for and reliable in the carrying out of such tests and making use of the ASHRAE standard (Standard 52 – 76 “Method Testing Air Cleaning Devices”) whereby the efficiency curve can be determined. Prior approval of the filters to be used is to be obtained before purchasing.

Maximum air flow through filters is not to exceed the manufacturers rated capacity.

Where called for in this Specification, a stationary inclined differential pressure gauge, complete with cocks, static pressure tips and necessary copper tubing shall be mounted where directed. The range of the instrument selected is to be suitable for the filter installation and is to be adjusted by the manufacturer ready for operation.

Provide access doors in ductwork or casing walls for convenient servicing and removal of filters.

Frames and filters shall be constructed to prevent the passage of unfiltered air with liners being provided between filter frames and unit casings, etc.

All metal parts of the filter shall be suitably protected against corrosion and shall be painted as specified elsewhere.

Filter units and filtration media shall be as herein specified. The application of the various filter systems shall be as indicated or as specified in the Detailed Installation Specification.

5.4.2. First Stage

Automatic renewable section, to be fitted with media of progressive density both in number and diameter of glass fibres, minimum depth 50mm when operating in air stream. Clean filtering media to be automatically fed at a predetermined rate across the filter face and re-rolled under compression into a dirty roll.

Filter casing to be of galvanised steel construction, with punched duct flange. All structural members minimum 2.40mm, galvanized steel.

Automatic section to be complete with initial loading of media; totally enclosed drive motor with built-in thermal protection; adjustable timer to regulate the rate of media fed and manual advance stitch; media run-out switch for each section and indicating light. Time operative only when fan operating. Alternatively pressure controls, interlocked with supply fan operation, shall be provided to advance the filter media. Electrical control base factory pre-wired.

Dirty media roll if in contact with leaving air, and/or clean media roll if in contact with entering air, shall be enclosed.

Filter media is to have a mean arrestance (ASHRAE) of at least 83% and dust sport efficiency (ASHREA) OF AT LEAST 30%.

5.4.3. Second Stage

Rear access filter assemblies attached directly to and immediately downstream of first stage, consisting of holding frame, mounting frame and replaceable filter cartridge. Cartridge face velocity to conform to first stage face velocity.

Pre-punched, holding frame, minimum 2,0mm galvanised steel, with gasket, external seals and filter locking device.

Replaceable, high efficiency, dry-type filtering media of ultrafine fibres, factory preformed and collapsible.

Replaceable, high efficiency, try-type filtering media of ultrafine fires, factory preformed and collapsible.

Filter media is to have a mean arrestance (ASHRAE) of at least 50%.

5.4.4. Washable Panel Filters

Each filter tank shall consist of a factory-made, robust, sectional steel supporting frame which shall accommodate the filter cells.

Media shall be kept in position by means of matching inner and outer retaining frames form a filter cell, or alternatively the filter cell structure shall be sufficiently rigid to ensure air tight fitment within the support frame.

Filter cells shall be easily removable from the upstream side of the filter when of the clip-on type, or from the side of the filter assembly when of the slide type.

Filter arrestance, efficiency and media thickness shall be as specified in the Detailed Installation Specification.

5.5. Control Systems

5.5.1. General

Supply and install a complete automatic control system for all the functions as shown on the Engineer's drawings, and as specified in the Detailed Installation Specification.

The control system shall be installed and put into operation by the Contractor.

The control system shall be complete with thermostats, humidistats, relays, controllers, valve, actuators, etc., to achieve system operation as specified.

Before the Contractor commences with installation of the control system, a complete set of drawings and detail control descriptions shall be prepared and submitted to the Engineer for approval.

Shop drawings shall include all schematic drawings and panel layouts, and shall be submitted to the Engineer in triplicate.

5.5.2. Instrument Panels

All control instruments serving a specific plant, plantroom or air-conditioned space, shall be grouped and mounted in one panel.

The panel shall be provided with a lockable door mounted on sturdy hinges. Both panel and door shall be fabricated out of sheetmetal of suitable thickness to give the required rigidity and strength.

Switches and dials controlling the control system and indicating its operation shall be mounted in the panel door, and shall be visible with the door closed.

Instruments shall only be adjustable with the door open.

Instrument panels shall not form part of electrical distribution boards, but shall be manufactured in accordance with constructional dimensions of electrical distribution boards. The colour of the control panel will be furnished by the Engineer after acceptance of tender.

5.5.3. Control Panels

Instrument panels shall be of the 2-way or 3-way type in accordance with the drawings.

Control valves of the 3 way type shall be installed as mixing valves, unless specified otherwise.

Valves of 50mm and smaller shall have brass bodies and screwed connections.

Valves of 65mm and larger shall have cast-iron bodies and flanged connections.

Valves shall be selected according to the system working pressure, and shall be provided with servos of sufficient size for the expected pressure differentials under normal operation.

Valves required for proportional control shall be selected for a pressure drop equal to the pressure drop of the controlled item, or not less than 25 percent of the system dynamic head.

Control valves shall be of the pneumatic diaphragm type, shall have suitable spring ranges and shall be provided with pilot operators where required. Control valve servos shall have sufficient capacity against the closed pressure drop to prevent chattering.

PART SIX

Contents

6. Detailed Technical Specifications

This part of the specifications must be read in conjunction with drawings CCS078-201 rev0 & CCS078-210 rev0. Parts 6 & 7 takes precedence in respect of discrepancies in the description of equipment.

6.1. Description of Installation

The upgrade of the SABC Gymnasium and Changing Rooms.
The site is located at Television House, cnr Henley rd & Artillary rd, Aucklank Park. Johannesburg.

Gymnasium AC units

This is an existing gymnasium. All existing equipment and ducting pertaining to the workout area & Aerobics area is redundant. All equipment and ducting is to be decommissioned and un-installed as part of this contract. All redundant items are to be handed over to an SABC representative.

IMPORTANT NOTE

- The equipment is **NOT** to be handed over charged with refrigerant.
- It will be the responsibility of the AC contractor to ensure the old refrigerant is re-claimed prior to removal of the equipment and handing over.
- Refrigerant is to be reclaimed as per industry accepted standards. Refrigerant is **NOT** to be released to atmosphere.

Three new ducted AC systems are to be installed to cover the entire work-out area, reception area and evaluation room.

One new ducted AC system is to be installed in the aerobics area,

Each of the 4 units will be individually controlled via a remote, hard-wired controller, located in the reception area. The wire ways and wiring between the main control panels and the remote controller, located at reception, shall comply with the latest SABC regulations and shall form part of the Air Conditioning Contract.

The four outdoor units are to be mounted at high level on the external wall, as shown on drawing CCS078-201 rev 0. All steel work required to accomplish this will form part of this contract. It is the responsibility of the AC contractor to guarantee the integrity of the steel frames.

Due to the position of the units, size and weight, should be considered when selecting the units. And will take priority in the final adjudication.

Rigging and crane hire is to be priced for, based on all lifts taking place during normal working hours. Irrelevant of the number of lifts, a firm price is to be submitted for the entire scope of work.

The tender prices submitted for all the new equipment are to remain fixed for 45 days. Escalation rates are to be submitted when returning this tender and will be applied should the installation only commence in the future.

The approved suppliers for these units are:

- Heating Centre
- Thermocold
- Ecoaire
- Daikin
- Mitsubishi
- Dunham Bush
- McQuay
- Haier
- Carrier
- LG
- Samsung

The Units for the Main Offer must be manufactured by one of the above suppliers. If a different supplier from those mentioned above is to be quoted on, it must be submitted as an alternative offer.

Note, Size and weight of units must be kept to a minimum.

Motors with capacities of 7.5 kW or larger shall be provided with Star-Delta start.

On receiving a signal from the smoke detection system the AC unit automatically switch off.

The air distribution is to be completely balanced. Measurements are then to be taken and detailed on a duct layout (overlaid on the store layout) and submitted to the Engineer. Final adjustments, after submission to the Engineer, are also to be allowed for.

Changing Rooms Ventilation.

This is an existing gymnasium. All existing equipment and ducting pertaining to the Change rooms is redundant. All equipment and ducting is too be decommissioned and un-installed as part of this contract. All redundant items are to be handed over to an SABC representative.

A complete new extraction system is to be installed as per details given in Part 7 and on Drawing CCS078-201

6.2. Design Conditions

Site Altitude		:	Approx. 1740 m above sea level
Ambient Temperatures-	Summer	:	32 °C db;
	Winter	:	6 °C db
Maximum Indoor Conditions		:	22 °C
Minimum Indoor Conditions		:	< 21 °C
Indoor Humidity		:	Uncontrolled
Noise Levels - All Areas		:	NC 35

6.3. Scope of Work

The Air Conditioning Contract shall include but not be limited to:

Supply and installation of the air-conditioning systems as specified, including testing and commissioning to final handover and acceptance.

The provision of all necessary controls, instrumentation and wiring from control panels to air conditioning units as specified herein.

The timeous provision of Builder's Work details.

The co-ordination with other trades and services especially with regard to structure, lighting, ceiling and piped services layouts.

Painting of exposed ducting and piping, where specified, control panels and any touching up as required. Colours to be used shall be selected by the Consulting Mechanical Engineer.

Provision of galvanised steel channel forms and holding down bolts for equipment plinths, which may be required for rotating equipment. Minimum depth 150 mm.

The provision of all scaffolding, skyjacks, containers, portable toilets as required.

The up-holding of all safety requirements including the supply of a "Safety File" as stipulated by the main contractor and his appoint safety officer.

Installation "Shop" drawings.

Record "As-Built" drawings.

Three sets of Operating and Maintenance Manuals.

Housekeeping. The removal from site of excess and waste material generated during HVAC works.

The entire installation must conform to the requirements of this specification and must be complete in every aspect. All equipment is to be vermin proof, and be suitable for a

Non aggressive corrosive environment.

The basic criteria for specific measurements with regards to noise levels is NC35

This project is to be carried out in accordance with the **Main Contractors construction programme.**

6.4. Programme

The Air Conditioning Contractor will have access to the site **Mid 2021** (to be confirmed)

The Air Conditioning Installation must be commissioned, tested and taken over by the Engineer as and when required according to the main building program. This is provisionally the **TBA End 2021**, but actual program dates will be confirmed by the main contractor once appointed. As the store will be trading during the refurbishment areas will be completed in phases, as such continuation of work cannot be guaranteed.

For any detailed programming requirements the Main Contractor, can be contacted on site.

The Air Conditioning Contractor will be notified of the success of his price. Thereupon the Air Conditioning Contractor shall IMMEDIATELY put the work in hand, notwithstanding the fact that no official Subcontract will by this time have been entered into. During the period prior to the signing of an official Subcontract, but during which the work must in terms of the above be proceeded with, the work will be administered by the Engineer as if, in fact, such document had already been in force.

The Air Conditioning Contractor shall be required within ONE WEEK after acceptance of his price, to submit to the Engineer for his approval, a Programme showing the order in which the Works will be executed. Such Programme shall show the times for the preparation of all drawings, ordering and delivery times promised by the suppliers for each major item of the Plant, manufacturing and delivery times for all manufactured items, installation and the programmed dates for testing and commissioning the Plant.

The Programme shall be prepared in consultation with the Main Contractor and the execution of the Works shall be programmed so as to keep pace with the Building Programme. The Air Conditioning Contractor is required to visit the site and discuss the programme with the Main Contractor. It shall be assumed that by submitting a tender, the Air Conditioning Contractor has complied with this clause.

The Contractor shall submit his Programme to the Engineer for approval and after approval by the Engineer in writing; the Air Conditioning Contractor shall supply copies to the Main Contractor.

After submission to and approval by the Engineer of such Programme, the Contractor shall adhere to the order of procedure and method stated therein unless he obtains the written permission of the Engineer to vary such order or method. The submission to and approval by the Engineer of such Programme shall not relieve the Air Conditioning Contractor of any of his duties or responsibilities under the Subcontract.

The times required for the submission of Drawings

Builder's Work Drawings	within **ONE WEEK**
Shop Drawings	within **ONE WEEK**

6.5. Site Supervision & Organisation

The Contractor shall, whilst the works are in progress, employ at least one good and competent supervisor, careful and skilled in all aspects of the trade and callings required by the contract.

This supervisor shall be on site whenever work associated with this contract is being carried out, and shall at all other times be available to attend to queries. This representative shall be nominated at the award of contract and must be acceptable to the Engineer.

The supervisor shall be the contractor's authorised representative on site and must be available to attend Progress Meetings when called upon to do so.

The supervisor shall be appointed to the contract as soon as possible after the awarding of the contract. The supervisor shall from time to time of his appointment, attend all meetings relevant to the contract, whether called for by the Architect or Engineer, and whether or not these take place prior to work actually commencing on site.

The supervisor shall not be transferred from his position unless on the expressed instruction of the Engineer.

The Contractor shall at all times have on site copies of all pertinent drawings as well as a copy of the specification. The Contractor shall institute the necessary procedures to ensure that the drawings on site are the latest issue, and that all superseded drawings are removed from site.

The Contractor shall at the time of pricing name both the Contract Manager and the responsible Director.

The contractor shall appoint a responsible person to take responsibility for the installation work being carried out on site. This person shall be responsible for liaising with the Engineer, the builder and other contractors with regard to progress, problems and queries. He / (she) shall be required to resolve any queries the Engineer may have, and shall be required to attend any site meetings and inspections as requested by the Engineer. This person shall be totally familiar with all details of the work being carried out on site at all times.

6.6. Work by Others

The following work associated with the Air Conditioning Installation **will not be** included in this contract.

Builder's Work

The provision of openings in concrete work.

The building in of duct sleeves etc, where required to provide an air tight or fire proof seal.

The flashing and waterproofing of all duct penetrations through external walls, roofs etc.

The casting of concrete plinths for mounting air conditioning equipment and waterproofing of the same.

The provision of timber frames in masonry openings as required for fixing ducts

The supply and fitting of door grills as per drawing.

Electrical Work

Unless otherwise indicated or specified, the Electrical Contractor shall provide isolators at the condenser points.

The supply and installation of power cables to HVAC control panels and termination on main isolators.

All fans, except where otherwise noted, shall be provided with local isolators.

The provision of fan starters and overload protection as required to be allowed for by the HVAC contractor.

The provision of power to single or three phase isolators adjacent to fans and smaller equipment.

Temporary lighting and power will be provided by the Employer.

6.7. Drawings

The following drawings form part of this specification and are to be read in conjunction with it. Tenderers are to note that the drawings are indicative of the work content and should be complete in all respects.

- HVAC Shop Floor Layout CCS078-201
- HVAC Redundant Equipment CCS078-210

Architectural and Structural Drawings

The Air Conditioning Contractor shall ensure that he is in possession of all information required for the installation of the Works and shall, if necessary, obtain copies of all relevant Drawings from the Architect and Structural Engineer so named in the documentation.

Builder's Work Drawings

All Builders' Work and work to be carried out by others in accordance with the Specification has been indicated on the RFQ Drawings. The Air Conditioning Contractor will check, approve, add to or alter such Drawings as may be necessary to suit the Plant offered by him, and accepted by the Engineer within the time stipulated

Such Builder's Work Drawings shall indicate the location and extent of all foundations, bases, openings, timber frames and all other Builder's Work and the capacities and/or dimensions of all electrical and water supply points, the position and dimensions for all water drainage connections and any other work to be provided by others for the Works, as detailed in these Specifications.

The Drawings shall be drawn to scale and in sufficient detail to enable the Builder to execute work without any misunderstanding.

Within a reasonable period after receiving such Drawings, the Engineer shall signify his approval, or otherwise, and one signed copy of each approved Drawing shall be returned to the Air Conditioning Contractor.

When approved, the following number of copies of each such Drawing shall be issued to each of the following:

Client/Developer
Quantity Surveyor
Main Contractor
Architect
Electrical Engineer
Structural Engineer

Shop Drawings

The Air Conditioning Contractor shall submit to the Engineer, for approval within the time stipulated copies of all Shop Drawings as required for the manufacture and installation of the Works or as the Engineer may reasonably require.

Within a reasonable period after receiving such Drawings, the Engineer shall signify his approval, or otherwise, in writing and one signed copy of each Drawing containing relevant comments if any, shall be returned to the Air Conditioning Contractor.

The Air Conditioning Contractor shall not, unless otherwise directed by the Engineer, in writing, commence with any work prior to the approval of the relative Shop Drawings. Work installed prior to the approval of Shop Drawings shall be liable to rejection by the Engineer and removal and/or replacement by the Air Conditioning Contractor, at the Air Conditioning Contractor's cost, if it is considered by the Engineer to deviate from the Specification.

Drawings approved as above described shall not be departed from except as authorised by the Engineer.

The Engineer shall have the right at all reasonable times, to inspect at the factory of the Air Conditioning Contractor, all Drawings of any portion of the Works.

Errors on Drawings

Any expense resulting from an error or omission in or from delay in delivery of the drawings shall be borne by the Air Conditioning Contractor.

The Air Conditioning Contractor shall be responsible for any discrepancies, errors or omissions in the drawings and other particulars supplied by him, whether such drawings and particulars have been approved by the Engineer or not, provided that such discrepancies, errors, or omissions are not due to inaccurate information or particulars furnished in writing to the Air Conditioning Contractor by the Engineer or Architect. The Employer shall be responsible for drawings and information supplied in writing by the Engineer or the Architect and for the details of special work by either of them.

6.8. Electrical Work

All conduit, trunking, cable trays and wiring from the isolators to the condensing units and HVAC Equipment are to be supplied and installed by the Air Conditioning Contractor.

All conduit, trunking, cable trays and wiring from the units to the Control Panels are to be supplied and installed by the Air Conditioning Contractor.

All Hard Wired Controllers are to be chased into the wall under this contract.

The Air Conditioning Contractor shall confirm the following information timeously to the Electrical Contractor as regards:

Maximum power to be consumed by each component of the new Air Conditioning installation.

The position of isolators for Air Conditioning equipment.

6.9. Sheet Metal Duct Work

Flexible ductwork shall be fire retardant, SABS approved in accordance with National Building Regulations, and fixed with jubilee clips.

All duct dimensions quoted are sheet-metal sizes.

Cognisance of structural limitations to be taken when producing working drawings.

Duct layouts to be co-ordinated with ceiling, lighting and piped building services layouts.

6.10. Vibration and Noise

Due to the close proximity of the units to sensitive occupied areas, it is essential that the AC Contractor takes care in selecting vibration isolators, which match the characteristics of the machinery used. The HVAC Contractor shall be responsible for the prevention of direct transmission of vibration from moving equipment to the structure.

The AC Contractor shall make the necessary corrections in an approved manner without additional charge for noise in excess of the specified limits and vibration considered excessive by the Engineer and for the transmission of noise and vibration due to faulty equipment or workmanship.

The outdoor units shall be placed on anti-vibration pads.

6.11. Insulation

All ducting outside the building shall be internally insulated with 50mm Sonic lining.
All ducting running inside the conditioned space to be uninsulated.
All ducting in ceiling voids shall be externally insulated.

6.12. Operating and Maintenance Manuals

The AC Contractor shall furnish to the Engineer, before the Works are taken over, a draft copy of the Operating and Maintenance Manuals, As Built drawings and Preliminary Commissioning Data for approval or comment.

Three hard copies and two CD Rom copies of the approved Operating and Maintenance Manuals, As Built Drawings and final Commissioning Data shall be submitted to the Engineer within one month after taking over of the Works.

The manuals shall be comprehensively indexed and bound in loose leaf plastic covers in a vinyl plastic folder with the name of the project type written on a card inserted into a clear plastic covered cardholder on the front cover and spine of the file. Files shall be sequentially numbered.

The manuals shall be arranged in three parts:-

Part I – Systems Operations
Part II – Equipment
Part III – As-built Drawings and Writing Diagrams

Part I – Systems Operation

This part describes the system in the building broken down in sub-systems, their operation, trouble shooting and corrective action, and monitoring and logging by means of text, graphics, table, flow charts, etc.

The contents of this section of the manual shall be arranged in accordance with the following index and shall contain information requested against each index heading:

Detailed HVAC System Description
HVAC System Operation

Part II – Equipment

This part shall be sub-divided on an equipment basis. The following checklist shall be used in indexing and sequencing the Manufacturer's information and results of final test data.

A. Descriptive Literature
   1. Catalogue Cuts, Brochures or Shop Drawings
   2. Dimensional Drawings and Record Drawings

B. Operating Characteristics
   1. Performance Tables, Charts or Curves and marked Operating Point or Points
   2. Pressure, Temperature and Speed Limitations
   3. Safety Devices and Settings

C. Operating Instructions
   1. Pre-start Checklist
   2. Start-up Procedure
   3. Inspection during Operation
   4. Adjustment and Regulations
   5. Testing

D. Maintenance and Instructions and Procedures
   1. Schedule of Routine Maintenance
   2. Procedure
   3. 'Trouble Shooting' Guides

E. Supplier Data
   1. Details of Equipment Guarantees

The Air Conditioning contractor shall use a copy of the operation and maintenance manual to explain to the store manager the complete workings of the HVAC system.

6.13. Financial

Rates in the BOQs shall be inclusive of design work, drawings, fabrication, fittings, hangers, painting, and accessories required for a complete installation.

The onus shall be on the contractor to ensure the quantities and calculations are correct. After acceptance of the RFQ, no adjustments will be allowed.

Only variation orders generated by the engineer and approved by the client shall be permitted.

Variations, both additions and subtractions, shall be calculated using the stipulated bill rates.

6.14. Claims For Payment

A detailed breakdown supplied by the Air Conditioning Contractor is to be used as the basis for controlling costs and substantiating claims for payment.

Shop drawings are to be submitted for approval together with an accurate schedule of materials, plant and equipment associated with that drawing.

Percentage completion is to be reflected on the breakdown, which is to accompany all Progress Claims. No payments will be made for claims which are not accompanied by the updated measurement of work done.

6.15. Guarantees

The Contractor shall unconditionally guarantee all new equipment and work for a minimum period of 12 (twelve) months from the date of First Delivery (Practical Completion); during which time any defects shall be rectified free of charge.

If the Contractor or his supplier has a standard guarantee which exceeds the minimum warranty called for, the remaining portion of such extended warranty must be ceded to the Client.

The guarantee shall cover the performance of the works and any defects due to inferior materials and/or workmanship, fair wear and tear accepted, and the Contractor shall repair any such defects without delay. This guarantee shall include malfunction and water, refrigerant gas, oil, or air leaks, and all adjustments.

Should any part of the complete works perform unsatisfactorily during the guarantee period so as to become detrimental to its functional use, the Contractor shall replace any such part of the complete works with equipment as prescribed by the Engineer.

PART SEVEN

Contents

CCS

7. Major Equipment Details & Specifications.

Detailed below is the minimum requirements of the equipment to be supplied as part of this project.

7.1. Air-Conditioning Units

7.1.1. Roof Top Unit.

- Numbering — AC01-AC02-AC03
- Make — Approved Suppliers Only
- Model — Supplier Dependant
- Required — 1
- Altitude — 1740 m
- Ambient — 32°C
- Total Cooling Capacity — 50 kW each
- Sensible Cooling Capacity — +/- 43 kW each
- Air On Coil — +/- 24°C
- Air Off Coil — +/-14°C
- Supply Air Quantity — +/- 3.0m³/s each
- Return Air Quantity — +/- 2,7m³/s each
- Fresh Air Quantity — +/- 0.3m³/s each
- Static Pressure — 350 pa
- Heating Capacity — NA
- Filters — 1 Sets Required

7.1.2. Roof Top Unit.

- Numbering — AC04
- Make — Approved Suppliers Only
- Model — Supplier Dependant
- Required — 1
- Altitude — 1740 m
- Ambient — 32°C
- Total Cooling Capacity — 35 kW each
- Sensible Cooling Capacity — +/- 30 kW each
- Air On Coil — +/- 24°C
- Air Off Coil — +/-14°C
- Supply Air Quantity — +/- 1.9m³/s each
- Return Air Quantity — +/- 1.7m³/s each
- Fresh Air Quantity — +/- 0.2m³/s each
- Static Pressure — 350 pa
- Heating Capacity — NA
- Filters — 1 Sets Required

7.2. Ventilation Fans

7.2.1. Staff Toilet Extraction.

• Numbering	**FAN 01**
• Type	Axial – Inline
• Make	Approved Suppliers Only
• Model	Supplier Dependant
• Required	1
• Size	Ø560mm
• Motor Size	1.2kW each
• Speed	1440rpm
• Air Quantity	2.1m³/s each
• Static Pressure	320pa
• Weather Louvre	Existing
• Burglar Bars	Existing
• Sound Attenuation	Yes: AS1 pod. 1.5 x diameter. 2 req
• Feet, Flanges, Flex Connection Hangers.	Yes

7.2.2. Kitchen Extraction

• Numbering	**FAN 02**
• Type	CX-10
• Make	Approved Suppliers Only
• Model	Supplier Dependant
• Required	1
• Size	Ø225mm
• Speed	1800rpm
• Air Quantity	0.25m³/s

7.3. Diffusers

- To be **RICKARD** type **CCD** or equal – as indicated on the drawing.
- To be **RICKARD** type **CRD** or equal – as indicated on the drawing.
- To be **EUROPAIR** type **DVK** or equal – as indicated on the drawing.
- To be **SOLAR PALAU** type **GCI** or equal – as indicated on the drawing.

7.4. Air Grills

7.4.1. Supply Air

- To be **EUROPAIR** type **DD** or equal – as indicated on the drawing.

7.4.2. Return Air**.**

- To be **EUROPAIR** type **RA** or equal – as indicated on the drawing.

7.4.3. Door**.**

- To be **EUROPAIR** type **DG** or equal – as indicated on the drawing.
- To be **TROX** type **AGS-T** or equal – as indicated on the drawing.

7.5. Weather Louvres

- To be **EUROPAIR** type **WL** or equal – as indicated on the drawing.

CCS

PART EIGHT

Contents

8. Proposed Major Equipment Details & Specifications.

This section is to be completed for all options submitted. One completed submission for each option returned. The contractor is to record, in detail, the specifications of equipment the RFQ is based on.

MAIN OPTION

8.1. Air-Conditioning Units

8.1.1. Roof Top Unit.

- Numbering **AC01-AC02-AC031**
- Make _____
- Model _____
- Number Supplied _____
- Size _____ LxWxH mm
- Weight _____ kgs
- Delivery Time _____ weeks
- Cooling Capacity _____ kW each
- Sensible Cooling Capacity _____ kW each
- Air On Coil _____ °C
- Air Off Coil _____ °C
- Supply Air Quantity _____ m^3/s each
- Return Air Quantity _____ m^3/s each
- Fresh Air Quantity _____ m^3/s each
- Static Pressure _____ pa
- Voltage _____ V
- Normal Running Amps _____ A
- Full Load Amps _____ A
- Heating Capacity _____
- Refrigerant _____
- Filters _____

8.1.2. Roof Top Unit.

- Numbering **AC04**
- Make _____
- Model _____
- Number Supplied _____
- Size _____ LxWxH mm
- Weight _____ kgs
- Delivery Time _____ weeks
- Cooling Capacity _____ kW each
- Sensible Cooling Capacity _____ kW each
- Air On Coil _____ °C
- Air Off Coil _____ °C
- Supply Air Quantity _____ m^3/s each
- Return Air Quantity _____ m^3/s each
- Fresh Air Quantity _____ m^3/s each
- Static Pressure _____ pa
- Voltage _____ V
- Normal Running Amps _____ A
- Full Load Amps _____ A
- Heating Capacity _____
- Refrigerant _____
- Filters _____

8.2. Ventilation Fans

8.2.1. Staff Toilet Extraction.

- Numbering _____
- Type _____
- Make _____
- Model _____
- Number Supplied _____
- Size _____ mm
- Motor Size _____ kWs
- Supply Air Quantity _____ m^3/s each
- Static Pressure _____ pa
- Electrical Supply _____ ph / V / A
- Weather Louvre _____
- Burglar Bars _____
- Sound Attenuation _____

8.2.2. Kitchen Extraction.

- Numbering _____
- Type _____
- Make _____
- Model _____
- Number Supplied _____
- Size _____ mm
- Motor Size _____ kWs
- Supply Air Quantity _____ m^3/s each
- Static Pressure _____ pa
- Electrical Supply _____ ph / V / A

8.3. Diffusers, Grills & Louvres

8.3.1. Diffusers.

- Make _____
- Model _____
- Material _____

- Make _____
- Model _____
- Material _____

8.3.2. Supply Air Grills.

- Make _____
- Model _____
- Material _____

- Make _____
- Model _____
- Material _____

8.3.3. Return Air Grills.

- Make _____
- Model _____
- Material _____

- Make _____
- Model _____
- Material _____

8.3.4. Louvres.

- Make _____
- Model _____
- Material _____

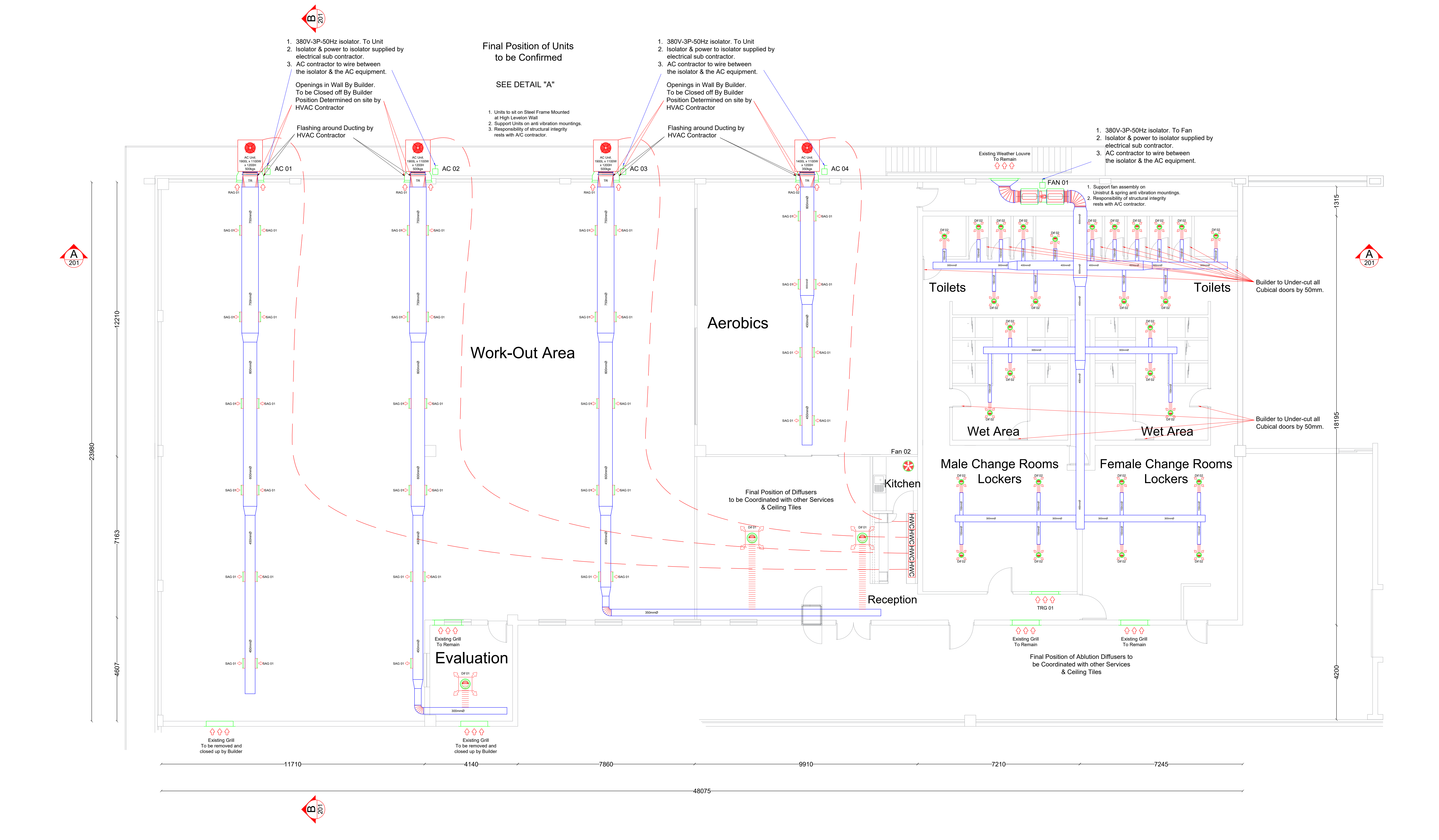
- Make _____
- Model _____
- Material _____

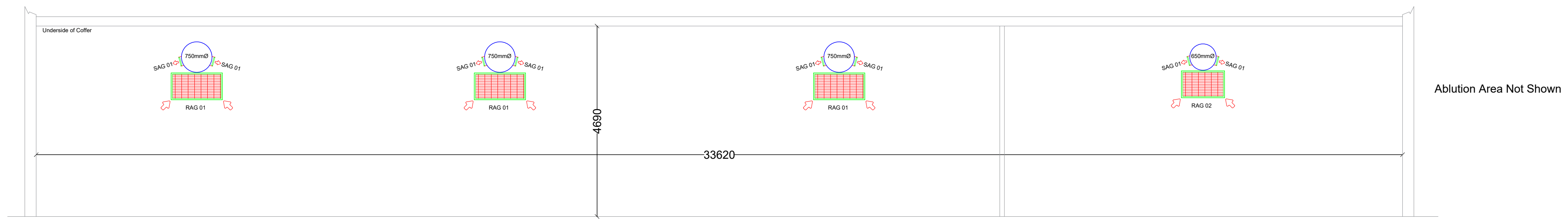
8.4. Automatic Controls

	Make	Model
• Electronic Controller	_____	_____
• Thermostats	_____	_____
• Safety Thermostats	_____	_____
• Fire Thermostat	_____	_____
• Pressure Switch	_____	_____
• Pressure Transducer	_____	_____
• Pressure Gauges	_____	_____
• Temperature Probe	_____	_____
• Damper Motor	_____	_____
• Voltage Monitor	_____	_____
• Time Switches	_____	_____

8.5. Switch Boards

	Make	Model
• Enclosures	_____	_____
• Isolators	_____	_____
• CBs	_____	_____
• Switches	_____	_____
• Contactors	_____	_____
• Overloads	_____	_____
• Relays	_____	_____
• Timers	_____	_____
• Instruments	_____	_____
• Time Switches	_____	_____





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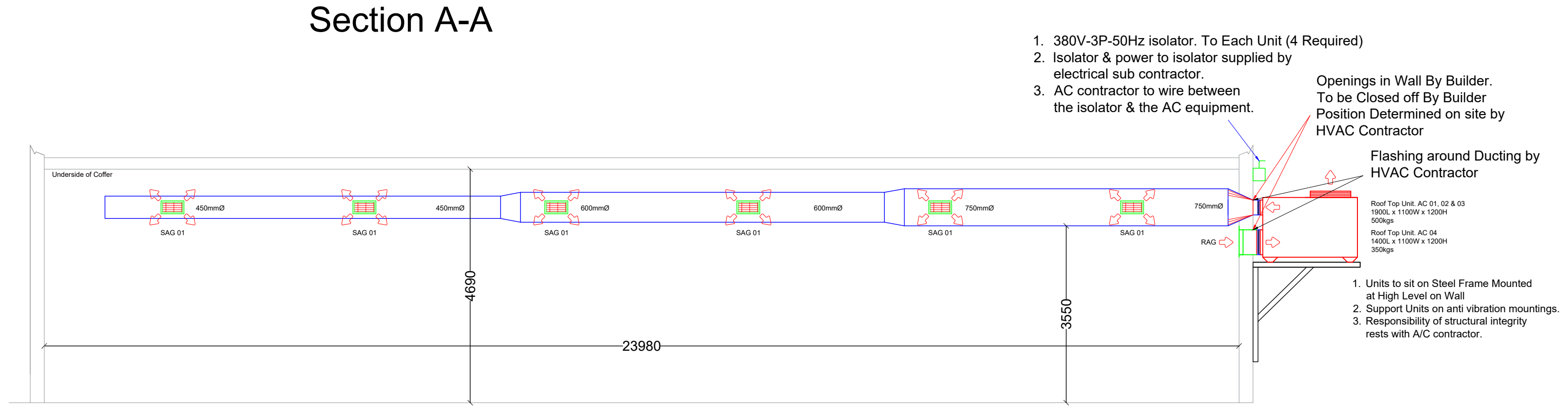

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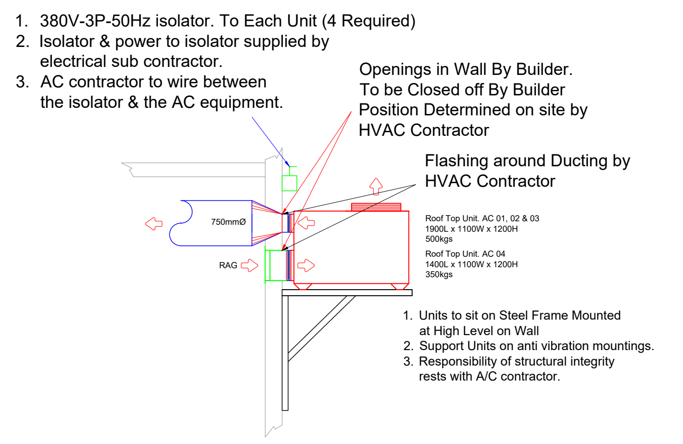
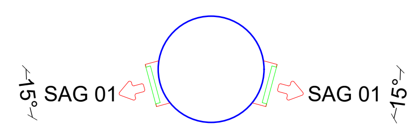


DETAIL "A"
NTS



Detail B
NTS

LEGEND

Equipment Description

AC Units

Item ID	Area	Type	Total Cool. kW	Flow l/s	F.A. l/s	Heat KWs	Power Req.
AC 01	Work-Out Area	Roof Top	50	3 000	300	Heat pump	380V-3PH-50Hz 25kw. 48A
AC 02	Work-Out Area	Roof Top	50	3 000	300	Heat pump	380V-3PH-50Hz 25kw. 48A
AC 03	Work-Out Area	Roof Top	50	3 000	300	Heat pump	380V-3PH-50Hz 25kw. 48A
AC 04	Aerobics Area	Roof Top	35	1 900	190	Heat pump	380V-3PH-50Hz 18kw. 34A

1. Controllers to contain 24 hour, 7 day programmable timer for auto start/stop with battery back up in case of power failures.
2. All units must be of the Inverter Type.

Fans

Item ID	Area	Description	Flow l/s	RPM	S.Pr pa	Power Req
Fan 01	Toilet Extraction	Ø560 axial flow fan C/W 2 x 1,5D pod sound attenuators	2100	1440	320	380V-3PH 50Hz-1.2kW
Fan 02	Kitchen Extraction	Ø225 Ceiling mounted CX10 or similar approved.	250	1440	-	220V-1PH 50Hz-0,03kW. Wired to light by Electrician

Diffusers

Item No.	No.	Description	Flow l/s	OBD	Remarks
Dif 01	3	595x595 square plate Ø300 neck	250 each	NO	Brian Rickard CCD or Similar Approved
Dif 02	29	Ø200 disk valve	70 each	NO	Trox or Similar Approved

Louvres

Item No.	No.	Description	Flow l/s	OBD	Remarks

Grills

Item No.	No.	Description	Flow l/s	OBD	Remarks
SAG 01	41	400 x 200 double deflection	+/-250	Yes	-
RAG 01	3	1 200x600 double deflection	+/-2600	Yes	-
RAG 02	1	1 000x600 double deflection	+/-1800	Yes	-
TRG 01	1	800x400	+/-1000	No	-

Symbols

Symbol	Description
1000 x 1000	Non Insulated Square Ducting
1000 x 1000	25mm Sonic liner, Internally Insulated Square Ducting
1000 x 1000	50mm Sonic liner, Internally Insulated Square Ducting
Ø500	Non Insulated Spiral Ducting
Ø500	25mm Foil Backed Externally Insulated Spiral Ducting
	Outdoor AC Unit
	Wall Mount Indoor AC Unit
	Ceiling Mount Indoor AC Unit
	600mmx600mm Square Plate Diffuser
	Round, Flush Diffuser
	Supply Air Grill. As detailed
	Return Air Grill. As detailed
	Axial Fan, With Attenuators. As detailed
	Plate Mount Fan, With Wire Grill. As detailed
	Ceiling Mount Fan
T/S	Temperature Sensor. 2 Required for Averaging
HWC	Hard Wired Controller. By HVAC Contractor
	AC Drain Point By Main Contractor as per Architect's Detail
	25mm PVC Conduit + 4x2 Box By Electrician as per Electrical Engineer's Detail
	Isolator Supplied & Fitted by Electrical Contractor
	Internal Ducting Burglar Bars, Supplied & fitted by HVAC Contractor
	Manual OBD
M	Motorised OBD
	Fussable LInk, Curtain Fire Damper
	Weather Louvre
	Door Grill

Notes:
1. Fan static pressures have been indicated as a guide for tendering purposes only. Actual pressures are to be calculated by the AC subcontractor to suit the equipment selections offered & are to be submitted for approval, prior to ordering equipment.
2. Performance specifications are for site altitude. AC & ventilation equipment selected must be rated accordingly.
3. Dif 01 & Dif0 2 to be powder coated as per Architect's colour specification.
4. Internal Square ducting running outside the Shop Floor envelope, to be internally insulated with 25mm Sonic Liner.
   Ducting running outside exposed to the Elements, to be internally insulated with 50mm Sonic Liner. as per specifications outlined in Part 4 of the Tender Document.
5. All Ducting, Louvres & Fans that penetrate an outside wall must be fitted with Burglar Bars.

To be read in conjunction with drawing:
CCS078-201
CCS078-210

NOTE:
All openings in walls, caused by the removal of old AC equipment & ventilation equipment, to be made good by the builder.

Rev	Date	By	Description	Chk	Eng
0	2021/04/06	AW	Issued for Tender	AW	
A	2021/03/20	AW	Consept Design	AW	

TENDER ONLY

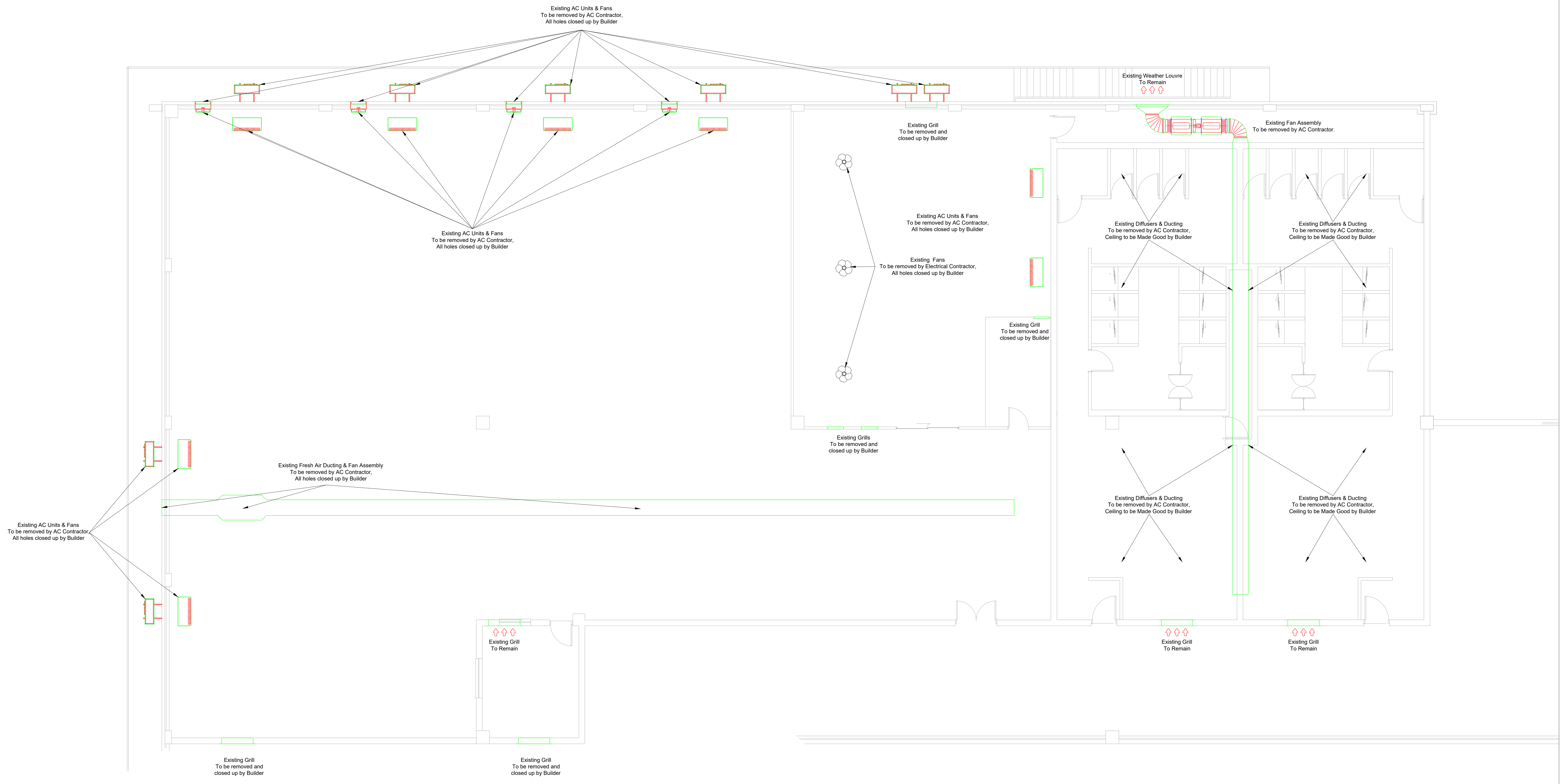
Issued for Tender

Drawing No:
CSS078-201

Title:	Revision:	Scale:
SABC. Layout.	0	1:150 @A2

Date:	Drawn By:	Checked By:	Engineer:
2021/03/20	A.W.		A.W.

HVAC, Refrigeration & Utilities Consulting



NOTE:

All openings in walls, caused by the removal of old AC equipment & ventilation equipment, to be made good by the builder.

Rev	Date	By	Description	Chk	Eng
0	2021/04/06	AW	Issued for Tender	AW	

TENDER ONLY

Issued for Tender

Drawing No: CSS078-210

Title: SABC. Redundant Equipment Layout.		Revision: 0	Scale: 1:125 @A2
Date: 2021/04/06	Drawn By: A.W.	Checked By:	Engineer: A.W.

HVAC, Refrigeration & Utilities Consulting