A WORKS CONTRACT FOR THE REPLACEMENT OF THE ENTIRE HVAC FAN COIL UNITS AND ASSOCIATED PLUMBING

FOR BOTSWANA SAVINGS BANK- HEAD OFFICE BUILDING, TSHOMARELO HOUSE, GABORONE

SPECIFICATION AND TENDER DOCUMENTATION

September 2024

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VOLUME 2

NOTES TO TENDERERS:

1. Tenderer's attention is drawn to the fact that the work in this section may only be executed by a SPECIALIST AIR CONDITIONING AND VENTILATION SUB-CONTRACTOR and proof of the aforementioned must be submitted.
2. The Conditions of Contract applicable to the main contract as well as the Preliminaries from the main contract document attached to the back of this document is applicable to this domestic sub contract.
3. The successful Tenderer for the mechanical installation shall be the Main Contractor - this contract shall enter into main building contract with the client Botswana Savings Bank.
4. The bill of quantities attached to this document is a PROVISIONAL BILL OF QUANTITIES which shall be re-measured at completion of the contract.
5. The Air Conditioning and ventilation specifications form an integral part of these bills of quantities and must be read in conjunction with the bills of quantities.
6. The Tenderer should submit additional information regarding the installer of the mechanical Installation together with the returnable schedules enclosed with the tender enquiry documents**.**
7. The contractor, on acceptance of his tender should submit within the period stated, the information indicated on the forms following immediately after the Summary of the bills of quantities for this installation.
8. The Tenderer is referred to the Architect's Layout drawings for the building issued with these tender documents.
9. The Tenderer shall submit the following fully completed forms with his / her tender:
    - Section 1 Returnable schedules
    - Section 5 Schedule of information
    - Section 7 Bills of Quantities

SPECIFICATION AND TENDER DOCUMENTATION FOR

HVAC FAN COIL UNITS AND ASSOCIATED PLUMBING SERVICES INSTALLATION

FOR

BOTSWANA SAVINGS BANK

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SECTION 1

RETURNABLE SCHEDULES

SECTION 1: PART 1

MAIN CONTRACT PRELIMINARIES

The Contractor is referred to the MAIN CONTRACT PRELIMINARIES and should acquaint himself / herself with the contents there of and make due allowances in the pricing of this document for any additional requirements.

SECTION 1: PART 2

RETURNABLE SCHEDULES

The Contractor is referred to the MAIN CONTRACT RETURNABLE SCHEDULES and should assist and provide the Main Contractor with the required information and documentation required for the completion of the tender documentation as called for.

SECTION 1: PART 3

LIST OF PREVIOUS SIMILAR CONTRACTS AND REFERENCES

TO BE COMPLETED BY THE TENDERER

The Tenderer shall complete the list below, duly listing at least three (3) previous similar contracts successfully completed, plus the consultancy firm / client involved in the project.

1. Contract .....
   Client .....
   Telephone .....
   Description .....
   Value BWP..... (to the nearest thousand)
   Year completed .....
2. Contract .....
   Client .....
   Telephone .....
   Description .....
   Value BWP..... (to the nearest thousand)
   Year completed .....
3. Contract .....
   Client .....
   Telephone .....
   Description .....
   Value BWP ..... (to the nearest thousand)
   Year completed .....

SECTION 1: PART 4

LIST OF PROPOSED DEVIATIONS FROM THE SPECIFICATIONS

The Tenderer shall list below any proposed deviation from the specification with the reasons and descriptions thereof. If there are no deviations write NIL. Only deviations listed here will be considered.

Item	Description	Add	Omit

Tenderer's signature: _____

Date: _____

Witnesses:

1. _____

2. _____

SECTION 1: PART 5

SHEDULE OF SUB-CONTRACTORS

SUB-CONTRACTORS TO BE EMPLOYED

The Tenderer must sate below the sub-contractors he intends to employ on this Contract.

NAME	**DESCIPTION OF WORK**
.....	.....
.....	.....
.....	.....
.....	.....
.....	.....
.....	.....
.....	.....
.....	.....
.....	.....

Date: _____ Tenderer Signature: _____

SECTION 1: PART 6

AIR CONDITIONING AND VENTILATION INSTALLATION MATERIAL SCHEDULE

The contractor shall complete the following schedules and submit them to the Representative/Agent within 21 days of the date of the acceptance of the tender.

The schedules will be scrutinised by the Representative/Agent and should any material offered not comply with the requirements contained in the specification, the Contractor will be required to supply material in accordance with the contract at no additional cost.

NB: **Only one manufacturer's name to be inserted for each item.**

Item	Material	Make or trade name	Country of origin
1.	Fan coil Units		
2.	Shut-off Valves		
3.	4-Way Modulating Valves		
4	Braided flexible hoses		

NOTE:

Should the contractor wish to supply materials other than that originally offered, prior written approval must be obtained from the Representative/Agent before any orders are placed.

CONTRACTOR:

_____

SIGNED: _____

DATE: _____

SECTION 1: PART 7

SCHEDULE OF IMPORTED MATERIALS AND EQUIPMENT TO BE COMPLETED BY TENDERER

Item	Material/Equipment	Pula (BWP) (Excluding VAT)
1		
2		
3		
4		
5		
6		

The Contractor shall list all imported items, materials and/or equipment which shall be excluded from the Contract Price Adjustment Provisions and shall be adjusted in terms of currency fluctuations only.

Copies of the supplier's quotations for the items, materials or equipment (provided that such costs shall not be higher than the relevant contract rate as listed above) should be lodged with the Representative/Agent of the Botswana Saving Bank within 60 (sixty) days from the date of acceptance of the tenders.

No adjustment of the local VAT amount, nor the contractor's profit, discount, markup, handling costs, etc shall be allowed.

The Contractor is referred to the price adjustment formula as contained in the main contract and should acquaint himself / herself with the contents thereof.

CONTRACTOR: _____

SIGNED: _____

DATE: _____

SECTION 2: PART 1

SPECIAL CONDITIONS OF TENDER

The Contractor is referred to the CONDITIONS OF CONTRACT contained in the MAIN CONTRACT and should acquaint himself / herself with the contents there of and make due allowances in the pricing of this document for any additional requirements.

SECTION 2: PART 2

SPECIAL CONDITIONS OF CONTRACT

The Contractor is referred to the CONDITIONS OF CONTRACT contained in the MAIN CONTRACT and should acquaint himself / herself with the contents there of and made due allowances in the pricing of this document for any additional requirements.

SECTION 3: PART 1

STANDARD TECHNICAL SPECIFICATION

1. QUALITY AND SCOPE OF THE WORK

The contract works described herein shall consist of the supply, delivery, erection, testing, balancing and commissioning into service of the air conditioning and ventilation installation as a whole. The contractor shall be responsible for selecting such equipment that will provide the performance as specified and to position it into the building spaces provided that sufficient spaces are left around the equipment for servicing and maintenance.

Where no specific kind or quality of material is mentioned in the specification, a standard article to the Engineers approval shall be supplied. All equipment shall be new and shall be kept in "as new" condition on site until take-over. Equipment selected shall be of high-quality material, design and manufacture and shall be suitable for the type of application and shall provide a reliable and trouble-free service without objectionable noises or vibration under continuous operating conditions.

NB: All work associated with this contract falls within the scope of this contract unless specifically excluded under Part 6 Division of Work.

2. COMPLIANCE WITH REGULATIONS AND STANDARDS

The contractor shall be responsible for ensuring that all equipment and methods used in the installation shall comply with all relevant statutory regulations. Where specific equipment or methods of construction has been specified it is the responsibility of the engineer that such equipment and methods comply with the relevant statutory requirements. The latest amendments of the following shall be complied with:

a) The "Code of Practice for the Wiring of Premises" SABS 0142-1978 as amended.

b) Occupational Health and Safety Act No. 85 of 1993 as amended.

c) Government Provincial and Local Authorities Ordinances, Regulations, By-laws, Rules and other legal instructions.

d) All relevant SABS specifications.

Where a conflict between the above-mentioned codes occurs, it shall be referred to the Architect for a decision and mentioned in the tender covering letter.

3. MATERIALS

Under normal conditions of use, all materials shall be free from defects, which are liable to cause undue

deterioration or failure. Materials shall not shrink, warp or cause mould or odors and shall be resistant to attack by local vermin and destructive pests.

Materials shall be stored in areas allocated by the Employer. Stored materials shall not overload the floor construction beyond design limits.

4. SUPPORTS

Approved methods of fixing to overhead construction shall be coordinated with the Building Contractor.

Where overhead construction is not suitable for fastening of supports additional framing shall be provided.

5. ACCESSIBILITY

All equipment shall be installed to be readily accessible for operation, maintenance and repair. Minor deviation from the drawings may be made to achieve this; however, change of magnitude or which involve extra costs shall not be made without the approval of the engineer.

Platforms and ladders shall be provided where required for access to equipment in accordance with the requirements of the authorities having jurisdiction.

6. PROTECTION AGAINST CORROSION

All steel work shall be adequately protected against corrosion. Where no specific protection has been specified, steel work shall be painted as follows:

Surfaces shall be thoroughly cleaned in accordance with SABS 064. A zinc chromate primer complying with SABS 679 type 1 shall then be applied. Finally, two coats of paint complying with Grade 1 of SABS 630 shall be applied. Colors shall be approved by the Architect.

Care shall be taken that the entire surface is covered to the same standard and where surfaces have been damaged during the installation, these shall be touched up to the same standard.

All hangers, anchors, brackets, guides and supports inside building shall be hot dip galvanised or copper.

Nuts, bolts and screw threads shall be cadmium plated or brass.

7. PAINTING

All equipment, piping, duct work, supports, hangers, plinths, bars, etc., located in plant rooms and where it is visibly exposed shall be painted to a colour scheme approved by the Engineer. Items which are protected against corrosion by other means (galvanizing etc.) shall be subject to painting when located as described above.

Surfaces shall be painted as follows:

Surfaces shall be thoroughly cleaned in accordance with SABS 064. A zinc chromate primer complying with SABS 679 type 1 shall then be applied. Finally, two coats of paint complying with Grade 1 of SABS 630 shall be applied.

Care shall be taken that the entire surface is covered to the same standard and where surfaces have been damaged during the installation these shall be touched up to the same standard.

All pipe work shall be painted in accordance with SABS 0140: Part III - 1978. "Identification Colour Marking Part III: Content of pipelines

8. SOUND AND VIBRATION CONTROL

The contractor shall be responsible for the detail design and/or selection of all sound and vibration control equipment. Sound and vibration control shall be designed to give the resultant sound pressure levels specified in Part 6 when based on the sound characteristics of the rooms given in Part 6.1. The vibration isolation system shall be designed and selected and adjusted for a maximum total transmissibility of not more than 2,5%.

All vibration isolation equipment shall be designed and selected after selection of the relevant equipment and shall be approved by the engineer before ordering of the equipment.

All rotating equipment shall be balanced, both statically and dynamically and shall not have any critical speeds within 30% of the operating speed. In addition, all rotating equipment and associated pipe work and ductwork shall be provided with vibration isolation mounts.

Isolators shall give both horizontal and vertical deflection and the amplitude shall not exceed 3mm.

Each spring mounting shall be provided with 7 mm thick neoprene acoustical pads.

All floor mounted equipment shall be erected on concrete plinths at least 25 mm high - concrete shall be provided by the Employer; however, construction details shall be supplied by the Sub-contractor.

All pipe and duct connections to vibrating equipment shall be flexible to allow freedom of the equipment

to move.

Where piping and ducting passes through walls and floors of plant rooms, acoustical seals shall be employed to confine airborne noises to the inside plant rooms.

Sound attenuators shall be selected together with a sound source to provide the specific sound pressure levels. Fans shall be selected to operate near maximum efficiency to minimize noise generation.

Sound attenuators shall be connected directly to fans and shall be vibration isolated together with the fan as indicated on the drawings.

Sound attenuators shall resist erosion by air flow, shall not produce dust and shall have an air flow resistance of not more than 100 Pa measured at sea level.

The contractor shall submit results of sound pressure levels measured in eight octave bands for 10 areas within the building as selected by the Architect.

9. INSULATION

Insulation of piping, ductwork and equipment shall comply with BS 5422: 1977; BS5608: 1978 and BS5970: 1981.

Insulation shall be applied in accordance with the manufacturers' general instructions and shall be carried out in a neat and workmanlike manner so as to present a smooth and even surface. Insulation shall be continuous through sleeves, wall and ceiling openings.

The insulation shall be compatible with the surface to be insulated and shall not cause any corrosion or stress corrosion under any operating conditions. Vapor-proofing and adhesives shall be compatible with the insulation.

Piping shall be clean, dry, free from oil scale and dust and shall be approved for tightness (tested and passed) before insulation is applied.

All insulation materials and their finishes shall resist rotting, mould, decay, fungus growth, attack by vermin or erosion under any operating conditions.

Overlaps shall be at least 50 mm.

The contractor shall, when required to do so, cut one or more sections from insulation installed to prove that correct thickness of insulation has been applied.

Unless otherwise specified the following piping need not to be insulated:

- condenser water piping,
- overflow, vent, drain and relief piping,
- cold water supply piping,
- water treatment piping.

9.1 **Ductwork**

All duct work, excluding return air duct work located in air-conditioned spaces and ventilation ductwork shall be insulated, unless specified otherwise elsewhere.

Supply air flexible ducts more than 1,2 m shall be insulated - the total length.

Ductwork shall be insulated with 40 mm thick insulation with thermal conductivity of 0,04Watt/m°C or less, or 50 mm thick insulation with thermal conductivity between 0,04 and 0,06Watt/m°C

Ductwork exposed to outdoor ambient conditions shall be insulated with 50 mm thick insulation with thermal conductivity of 0,04Watt/m°C or less.

Ductwork shall be insulated with either rigid or flexible materials and covered with Aluminium foil - flexible materials shall have a density of at least 16 kg/m^3
All joints in insulation shall be vapor proofed and sealed with vapor barrier material, as specified for chilled water piping, clause 9.3: 'Pipe work finish and vapor barriers' clause 1 – Indoor pipe work. Sealing material shall overlap the joint by at least 50mm on either side.

Insulated ductwork exposed to outdoor conditions shall be covered by galvanised sheet metal or approved equal. Sheet metal cover shall be sealed watertight to prevent the ingress of moisture into the insulation.

Insulated ductwork in the plant rooms shall be neatly finished and shall only be protected by galvanised sheet metal where traffic in the plant room may cause damage to the Aluminium foil covering.

Insulation to ductwork shall be generally applied in a neat and workmanlike manner.
Internally insulated ductwork shall not be permitted unless otherwise indicated on the drawings.

9.2 **Pipe work (Chilled Water)**

Chilled water piping shall be insulated as follows:

Thermal Conductivity of Insulation Material	0,04 Watt/m°C or less
Pipe Diameter	Thickness
250 mm and below above 250 mm	50 mm 75 mm

Where insulation is specified for piping, same shall apply to all fittings and pipe connections within the system. Preformed pipe insulation shall be used on valves and flanged joints to equipment which need regular replacement.

9.3 **Pipe work finish and Vapor barriers**

Insulation to piping and equipment operating below ambient temperatures shall be externally sealed with a vapor barrier which shall be applied immediately after dry insulation has been fitted. Piping and equipment shall be at ambient temperature before and while vapor barrier is applied.

Hangers, supports etc., which are in contact with the cold surface shall be adequately insulated and vapor sealed to prevent the formation of condensation under any operating conditions.

At discontinuities and at ends vapor barrier shall be returned to the surface to prevent moisture from entering the insulation edges.

Where equipment is required to be removable, the vapor barrier shall be stopped short of the fitting and sealed to the shell such that vapor cannot enter the insulation when equipment is removed or replaced. Vapor barrier of such removable equipment shall be separate from the main barrier and shall overlap the main barrier were sealed to it.

All insulated pipe work shall be finished as follows:

1. Indoor pipe work: (concealed and visible

   Vapor barrier shall be suitable for type of application and shall comply with, and perform, as follows:

   Specification compliance: BS 5970 - 1981 Section 8

Description: Water based Thixotropic PVA emulsion

Specific gravity - 1,3 at 25°C

Solids content - 45% by volume

Water vapor permeance - 0,9 perm.

Adhesion to insulation material - good

Fire performance (dry): Class 1 (BS 476 Part 7 - surface spread of flame)

Application to the insulation material shall be according to the manufacturer's specification with the following elements:

- a coat of PVA emulsion
- cotton canvas as reinforcing membrane (complying with BS 3958 Part 4).
- a second coat PVA emulsion.
- galvanized sheet metal finish (only on outdoor piping)

Paint as specified elsewhere and according to manufacturer=s specifications.

Piping that is readily accessible such as in plant rooms shall be finished in hard setting cement or galvanized sheet metal after vapor proofed as described above and before painted.

2. Outdoor pipe work

Vapor barrier shall be applied as described for indoor pipe work and shall be finished as follows before painted:

Apply coat of UV protected over coating or lag tone coating or galvanized sheet metal protection.

9.4 **Fire Hazard Ratings**

Fire hazard ratings of insulating materials, finishes, and adhesives, shall be as follows:

- Fuel contribution index shall not exceed 0 when compared with asbestos taken as 0.

- Smoke contribution index shall not exceed 10 when compared with hardboard taken as 100.

- Spread of flame index shall not exceed 0 when compared with asbestos taken as 0.

The above ratings shall be those as determined by the NBRI of the CSIR of South Africa and in accordance with test procedures of BS 476.

The products of combustion of insulation materials shall be completely non-toxic to humans.

9.5 **Plant Equipment**

All piping and components operating below 15°C shall be insulated to prevent condensation of water as specified.

9.6 **Fans**

Fans handling cooled or heated air and are externally subject to ambient temperatures shall be insulated with semi-rigid material covered with bird wire and held into position with welded pins at 300 mm Centres each way and covered with hard setting cement of at least 12 mm thickness.

Insulation thickness shall be as specified for ducting.

9.7 **Air handling unit and enclosures**

Air handling units or portions thereof handling cooled or heated air [below 20°C or above 30°C] shall be manufactured from prefabricated insulation panels with finishes as specified under air handling units. Prefabricated insulation panels shall be a minimum of 50 mm thick with thermal conductivity less than 0,04Watt/m°C.

9.8 **Cooling coil sumps**

Sumps shall be insulated with 25 mm thick insulation with a thermal conductivity of not more than 0,04 W/m°C.

10. **IDENTIFICATION**

Identification colors shall be approved by the Engineer. Identification shall be neat and legible and shall be applied after completion of final finishes.

Piping and Valves

Piping shall be marked with colour coded polyvinyl chloride bands identifying fluid carried and direction of flow. Band widths shall be 200 mm wide for pipes up to 250 mm diameter and 400 mm wide for larger piping.

Piping shall be marked after installation of insulation and painting has been completed.

Piping shall be marked every 10 m of pipe run, before and after bends, pipe connections to valves and equipment, where pipes leave walls, floors, ceiling and where concealed pipes are visible through access doors.
Valve tags identifying its function shall be bronzed or welded to all valves or fastened by heavy brass chains. Valve tags shall be at least 50 mm in diameter.

Numbering or identification of tags shall correspond to identification on central and diagrammatic charts framed in plant room and contained in operating and maintenance manuals.

Labels

Labels shall be of non-corroding material, shall consist of white lettering with a minimum height of 4mm on a black non-glossy background. Labels shall be screwed into position.

Labels shall be provided under each gauge, meter, pilot light, instrument, panel, switches, controllers, etc., identifying the function and set point if applicable to such equipment.

11. INSTRUMENTATION

Permanently installed instruments shall be provided as shown on the tender drawings and as necessary for logging and monitoring the performance of equipment.

Test instruments shall be checked for accuracy by the manufacturer, or an approved laboratory and test certificates shall be submitted to the Engineer prior to testing for approval.

Thermometers and Thermometer Wells

Thermometers shall have an accuracy of 0,5°C and graduation in steps of 1°C. The range shall be selected to suit the application.

Thermometer wells shall be vertical or at an angle to retain oil. Piping, smaller than 80 mm, shall be

enlarged where thermometer wells are required to contain these wells.

Dials of duct thermometers shall not be less than 70mm in diameter.

The casing material shall be brass, stainless steel or steel with epoxy powder coating protection.

Pressure Gauges

Pressure gauges shall be of the Bourdon dial type.

Ranges of all pressure gauges shall extend to 150% of maximum operating pressure and accuracy shall be 2% of the maximum scale reading.

Dial and differential pressure gauges shall be not less than 100 mm in diameter.

Differential pressure gauges shall have zero pressure in the centre of the scale.

Pressure differential gauges

Pressure differential gauges shall be of the diaphragm or bellows type.

Gauges shall be selected for a maximum system temperature of 100EC, a static pressure of 10 Bar and the differential pressure required by the particular application.

Dial shall be a minimum of 90 mm diameter, shall be direct reading with a single needle rotating over a fixed scale.

Gauges shall be glycerin filled to damper pulsations.

Unit shall be provided with an over pressure safety on both sides.
The casing material shall be brass, stainless steel or epoxy powder coating protection.

Range shall extend between 110 and 150% of maximum operating pressure and accuracy shall be 2,5% of maximum full-scale reading.

Manometers

Manometers shall be of the plastic molded type with a curved inclined/vertical tube suitable for pressure, vacuum and pressure differential measurement.

Scales shall be clearly marked for easy reading. Unit shall be complete with fluid wells, zero adjustment knob, and built in spirit level.

Flow meters

Flow meters shall be of the orifice direct reading type.

12. TESTING, BALANCING AND COMMISSIONING

Testing, balancing and commissioning shall consist of the following:

1. Checking of all safeties by means of simulated overload conditions.

2. Checking and setting up protection devices to stop the operation of equipment at overload or abnormal conditions.

3. Balancing of water systems including all existing >secondary= and >tertiary= systems connected to the new system.

4. Checking the performance criteria by plotting it on the original selection curve of all fans and pumps.

5. Marking operating values (temperatures, pressures, amps, etc.) on gauges and thermometers as appropriate.

6. Compile a field test report of the above tests for inclusion in the operating and maintenance manual.

The testing, balancing and commissioning report shall be submitted to the Engineer for approval prior to application for final take-over.

NOTE:

All testing operations shall be witnessed and approved by the Engineer.

13. DOCUMENTATION

Documentation for all equipment shall be submitted and shall include installation, testing, balancing and commissioning instructions and trouble analysis guide and details of all safety protection devices, where applicable.

14. PLANT ROOM INSTRUCTIONS

Plant room instructions shall consist of:

1. Notices, certificates, diagrams, etc. and all notices as required by the factory inspector.

2. Schematic layout of all systems on which all equipment, control devices and instruments are correctly indicated for that particular plant room.

   Diagrams shall contain information on set differential bands, throttling ranges, time delays, overload settings and other relevant data necessary for the checking and adjusting of each instrument, control and motor function.

3. Wiring diagrams.

Plant room instructions shall be printed on high quality, non-deteriorating paper framed behind glass.

15. OPERATING AND MAINTENANCE MANUALS

The manuals shall contain the following information and shall be comprehensively indexed.

a) Description of system

b) Equipment data:

- manufacturer and model numbers
- size and rating
- pressure speed and temperature limitations
- performance curves / tables with selections indicated

c) Operating procedures:

- starting and stopping procedures
- abnormal and emergency operating procedures
- adjustment and regulations
- safety devices and settings
- temperature, pressure, humidity, duct pressure, etc, settings for controllers & sensors

(d) Commissioning data

(e) Maintenance:

- routine maintenance schedule and calendar
- procedures
- trouble shooting charts

(f) Spares:

- list of spares and model numbers
- address of suppliers

(g) Maintenance and service contract:

- maintenance contract and price
- escalation formula

16. **MAINTENANCE AND SERVICE CONTRACTS (Not the first year's maintenance)**

The price for a maintenance contract shall remain valid until the tender closing date. Thereafter an escalation clause may apply.

Full details including an example of how the formula will be applied in future and indices that will be used shall be submitted.

The maintenance contract shall commence on the first anniversary of take-over date and shall continue indefinitely until terminated.

Either party may terminate the agreement by giving notice thirty days prior to the anniversary date of the contract.

Adjustments in the contract price as a result of the escalation in costs shall be given 60 days prior to anniversary date of contract.

A change in the scope of the work shall be entitled to an adjustment in the contract price. Notices of such adjustments shall be given 30 days prior to the anniversary date.

Full details and number of routine services shall be submitted. Cost per hour of after hours and

emergency call-outs shall be submitted with the contract price.

The contract price shall include the regular inspection, adjusting of controls, lubrication and such service and maintenance work as may be required for the particular system or piece of equipment. Cost of lubricants, consumables and filters shall be included.

The cost of repairs and replacements shall not be included in any of the abovementioned two prices and shall only be carried out when reported to and approved by the owner.

17. DEFINITIONS AND ABBREVIATIONS

Definitions and abbreviations used in this document shall mean:

"Approved"; "Satisfactory"; "Accepted"; or "Directed"

As approved, satisfactory, accepted or directed by or to the Engineer.

"Balancing"

Work, adjustments and checks necessary to proportion the flow within the distribution system (sub-mains, branches, terminals) in accordance with specified design quantities.

"Commissioning"

Work necessary to place the installation and work covered by this specification into normal operating condition.

"Concealed"

Embedded in masonry or other construction, installed in furred spaces within double partitions or hung ceilings, in trenches, in crawl spaces or in enclosures.

"Exposed"

Not installed underground or concealed as defined above.

"Indicated"; "Shown"; or "Noted"

As indicated, shown or noted on drawings and/or specifications.

"Install"

To erect, mount and connect complete with all related accessories.

"Provide"

To supply, install and connect up complete and ready for safe regular operation particular work referred to.

"Proof"

Submit documentary proof through either controlled test in their own laboratory or from an approved independent testing body such as the SABS.

"Similar" or "Equal"

Of approved manufacture equal in materials, weight, size, design and efficiency of performance to product specified by name.

"Supply"

To purchase, procure, acquire and deliver complete with all related accessories.

"Testing"

Work and checks necessary to determine quantitative performance of equipment, installation and workmanship.

"Wiring"

Conduit, fittings, wire, junction and outlet boxes, switches, cutouts and socket outlets and all related items.

"Works"

All labour, materials, equipment, apparatus, controls, accessories and other items required for proper and complete installation

Abbreviations

AC - Air Conditioning

AHU - Air handling unit

API - American Petroleum Institute

ASA - American Standards Association

ASHRAE - American Society of Heating, Refrigeration and Air Conditioning Engineers.

ARI - Air Conditioning Refrigeration Institute (USA)

ASME - American Society of Mechanical Engineers

ASTM - American Society for Testing and Materials

AFFL - Above finished floor level

BS - British Standards Specifications on Institute

BS CP - British Standards Code of Practice

CSIR - Council of Scientific and Industrial Research (SA)

DIN - Deutsche Industries' Normal

EL - Elevation

HVCA - Heating and Ventilating Contractor's Association (UK)

MCC - Motor Control Centre

NBFU - National Board of Fire Underwriters (USA)

NBRI - National Building Research Institute of the CSIR of SA

NBS - National Bureau of Standards (USA)

NEMA - National Electrical Manufacturers Association (USA)

NFPA - National Fire Protection Association (USA)

SABS	-	South African Bureau of Standards
SMACNA	-	Sheet Metal and Air Conditioning Contractor's National Association, Inc. (USA)
UL	-	Underwriters Laboratories
VAV	-	Variable Air Volume
WBGT	-	Wet Bulb Globe Thermometer Index

SECTION 3: PART 2

DETAILED TECHNICAL SPECIFICATION

1. SCOPE OF CONTRACT

1.1 GENERAL DESCRIPTION OF THE WORKS

This specification covers the supply, delivery, installation, testing, commissioning and handing over of the complete **HVAC, Mechanical Services and monitoring installation for the Botswana Savings Bank** as specified below and as indicated on the drawings, which form part of this specification. All the work shall be carried out to the complete satisfaction of the Client, Architect and Consulting Engineers.

1. The hydronic cassette cassettes are the 4-pipe type 42GW as follows:
   - 42GW701 – 8.7[kW] 21 x Nos off
   - 42GW400 – 4.4[kW] 204 x Nos off

1.2 SCHEDULE OF BUILDINGS AND MECHANICAL SERVICES

The buildings, number of buildings and mechanical services to be provided is as follows: -

BUILDING DESCRIPTION	NUMBER OF BUILDINGS	MECHANICAL SERVICES
Main Building consisting of one parking basements, Ground Floors, First Floor, Second Floor Third Fourth Floor Fifth Floor Sixth Floor and Roof top HVAC Plant Rooms	One	**HVAC**: basement extract ventilation and mixing system, ducted fresh air system; toilet ventilation and extraction; central kitchen extract system to roof; CHW fan coil system(four pipe system – cooling and heating coils heating) for the entire building, ducted corridor and lift foyer AC from roof plant; hot water recovery from chillers and storage on roof top; four way blow ceiling cassette, ducted preconditioned fresh air for the offices atrium and lift foyers; toilet extract systems to roof, roof top and ground floor stair case pressurization systems, sprinkler system at car park basement.

1.3 DRAWINGS BY ENGINEERS AND ARCHITECTS

This specification must be read in conjunction with all Engineer's and Architect's drawings. Any discrepancies must be brought to the notice of the Engineer before submittal of the tender.

1.3.1 Mechanical Engineers' Drawings

The Mechanical Engineers' tender drawings for this project are listed below:

DRAWING NO DESCRIPTION

(To be issued to successful bidder)

1.3.2 Electrical Engineer's Drawings

A set of Electrical Installation drawings for this project will be made available at the offices of the Electrical **Consulting Engineers,** for inspection by the tenderer to familiarize himself with the electrical installation details.

1.3.3 Architect's and Structural Engineer's Drawings

A set of Architectural and Structural drawings for this project will be made available at the offices of **,** for inspection by the tenderer to familiarize himself with the building construction details.

1.3.4 Main Contractor

The construction has commenced and the Main Contractor s on site, all tenderers are advised to contact the Main Contractor and to familiarize themselves with the site, the building program and the conditions of contract

1.4 SERVICE CONDITIONS

Tenderers shall ensure that all equipment offered is suitable for use under the conditions specified and are invited to call for any further information that may be required.

1.4.1 General Location

Site Location	:	Gaborone, Republic of Botswana
Site Altitude	:	~1006 m
Site Latitude	:	30°, 05' South
Site Longitude	:	31°, 48' East

1.4.2 External Design Conditions

Summer Ambient Temperature	:	40°C DB - 24°C WB
Winter Ambient Temperature	:	0°C DB

1.4.3 Internal Design Conditions

Air-conditioned Office Areas, Public areas, bedrooms and Auditoriums

Summer Room Temperature	:	22 ± 1.0 °.C DB
Winter Room Temperature	:	21 ± 1.0 deg. C DB
Summer Room Relative Humidity	:	40 - 60% (not controlled)
Kitchens and Foyers	:	22 ± 2.0 °C DB not heated

Ventilation: toilets and plant rooms

Toilet and plant room ventilation	:	15ach/h

1.5 NOISE LEVELS

The *AC Subcontractor* shall ensure that all Plant selected and installed under this contract is suitably silenced and mounted on vibration isolation media and AV mounts to limit the noise levels in the complex and surrounding to the following levels: (Ref. 0,002 mBars)

All general occupied and air-conditioned internal areas	35 db
Conference centre	25 db
Basement, internal plant areas and kitchens	45 db
Outdoors – 1m from any plant or outlet	60 db

1.5.1 The foregoing shall hold good for a background level 3 db less than the specified N.C. in any octave band; adjustments shall be made for any higher background levels.

Note:
The sound levels specified will be accepted on site tests providing there are no predominant frequency components audible. If such a test is not to the satisfaction of the Supervisor an octave band analysis may be called for.

1.5.2 The *AC Subcontractor* shall submit to the Engineer for perusal certified octave band Sound Power Levels (Ref. 10^{-12} watts) for all Plant installed under this contract.

1.5.3 The *AC Subcontractor* shall submit to the Engineer all sound level calculations, silencer selection data and AV mount selections for approval, prior to the ordering of silencers for this project.

1.5.4 Because this Plant operates on a continuous basis, particular care shall be taken in the selection of the outdoor plant to ensure that they do not create a noise nuisance after hours for the adjacent properties. External noise levels shall meet all Municipal and Nationals codes and standards. Any complaints about noise from the AC plant shall be investigated and resolved by the AC contractor at his cost – unless he can demonstrate, by expertly conducted field measurements, that he has met all the specified requirements.

1.6 AIR TERMINAL VELOCITIES

1.6.1 The *AC Subcontractor* shall select all grilles and diffusers so as to avoid exceeding the following room air terminal velocities.

1.6.2 Terminal velocity from any outlet in any air-conditioned space, at any point 1,8m from the finished floor level and at an air temperature as indicated, shall not exceed:

22°C - 0,22 m/s

20°C - 0,12 m/s

1.6.3 Terminal air temperature shall not be below 20°C when measured at any point 1,8m from the finished floor level.

It shall be the *AC Subcontractor's* responsibility to ensure that the selected grilles and diffusers meet the aforesaid requirements while keeping to the lay-out given on the drawings.

NOTE:

All equipment shall be selected to suit the altitude and external design conditions for Gaborone, Republic of Botswana.

1.7 OTHER SERVICES

1.7.1 Electrical

Surface mounted and recessed lighting will be used in the buildings, as indicated.

1.7.2 Fire Evacuation Alarm System

The building will be protected by a fire detection and evacuation alarm system, which shall be interlocked with HVAC electrical circuits, in order to shut off the relevant air conditioning and ventilation systems, when a fire occurs. Extraction systems and staircase pressurization fans shall also be interlocked with the fire systems- to this end fire relays shall be provided by others adjacent to the AC plant for signaling purposes- these plant shall run in the event of a fire and shall be used for smoke extraction purposes with standby power supply and fire rated fans.

1.8 BUILDING CONSTRUCTION PERIOD

The mechanical contractor shall be responsible for provision of the building construction period and program.

1.9 INSURANCE AND SURETY

The Main Contractor shall carry Insurance in accordance with the contract requirements.

1.10 CHILLED WATER TREATMENT

The Mechanical Contractor shall have the water tested by a water treatment specialist who shall recommend the required anti corrosion treatment which shall include a scale and corrosion inhibitor (no chromates allowed- use sodium borate/nitrates) and a biocide for algae slime and microbial corrosion.

A chemical dosing pot system to be fitted to the chilled water system.

1.11 DRAWINGS BY MECHANICAL CONTRACTOR

The Mechanical contractor shall be responsible for providing the following drawings for the execution of the project.

1.11.1 Mechanical contractor's Drawings

1.11.2 Detailed Dimensioned Builder's Work Drawings

1.11.3 Detailed Dimensioned Shop Drawings

1.11.4 Detailed Electrical & Control Drawings

1.11.5 Record Drawings and Manuals

1.12 SAMPLES AND TECHNICAL DATA

The Mechanical Contractor shall submit samples and/or equipment submittals including technical data of all equipment and fittings for the approval of the Engineer before ordering or commencing manufacture of these items.

1.13 INSPECTION, TESTING AND COMMISSIONING

The Mechanical Contractor shall be responsible for testing and commissioning of the complete plant and allow for inspections by the Engineer as required.

1.14 OPERATING AND MAINTENANCE MANUALS

The Mechanical Contractor shall provide Operating and Maintenance Manuals in accordance with the Engineers requirements: these to include all technical information on the equipment installed, selection calculations, commissioning data, as built drawings and wiring diagrams

1.15 MAINTENANCE AND DEFECTS

The Mechanical Contractor shall be responsible for Maintenance and Defects in accordance with the conditions of contract.

The period of liability for Maintenance and Defects shall be 12 months.

1.16 ASSOCIATED SERVICES

1.16.1 BUILDER'S WORK

The Mechanical Contractor shall be responsible for providing all small openings in the building required for the mechanical installations and for providing the necessary flashing, support brackets for pipework ductwork etc. unless these are timeously shown on a Builder's workshop drawing where they will be carried out by the Main Contractor.

The Mechanical Contractor shall be responsible for providing all Builders' Work Drawings for the work to be provided by the Main Contractor. Full dimensioned details of all openings plinths etc are to be included on these drawings which are to be submitted to the Engineer for approval in good time to comply with building programme.

The Mechanical Contractor shall also mark out or check the positions and sizes of all these openings, bases, etc., provided by the Main Contractor.

The Main Contractor shall provide all waterproofing and making good.

1.16.2 ELECTRICAL WORK

The Mechanical Contractor shall be responsible for all electrical work including the control panels, where specified and wiring to all mechanical equipment that forms part of this contract.

The Mechanical Contractor will provide the mains supply and earth connection to the main isolator and earth bar at each control panel, located as indicated on the drawings. Also power supplies to items of plant as indicated in this specification

Where no control panel is specified, the Mechanical Contractor will provide the main supply and earth connection, terminating at the equipment isolator as indicated on the drawings.

The Mechanical Contractor shall be responsible for providing all power supply loading data and the exact positions of all connections he requires for all his plant on the Builders' Work Drawings. He shall also submit control panel

drawings, wiring diagrams and schematics for approval by the Engineer before manufacture of the control panels is commenced.

1.17 SABS SPECIFICATIONS TO BE USED FOR THIS INSTALLATION

SABS 046	-	Copper tube manufacturing code of practice
SABS 0400	-	The applications of building regulations
SABS 0103	-	The measurement and rating of environmental noise with respect to ɔeech communication
SABS 0139	-	The prevention, automatic detection and extinguishing of fire in
SABS 0140	-	Identification colour marketing
SABS 0142	-	Code of practice for the wiring of premises
SABS 0147	-	Refrigerating systems, including plants associated with air-ɛms
SABS 0173	-	Installation, testing and balancing of duct work
SABS 630	-	Decorative high-gloss enamel paint for interior and exterior
SABS 763	-	General coating thickness
SABS 1238	-	HVAC duct construction standards
Act 103	-	National Building Regulations and Building Standard Act, 1977 (Act No 103 of 1977) as amended

5. PIPING AND FITTINGS

Piping to each of the systems will be fabricated on site to suit the application and shall be carried out by specialist pipe fitters and welders with valid welding certificates to SABS; samples of all welds shall be prepared for approval together with a method statement; samples shall be cut out of the works for testing purposes as the installation proceeds and welds shall be marked with the welders identity. The systems shall be as follows:

5.1 Chilled water systems: medium grade steel piping to SABS 062 welded and screwed, piping shall be insulated with Aluminium mylar lined preformed fire retardant virgin grade polystyrene or megaphone insulation (50mm for pipes>/=80mm, 25mm for pipes< 80mm), plastered bends and fittings; steel reinforced hose with crimped swivel fittings between shut off valves and room fan coil units insulated with 25mm thick Therma flex (closed cell no seam). Vapor barriers shall be continuous and consistent over all chilled water piping, valves and cold surfaces to prevent any condensation whatsoever.

5.2 Condensate drains: UPVC class 12 suspended at 800mm centres with access fittings at all bends and tees in ceilings for splits, GMS 40mm steel in plantrooms with access bends; 22mm copper in bedrooms with compression fitting connections

5.3 Domestic cold water: medium grade GMS to SABS 062 welded and screwed, hot dipped after manufacture.

5.4 Domestic Hot water and heat recovery: Copper to SABS 0400 class 2 medium hard; silver soldered/brazed ss flanges. And compression fittings. Insulation as per chilled water above.

5.5 Sewage and Storm water sumps: medium grade GMS to SABS 062 welded and screwed, hot dipped after manufacture.

6. DUCTING

6.1 Ducting shall be manufactured to SABS 1238 low and medium pressure standards: the following shall apply:

6.1.1 Air conditioning supply and return ductwork and plenum boxes: low pressure, mez flanges, externally lined with 25mm insulation.

6.1.3 Spigots and flexibles: externally insulated with 25mm FBI.

6.1.4 Roof top AC and ventilation ducting: all joints to be externally sealed and waterproofed with fabric and acrylic compound.

6.1.5 Ventilation ducting: low pressure mez flanges.

6.1.6 Sheet metal thickness shall be to SABS for the relevant duct size.

7. CHILLED WATER INDOOR FAN COIL UNITS

GENERAL CONDITIONS

Chilled water on/off: $6^{o}C/12^{o}C$
Off coil cooling air temperature db/wb $11^{o}C/10.5^{o}C$
Volume and pressures at 1006masl. OA at $38^{o}C/24^{o}C$

All Fan Coil Units to be prefabricated with CHW cooling and heating coils (cu-al coils). All plant will be variable temperature plant with hot water heating and fixed minimum fresh air dampers, four-way CHW valves, Offices fan coils shall have four- way valves. Coil flushing and supports shall be GMS and condensate trays shall be 304SS.

Fan coils shall fit into a 450mm deep ceiling and shall include insulated PVC condensate tray and safety tray under valve set.

Fan coil controls shall be electro mechanical simple devices for use by the public with fan speed control and a manual heating cooling switch. Two way valve motor drivers shall be silent and not audible in the room.
Cooling coils shall be cu-al, 12 fins per inch maximum.

Cooling coil support plates and frames shall be of GMS. All coil flashing plates shall be of GMS. Condensate trays shall prevent air short circuiting, they shall extend on both sides of the coil and shall incorporate adequate drainage which shall be trapped. Condensate trays shall be of 304 SS. No carry over shall be allowed, If necessary PVC eliminators shall be provided to prevent this.

Fans shall be dual width, dual inlet B.C. centrifugal fans with belt driven motor assembly. The fans shall be mounted on a rigid fan deck which shall be fully AV sprung and vibration isolated. Ball bearings shall be of the self aligning type and the entire fan shall be statically and dynamically balanced. Fan motors shall be TEFC with soft/star delta start > 7,5 kW. Motor size shall be non-stall and at least 20% oversized at the duty point.

The chilled water control valve shall be a motorised, modulating three way valve with minimal hysteresis for accurate control; three way valve bypass port resistance shall be set with a globe valve. Manual control capability (during power failures) shall be incorporated.

All cold surfaces shall be insulated internally and externally to prevent condensation. All penetrations shall be vapour proofed and sealed.

Units shall be supplied on a heavy-duty galvanized steel framed skid base which shall be positioned on plinths. All Plant and filters shall be readily accessible for maintenance and repair - suitable lockable, heavy duty, weatherproof airtight plantroom doors with a GMS top and bottom latching container type mechanism.

17. COMMISSIONING OF HVAC AND MECHANICAL PLANT

17.1 TESTING AND BALANCING

All HVAC and Mechanical plant installed under the Contract shall be tested and balanced generally in accordance with the requirements of the Specification and Clause 7 of SABS 0173-1980 and the recommendations of SARACCA.

17.2 INSTRUMENTS

All instruments used for measurements shall be provided by the Contractor and shall be accurately calibrated and maintained in good working order during the course of the commissioning process to the satisfaction of the Engineer. All tests shall be carried out by the Contractor to the Engineers satisfaction.

17.3 SPECIALIST CONTRACTOR

Testing, measurement and balancing of all plant parameters shall be carried out by the specialist contractor as part of the plant start-up and commissioning process. Having set up the plant to operate to the Specified requirements the Contractor shall measure and record all required operating parameters as per the schedule below. The contractor shall make whatever adjustments are required to achieve the specified duties and plant operating parameters.

17.4 TEST RESULT

Once the Contractor is satisfied that he has achieved the requirements of the Specification he shall present the Consulting Engineer with the typed and printed operating data. The Engineer shall then “sample” the data and carry out random tests to verify the recorded plant performance parameters under different conditions. Should the Engineer find that any of the measured parameters are inaccurate or false he shall instruct the Contractor to re-commission/repair /replace the plant and to take new measurements. After the Engineer has concluded his tests he shall then present the commissioning data to the Client who may then request further tests and measurements to ratify the presented data; Client sampling shall be limited to not more than 10% of the values recorded or as agreed with the Engineer. The Client may not request or carry out new or different tests other than those listed for this Project in the Schedule hereunder. Only after the above process has been reasonably

concluded and the Engineer is satisfied that the tests are accurate and representative and that they have been successfully demonstrated to the Client shall the plant be deemed to be practically complete.

17.5 SCHEDULE OF MECHANICALPLANT PARAMETERS TO BE TESTED, BALANCED AND SET

Schedule of mechanical plant parameters is as follows:

	Item/plant	**parameter**	**Units of measurement**	**Extent of testing**	**% deviation allowed from design values**
1	Water pumps operating point on pump curves	Pressure and volume to be plotted	kPa; liters/s	All pumps	5.0%
2	Fans	Air volume and noise levels- if objectionable	m3/s; 125Hz-4kHz octave band SWL dB	All fans	5.0%
3	Air grilles, nozzles and diffusers	Air volume and noise levels- if objectionable	m3/s; 125Hz-4kHz octave band SWL dB	All grilles and diffusers	5.0%
6	Split AC units	Air temperature and volume and noise levels if objectionable	ºC; m3/s; 125Hz-4kHz octave band SWL dB	All unit grilles and diffusers	5.0%
7	Filters	Face velocity and pressure drop	m/s; Pa	All individual filter units	5.0%
8	Heaters	Amps	A	All heaters	5.0%
9	Room temperatures	Air temperature with associated outdoor condition	ºC	All controlled air conditioned environments: air temperatures in rooms at occupant level; 24h recordings in close control areas	5.0% (or specified limits)

17.6 TEST REPORTS

Two copies of the final complete test reports with all pertinent data shall be included in the Maintenance and Operating Manuals for the project.

All parameters which may require adjustment and in particular those with seasonal variances shall be measured and proven, as required by the engineer, at any time during the 12 month free maintenance and guarantee period at no additional cost to the Contract.

SECTION 4

SCHEDULE OF CAPACITIES

EQUIPMENT DATA SHEETS: FAN COIL UNITS			
Ref. No.	FCU01	FCU02	
Location	Offices	Offices	
Room Served	Offices	Offices	
Unit Type	Ceiling Cassette	Ceiling	
Number Off	204	21	
Mounting	Ceiling	Ceiling	
Operating System	4 pipes cooling and heating	4 pipes cooling and heating	
Heating Capacity at Design Conditions(kW)	1.35	5.07	
Total Cooling Capacity at Design Conditions (kW)	4.79	8.88	
Maximum Unit Outdoor Operating Temperature (°C) Winter/Summer	35/0	35/0	
Inlet Water Temperature Cooling	6.5	6.5	
Outlet Water Temperature Cooling	11.5	11.5	
Inlet Water Temperature Heating	45	45	
Outlet Water Temperature Heating	35	35	
Fan Speed Setting (H/M/L) for load to be met	M	M	
Fluid Flow Rate at above Speed(L/h) - Cooling	674	1234	
Fluid Flow Rate at above Speed(L/h) - Heating	109	337	
Fan External Pressure (Pa)	23	350	
Drain connection size (mm dia.)	32	32	
Fresh Air Spigot Size (mm)	-	-	
Electrical Supply (V/Ph/Hz)	380/50/3	380/50/3	
Power Input (kW)	42	42	
Maximum Permitted Room Noise Level (NR)	35	35	
Recommended Manufacture or Equal	Carrier	Carrier	
Model Offered	42GW400	42GW701	
Notes:			
Design Conditions are as specified in the particular specifications			

SECTION 5

SCHEDULE OF IMFORMATION

EQUIPMENT DATA SHEETS: FAN COIL UNITS			
Ref. No.	FCU01	FCU02	
Location	Offices	Offices	
Room Served	Offices	Offices	
Unit Type	Ceiling Cassette	Ceiling	
Number Off	204	21	
Mounting	Ceiling	Ceiling	
Operating System	4 pipes cooling and heating	4 pipes cooling and heating	
Heating Capacity at Design Conditions(kW)			
Total Cooling Capacity at Design Conditions (kW)			
Maximum Unit Outdoor Operating Temperature (°C) Winter/Summer			
Inlet Water Temperature Cooling			
Outlet Water Temperature Cooling			
Inlet Water Temperature Heating			
Outlet Water Temperature Heating			
Fan Speed Setting (H/M/L) for load to be met			
Fluid Flow Rate at above Speed(L/h) - Cooling			
Fluid Flow Rate at above Speed(L/h) - Heating			
Fan External Pressure (Pa)			
Drain connection size(mm dia.)			
Fresh Air Spigot Size (mm)			
Electrical Supply (V/Ph/Hz)			
Power Input (kW)			
Maximum Permitted Room Noise Level (NR)			
Recommended Manufacture or Equal			
Model Offered			
Notes:			
Design Conditions are as specified in the particular specifications			

SECTION 6

SCHEDULE OF DRAWINGS

Drawings are attached to this document in A1 format for information only – All Tenderers are to price in accordance with the Bill of Quantities.

SECTION 7:

PROVISIONAL BILL OF QUANTITIES

7.1 GENERAL

7.1.1 These Bills of Quantities contain pages numbered consecutively in each Bill as indicated in the Master Index. Before the Tenderer submits his tender, he shall check the number of pages, and if any are found missing or duplicated, or the figures or writing indistinct, or the Bills of Quantities contain any obvious errors, he should notify to the Engineer at once and have same rectified, as no liability whatsoever will be admitted by the Engineer in respect of errors in tender due to the foregoing. The Bills of Quantities are provisional and no claim of loss of profit etc. will be accepted die to any change in the scope of the works. The rates shall remain fixed no matter what the change in scope, either up or down.

7.1.2 Bill of Quantities form part of and must be read in conjunction with the specification document and the drawings, which contains the full descriptions of the work to be done and material and equipment to be used. Unless otherwise described in the Bills of Quantities, reference shall be made to the Specification and drawings for the full meaning of descriptions and scope of the work to be done and materials and equipment to be used. No claims will be considered for extras where the tenderer has not read the requirements of the Standard Specification (Section 3), Drawings and the Detailed Technical Specification (Part 5) in conjunction with the Bill description and included the full requirements in the rate.

7.1.3 The responsibility for the accuracy of the Quantities written into the Provisional Bills remains with the Consulting Engineers who prepared the Bills. The Tenderer shall be relieved of responsibility of measuring quantities at the tender stage, and the tender sum submitted shall be in respect of the quantities set out in the Bills and Specification, although the tenderer will be required to make his assessment of items such as brackets, fixing etc., from details stated in the Specification and Drawings and shall include in the item prices for such small installation materials as are required for the complete installation in accordance with the Specification. It shall be noted by the tenderer that the Specification and Drawings form part of the Bills of Quantity and in interpreting the descriptions in the bills reference shall be made to the Drawings and Specification to gain a proper understanding of the full scope of each description (which description are of necessity of an abbreviated format).

7.1.4 The Priced Bills of Quantities of the successful tenderer will be checked and the Engineer reserves the right to call for adjustments to any individual price and to rectify any discrepancy whilst the total tender price, as submitted, remains unaltered.

7.1.5 The Drawings are attached in the document. Tenderers are to price in strict accordance with the Bill of Quantities Provided

7.1.6 The quantities in these Bills of Quantities are provisional and shall not be used for ordering materials. Ordering shall be done only on the basis of approved equipment submissions and approved drawings that shall be prepared by the successful sub contractor.

7.1.7 The published national indices shall be used for this contract, if applicable.

7.1.8 The appropriate portion of the Preliminaries sum is payable on the percentage of work completed, unless otherwise stated by the Client

7.1.9 Unless a separate rate for the supply and for the installation of any item is specifically called for, the supply and installation costs of any item shall be fully included in the unit price. The description of each item shall, unless otherwise stated herein, be held to include samples, making, conveying and delivering, unloading, storing, unpacking, hoisting, setting, fitting and fixing in position, cutting and waste, patterns, models and templates, plant temporary work, return of packing, establishment charges, profit and all other obligations arising our of the Conditions of Contract.

7.1.10 The rates shall include the cost of preparation of drawings, design, selection of equipment, testing, documentation, manuals, as built drawings, etc. all as necessary to meet the requirements of the specification.

7.1.11 It shall be noted that the contract includes the installation of piping and wiring in confined spaces (i.e. Shafts plantroom etc.) that will require close co-ordination with other services as well as particular sequencing of work.

7.1.12 All measurements are net unless otherwise stated and Tenderers must allow for wastage in the rates.

7.1.13 All provisional sums shall be spent as directed by the Engineer and any balance remaining shall be deducted from the amount of the contract sum.

7.1.14 All rates and prices given in the Bills of Quantities shall be net and exclusive of VAT. Provision is made on the Form of Tender for the applicable VAT to be added.

7.1.15 Where specific product names and manufacturer's names are used in the item descriptions in the Bills Tenderers may offer equivalent products or other manufacturers' equipment but the onus will be on the tenderer/successful contractor to prove to the Engineer that the alternative offer is indeed a product of equivalent quality and performance to the specified product / manufacturer. The Engineer reserves the right to insist on the named product or manufacturer should he not be satisfied with the alternative offer.

7.1.16 Payment of retention money, calculated in terms of clause 23 (2) (e) of the conditions of contract, shall be considered on receipt of an acceptable guarantee to the value of the full amount of the retention money stated in the said clause. If Tenderers would like to take advantage of this, they must indicate the saving which they are prepared to offer

to the Province as a counter offer. Provision for this will be made in the final summary. Only guarantees issued by a recognized commercial bank or building society situated within the borders of Republic of Botswana and/or registered insurance company which is authorized by the register of insurance companies to issue unconditional guarantees, will be considered and must be submitted on the official guarantee form of the administration. This provision is only applicable to contracts when the tender amount is BWP100 000.00 or more.

7.1.17 The lowest or any Tender will not necessarily be accepted.

7.2 METHOD OF MEASUREMENT

7.2.1 All piping support costs shall be included in the rate for piping and fittings and shall include fixing to concrete slabs, roof trusses etc. as described in the Bills of Quantity or indicated in the drawings.

7.2.2 The rate for piping shall include cutting, jointing and running joints. The lengths of piping shall be measured over/through all fittings but not over valves, pumps and in-line instruments such as strainers site glasses etc.

7.2.3 Pipe fittings are measured as extra - over piping. The rate given for items of equipment AHU'S, Fans, pumps etc., shall include all necessary accessories and controls required to install, commission and operate the equipment in accordance with the specification.

The ducting will be measured COMPLETE WITH:

- External Insulation
- Supports
- Bends and transformations

Item No.	Description	Unit	Amount
	Additional P & G in accordance with the Standard and Detailed specification		
	MECHANICAL SERVICES INSTALLATION		
A	Preparation of O & M manuals and recommissioning reports		
	Fixed	Item	
	Value related	Item	
	Time related	Item	
B	Preparation of shop drawings samples etc		
	Fixed	Item	
	Value related	Item	
	Time related	Item	
C	As Built Drawings		
	Fixed	Item	
	Value related	Item	
	Time related	Item	
D	Testing, Commissioning, Balancing & Handing over		
	Fixed	Item	
	Value related	Item	
	Time related	Item	
E	Maintenance of complete installation for 12 months		
	Supervision and Attendance		
	Fixed	Item	
	Value related	Item	
	Time related	Item	
F	Engineering, Submissions & Approvals		
	Fixed	Item	
	Value related	Item	
	Time related	Item	
G	**TOTAL CARRIED FORWARD TO SUMMARY PAGE**		

Item No.	Description	Unit	Qty	Rate	Amount
	CHILLED WATER FAN COIL UNITS				
	Supply, deliver, offload & store on site, chilled water-cooled fan coil units complete with coil, shut-off valves, 4-way modulating valves, actuators including all necessary CWS, CWR, HWS, HWR and condensate pipe connections and fittings, fans, supports, control panel accessories, drip tray and all other fixtures as specified for a complete installation				
	Ceiling cassette Fan Coil Units				
	Ceiling Cassette - 4 pipe unit complete with extended condensate drip tray, power control unit, 3 m PVC power cable with 13 amp BS square pin plug and controls suitable for interfacing with BMS. Allow for cable ties as necessary for securing power cable.				
A	**Fan Coil Unit Cooling Capacity - 4,40 [kW]-Cassette Unit - 42GW400**	No.	204		
B	All necessary supports and fixings for Fan Coil Units. Note all drop rods to be fitted with washers and two locking nuts. Fan Coil Units to be supported on 'Teco' type acoustic anti- vibration pads.	Item			
C	15 mm NB quarter turn ball valve type isolating valves wrapped in anti-condensation tape 'Pekay' or similar.	No.	816		
D	15 mm NB x 1 m long braided flexible hoses (benchmark manufacturer 'Parker Hannifin') with push fit connections and matching interfaces on respective pipework complete with continuous 25 mm thick closed cell thermal insulation fitted and overlapping push fit connections.		408		
E	**Fan Coil Unit Cooling Capacity - 8,70 [kW]-Cassette Unit - 42GW701**	No.	21		
F	All necessary supports and fixings for Fan Coil Units. Note all drop rods to be fitted with washers and two locking nuts. Fan Coil Units to be supported on 'Teco' type acoustic anti- vibration pads.	Item			
G	15 mm NB quarter turn ball valve type isolating valves wrapped in anti-condensation tape 'Pekay' or similar.	No.	84		
H	15 mm NB x 1 m long braided flexible hoses (benchmark manufacturer 'Parker Hannifin') with push fit connections and matching interfaces on respective pipework complete with continuous 25 mm thick closed cell thermal insulation fitted and overlapping push fit connections.		42		
J	Decommissioning and removal of old units including the flexible connections and associated fittings	No.	225		
K	Installation of new units, chilled & heating water piping, condensate piping connection, electrical power & thermostats connect	No.	225		
L	**TOTAL CARRIED FORWARD TO SUMMARY PAGE**				

Item No.	Description	Unit	Qty	Rate	Amount
	Allow for contingency and provisional sums as follows:				
A	Allow for the repair and service of damaged ductwork	Item	1	250,000.00	
B	Add for Profit & Attendance	Item	1		
C	Allow for the repair and service of damaged chilled water pipe work insulation	Item	1	250,000.00	
D	Add for Profit & Attendance	Item	1		
E	Allow for Repair of damaged ceiling and replacement of Grid	Item	1	300,000.00	
F	Add for Profit & Attendance	Item	1		
G	Allow for Client Contingency	Item	1	300,000.00	
C	**TOTAL CARRIED FORWARD TO SUMMARY PAGE**				

Bill Summary

ITEM	DESCRIPTION	Unit	Quantity	TOTAL
	BILL SUMMARY			
	-			
A	Total Brought forward from Page 52	Sum	1	
B	Total Brought forward from Page 53	Sum	1	
C	Total Brought forward from Page 54	Sum	1	
TOTAL FOR THE MECHANICAL SERVICES INSTALLATION (EXCL. VAT) CARRIED TO FORM OF TENDER				