

Tender Specification

For the

**Supply and Installation of Mechanical Heating-, Ventilation-  
and Air Conditioning- Systems for South African Medical  
Research Council**

**17167-SAMRC-917 ParoWB-MTS01**

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## 1. Tender Information

### Project

Supply and installation of mechanical heating-, ventilation- and air conditioning-systems for South African Medical Research Council Block B.

### Client

South African Medical Research Council

### Architect

Ebesa Architects

### Engineer

NWE Consulting Engineers, represented by C Smit (forthwith referred to as “the engineer”)

## 2. Notes to Tenderers

### 2.1. Scope of work

- 2.1.1. Installation of fresh air supply systems and air conditioning systems as per reference drawings including the manufacture, supply, delivery to site, all equipment, materials, temporary storage, hoisting, setting out, fixing in position, protection where required, testing, commissioning, handing over, contract guarantee. Before any work is put in hand, the contractor has to familiarize himself with the site. The contractor shall ensure that all built up equipment can pass through the routes provided and fit into the space allocated.
- 2.1.2. Electrical connections of units and applicable isolators to relevant distribution boards are included in this scope. All electrical equipment to be supplied and fitted with IP65 isolators.
- 2.1.3. All interfacing ductwork will be done by contractor, as per reference drawing.
- 2.1.4. The contract shall include but not be limited to:
- The daily removal from site of any waste generated by the works.
  - The timeous provision of details of any builder works requirements and other items that are to be supplied or provided by other contractors in order for this contract to be completed. These details are to be provided to the consulting engineer a reasonable period of time prior to the service/item being required.
  - The provision of any scaffolding and lifting equipment required for the completion of the air conditioning and ventilation installations as described in this document and on the drawings.
  - The contractor shall co-operate fully with all other trades and contractors operating on site and is to furnish and request any information necessary for the entire works to proceed in an orderly manner without interference or delay.
  - Where work is to be installed in close proximity to work of other trades, or where there is evidence that work may interfere with work of other trades, the contractor shall assist in resolving space allocations and make proposals for the necessary adjustments.

- The specifications and requirements to achieve this successfully as stipulated in this document.

## **2.2. Additional information**

- 2.2.1. Only information given formally in writing to tenderers by the engineer during the tender period will be regarded as binding on the contract. Verbal information, given during the site inspection or at any other time prior to the award of the contract, will not be regarded as binding on the contract.

## **2.3. Amendments to tender documents**

- 2.3.1. In the event of it being deemed desirable to amend, alter or replace samples, specifications, copies or conditions subsequent to the specified date and hour and before notification or acceptance has been given, new tenders shall be called for.
- 2.3.2. In the event of it being necessary in the interest of the employer to alter the conditions after a tender has been accepted, the employer shall make the best arrangements with the contractor.
- 2.3.3. If there is a discrepancy between this document and a drawing, the drawing will be regarded as correct.

## **2.4. Qualifications**

- 2.4.1. The tender must conform to all requirements of this specification and any qualifications related to the tender document will not be entertained and the tender may be disqualified.
- 2.4.2. Tenderers wishing to include for alternative equipment and materials etc. may do so provided full details of pricing etc. are submitted together with the tender.

## **2.5. Uncertainties**

- 2.5.1. Uncertainties and doubts as to the meaning and interpretation of items in these documents must be submitted to the engineers to have them explained, rectified or cleared before tenders are submitted.

## **2.6. Plant, Scaffolding, Cranage, etc.**

- 2.6.1. The tenderers are to make due allowance in their tenders for whatever is required to enable them to complete the works. The tenderer must supply all necessary equipment required for access in order for the works to be completed.

## **2.7. Tender price**

- 2.7.1. The tender price is to include for the supply of all labour and material required for the complete sub-contract works, the cost of transport of materials to site and programming, the removal from site of waste specific to the work performed and co-ordination of the sub-contract works. Any items or work not specifically stated here or shown on the drawings but generally required to complete the works shall also be included in the tender price together with any cost implications of the “preliminaries” applicable to this contract.
- 2.7.2. Tender must be submitted clearly indicating: equipment ; installation and commissioning , as per bill of quantities

## 2.8. Variations to the tender price

- 2.8.1. The tenderer shall accept full responsibility for the accuracy of his measurement of quantities etc. Claims for variations from the tender price must be authorized by the engineers prior to the commencement of the variation work. Any variations must be submitted to the engineers for approval together with the cost of the variation. Any claims for unauthorized variation work will not be considered. Variation costs will be based on the schedule of rates submitted with this tender.

## 2.9. Programme

- 2.9.1. If the following dates are unreasonable or cannot be met by the tenderer, the tenderer must state reasonable completion dates in his/her tender for the works and it will be taken into consideration during the evaluation of the tenders:

***Start – to be advised at site handover***

***End – to be advised at site handover***

- 2.9.2. No claim will be entertained for the working of overtime, disruption, out of sequence activities, additional supervision and/or plant which might be necessary to achieve the programme dates.
- 2.9.3. The tenderer must submit a Gantt chart indicating programme detail as per bill of quantities.

## 2.10. Cleaning

- 2.10.1. Tenderers are to allow for cleaning up their work and storage areas. Should the site have to be cleaned due to the HVAC contractors' negligence, the costs will be contra-charged to that contractor.

## 2.11. Liaison

- 2.11.1. The ventilation contractor shall, in each case, provide the engineer and principal contractor with all necessary information, dimensions, materials, etc., as called for in the specification, in good time.
- 2.11.2. It is essential that the ventilation contractor works in close collaboration with the principal contractor to ensure that where his services run in proximity with other services, there are no clashes.
- 2.11.3. Failure to comply with the above may mean that corrective measures will have to be taken to correctly position the equipment. Any abortive work resulting will be entirely to the ventilation contractor's account.

## 3. Standard specification and liability

### 3.1. Standard specification

All plant equipment and workmanship covered by this contract shall in every respect comply and be carried out in strict accordance. All materials and equipment used shall be new and of a high quality which complies with the relevant SABS and/or BS standard or equivalent. Tenderers shall ensure that they are acquainted with the contents of SABS specifications quoted in the document.

The installation shall comply with, but not limited to:

- 3.1.1. The Occupational Health and Safety act 85 of 1993 and regulations.

- 3.1.2. SANS 10142: code of practice for the wiring of premises
- 3.1.3. SANS 10400: national building regulations
- 3.1.4. All municipal regulation laws, by-laws and special requirements of the local authority and the local supply authority.
- 3.1.5. SABS 0140 / 1091: painting / color-coding
- 3.1.6. The standard specifications and regulations of any government department or public service company where applicable. Please note that some of the specifications specified do override the specification as supplied / amended by the South African Bureau of Standards.
- 3.1.7. The successful contractor shall at his own cost issue all notices in respect of the installation to the local authorities and shall exempt the administration from all losses, costs or expenditures which may arise as a result of the contractor's negligence with the requirements of the regulations listed above.

### **3.2. Materials and workmanship**

- 3.2.1. Unless otherwise authorized, all materials, plant and equipment shall comply with the relevant SABS standard specifications or code of practice or to the British Standard specification where no SABS standard exists.
- 3.2.2. Materials wherever possible, must be of South African manufacture.
- 3.2.3. All plant and equipment be correctly and competently installed, cleaned, painted and tested for operation. Any changes and adjustments required to obtain satisfactory operation shall be made by and at the expense of the contractor.
- 3.2.4. No materials which are themselves flammable or which supports combustion may be used, and the contractor is advised to submit samples for approval of any suspect material to the local fire authority before commencing installation.

### **3.3. Installation Specifications**

#### **3.3.1. General**

- 3.3.1.1. Tender and Construction drawings are schematic and do not purport to show exact positions of mechanical equipment, ducting, and piping. All final dimensions and positions must be checked prior to manufacturing and installation.
- 3.3.1.2. Any clash of mechanical elements with each other or the elements of any other discipline shall be reported to the engineer, and resolved with his prior approval.
- 3.3.1.3. Offsets or transformations shall be made where structural or architectural elements interfere with the straight running of ducting, pipes, trunking, and cable trays, and shall be subject to prior approval of the engineer.

#### **3.3.2. Cable Trays and Trunking**

Cable trays and trunking shall be supplied and installed in accordance with the specifications and details noted on the drawing and this document. Unless otherwise specified the following requirements apply:

3.3.2.1. All trays and trunking shall make use of professionally manufactured galvanized steel systems, and shall be installed in strict accordance with the relevant supplier requirements and instructions.

3.3.2.2. Where tees and bends are present in cable tray route(s), tee-, bend-, and crossover- sections featuring radius bends shall be used.

3.3.2.3. All trays and trunking shall be sized large enough to ensure that all piping and wiring to be fitted can be laid side by side, with reasonable clearance between individual pipes and without any compression of insulation.

### 3.3.3. Metals

All metal items shall be supplied and installed in accordance with the specifications and details noted on the drawing and this document. Unless otherwise specified the following requirements apply:

3.3.3.1. Dissimilar metals shall be separated with rubber insert.

### 3.3.4. Anti-vibration Mounts

Anti-vibration mounts shall be supplied and installed in accordance with the specifications and details noted on the drawing and this document. Unless otherwise specified the following requirements apply:

3.3.4.1. All mechanical machinery and moving equipment shall be installed with anti-vibration mounts.

3.3.4.2. Mountings shall be selected to completely dampen and absorb all unbalanced forces and vibrations for all machine speeds.

3.3.4.3. Mountings shall be selected for the weight of the machine in combination with any imbalance force(s).

3.3.4.4. Mountings shall be installed with levelling bolts and neoprene stabilisers for vertical and lateral adjustment.

## 3.4. Ventilation and Ducting Specifications

### 3.4.1. Fan Specifications

Fans shall be supplied and installed in accordance with the specifications and details noted on the drawing and this document. Unless otherwise specified the following requirements apply:

3.4.1.1. All fans shall be installed in strict accordance with the relevant supplier requirements and instructions.

3.4.1.2. Fans shall be self-supported, and fitted with anti-vibration mountings or anti-vibration hangers as per section 3.3.4.

3.4.1.3. Fan openings not connected to ducting or other equipment shall be temporarily closed off with removable screens.

3.4.1.4. Fans shall be installed with flexible collars on both the suction and supply side, and no inward folds of the collar fabric shall be accepted.

3.4.1.5. Fans shall be marked with arrows indicating both the direction of rotations and airflow.

3.4.1.6. Roof mounted fans shall be supplied and installed as per section 0.

3.4.1.7. Wall mounted fans shall be supplied and installed as per section 3.4.2.



### 3.4.2. Wall Mounted Fans

Wall mounted fans shall be supplied and installed in accordance with the specifications and details noted on the drawing and this document. Unless otherwise specified the following requirements apply:

- 3.4.2.1. All fans shall be installed at a height approximately centred between the window and ceiling levels.
- 3.4.2.2. All fan faces shall be installed flush with finished wall surface, and covered with an aluminium weather louver on the exterior elevations and an aluminium single deflection (horizontal) supply air grille on the interior elevation.
- 3.4.2.3. All fans shall be fitted with a controller with on/off functionality, as well as at least 4 speed settings. The controller must be installed approximately 50 mm above the supply grille frame, centred and neat.
- 3.4.2.4. All electrical conduits, cables and wires must be chased into the wall.

### 3.4.3. Roof Mounted Fans

Roof mounted fans shall be supplied and installed in accordance with the specifications and details noted on the drawing and this document. Unless otherwise specified the following requirements apply:

- 3.4.3.1. Roof-mounted fans shall be installed within a uni-strut frame suitable for waterproofing, or another suitable solution with prior approval of the engineer.
- 3.4.3.2. Roof-mounted fans shall be installed with the supplier specific cowl and bird proofing, or another suitable solution with the prior approval of the engineer, subject to the requirements of section 3.4.4.

### 3.4.4. Roof Ventilators and Cowls

Roof ventilators (including turbine roof ventilators) and cowls shall be supplied and installed in accordance with the specifications and details noted on the drawing and this document. Unless otherwise specified the following requirements apply:

- 3.4.4.1. All items shall be of steel or aluminium construction, and shall be epoxy powder coated or galvanized. Coating/treatment type and colour shall be approved by the engineer prior to installation.
- 3.4.4.2. All items shall be installed in such a manner to allow for effective water proofing.

### 3.4.5. Ducting

Ducting shall be supplied and installed in accordance with the specifications and details noted on the drawing and this document. Unless otherwise specified the following requirements apply:

- 3.4.5.1. All ducting to be galvanized steel constructed according to SMACNA Low Velocity Duct Construction Standards
- 3.4.5.2. All ducting which passes through walls must be isolated from the wall by a wooden frame or intumescent fireproof sealer where the wall forms part of a firewall.
- 3.4.5.3. All rectangular ducting to be supported by overhead hangers of the trapeze type.
- 3.4.5.4. All circular ducting to be supported overhead hangers of the strap type.

3.4.5.5. Samples of any hanger system (other than the above) shall be approved by the engineer prior to installation.

3.4.5.6. All angle irons and fastening equipment used shall be corrosion proof.

3.4.5.7. All ducting elbows shall be of the full-radius type. Square elbows with galvanized turning vanes may be used with prior approval of the engineer.

3.4.5.8. All flexible ducting to be in accordance with section 3.4.7.

#### 3.4.6. Ducting Insulation

Ducting insulation shall be supplied and installed in accordance with the specifications and details noted on the drawing and this document. Unless otherwise specified the following requirements apply:

3.4.6.1. All ducting and other mechanical element which handles or transports conditioned air shall be insulated.

3.4.6.2. All interior ducting and fittings shall be insulated to achieve an R-value of 1 m<sup>2</sup>K/W.

3.4.6.3. All exterior ducting and fittings shall be insulated to achieve an R-value of 6 m<sup>2</sup>K/W.

3.4.6.4. Samples of all insulation shall be approved by the engineer prior to installation.

#### 3.4.7. Flexible Ducting

Flexible ducting shall be supplied and installed in accordance with the specifications and details noted on the drawing and this document. Unless otherwise specified the following requirements apply:

3.4.7.1. All flexible ducting shall only be used where specifically indicated, or for the final connection between ducts and diffusers or plenum boxes.

3.4.7.2. Where flexible ducting is thus used its straight length shall not exceed 1 m, and it shall be installed in such a manner to avoid any unnecessary length and resulting bends and folds.

3.4.7.3. All flexible ducting shall be fixed to spigots by means of sheet metal rings and circlips.

3.4.7.4. All flexible ducting shall be of an acoustically insulated and fireproof construction.

#### 3.4.8. Grilles, Diffusers, and Louvers

Grilles, diffuser, and louvers shall be supplied and installed in accordance with the specifications and details noted on the drawing and this document. Unless otherwise specified the following requirements apply:

3.4.8.1. All items shall be of an aluminium or steel construction.

3.4.8.2. All items shall be subject to an epoxy powder coating or a similar durable coating, subject to the prior approval by the engineer. Coating colour shall be confirmed with the engineer prior to installation.

3.4.8.3. Where required for commissioning/balancing purposes, all items shall be fitted with an airflow damper in accordance with section 3.4.10.

3.4.8.4. All exterior items shall be fitted with wire mesh vermin screen.

#### 3.4.9. Filters

Filters shall be supplied and installed in accordance with the specifications and details noted on the drawing. Unless otherwise specified the following requirements apply:

- 3.4.9.1. Washable panel filters shall be of the pleated type and not less than 50mm thick. Each filter shall use synthetic media bounded together with galvanised wire for reinforcing, and bonded in the frame, ensuring no air bypass.
- 3.4.9.2. Fresh air systems shall be supplied with washable panel filters installed in a suction-side plenum. The plenum shall be so constructed to allow sufficient space for inspection and servicing. Access doors or panels shall be constructed to seal once closed.
- 3.4.9.3. Fresh air systems specified with hinged weather louvers shall be supplied with washable panel filters installed in a suction side plenum. The plenum shall be so constructed to allow inspection and servicing through the louver opening.
- 3.4.9.4. Fresh air systems shall not be operated for extended periods or for the purposes of commissioning without the specified filter installed.
- 3.4.9.5. One complete set of spare filters are to be provided where washable filters are specified.

#### 3.4.10. Airflow Dampers

Airflow dampers shall be supplied and installed in accordance with the specifications and details noted on the drawing and this document. Unless otherwise specified the following requirements apply:

- 3.4.10.1. All items shall be of the geared opposed blade- or iris- damper type.
- 3.4.10.2. All items shall be so installed to ensure that access to manual adjustment levers and locking mechanisms is unobstructed for the full actuation range.

#### 3.4.11. Fire Dampers

Fire dampers shall be supplied and installed in accordance with the specifications and details noted on the drawing. Unless otherwise specified the following requirements apply:

- 3.4.11.1. All fire- and combination fire/smoke- dampers shall comply with the requirements of SABS 193, and shall have the applicable SABS mark and certificate.
- 3.4.11.2. All dampers shall be activated by a fusible link. Re-usable fusible links are not acceptable.
- 3.4.11.3. All dampers shall be flanged on both sides, and an access panels shall be provided on the upstream side of each damper.
- 3.4.11.4. All dampers shall be installed so as to form part of a continuous barrier to the passage of fire (when in the closed position). As such the damper shall be mounted in the wall, or be installed immediately adjacent to it with the prior approval of the engineer.
- 3.4.11.5. For all wall mounted dampers a sheet metal sleeve shall be built into the wall. The damper shall be fixed on all sides with retaining angles, which shall be fastened to the sleeves only (and not the wall). The retaining angles shall lap the masonry by at least 25 mm. Angle dimensions and the clearance between the sleeve and damper shall be as per the values tabulated below:

Largest Damper Dimension (m)	Angle (mm)	Clearance (mm)
0 – 1.2	38 x 38 x 3.2	5
1.2 – 1.8	44 x 44 x 3.2	10
≥ 1.8	51 x 51 x 4.8	15

3.4.11.6. For all suspended dampers the dampers shall be self-supported (support from ducting is unacceptable), and all ducting between the damper and the closest wall shall be of a 2mm welded construction.

### 3.4.12. Smoke Dampers

Smoke dampers shall be supplied and installed in accordance with the specifications and details noted on the drawing. Unless otherwise specified the following requirements apply:

- 3.4.12.1. All dampers shall be fitted with an electrical solenoid which will open the damper when powered. Normally open dampers are not acceptable.
- 3.4.12.2. All dampers shall be flanged on both sides, and an access panels shall be provided on the upstream side of each damper.
- 3.4.12.3. All dampers shall be self-supported, and care must be taken to ensure that access to the closing device is unobstructed. Dampers supported by surrounding ductwork shall not be acceptable.

### 3.4.13. Commissioning

- 3.4.13.1. Commissioned ducted systems shall be tested for leakage according to SABS 10173, and may not exceed 5% or the SABS permissible leakage (whichever is less).
- 3.4.13.2. All supply and extract systems shall be commissioned to within +10% of the design airflow.
- 3.4.13.3. All supply systems shall be commissioned in such a manner as to simulate a 100 Pa pressure drop before the fan to simulate a used fresh air filter and the method shall be approved by the engineer prior to commissioning.

## 3.5. Air Conditioning

### 3.5.1. DX Specifications

DX- air conditioners and systems (e.g. VRF systems) shall be supplied and installed in accordance with the specifications and details noted on the drawing. Unless otherwise specified the following requirements apply:

- 3.5.1.1. All units and systems shall comply with the minimum requirements provided in SANS 10400:O and SANS 204 Section 4.8 (as enforced by SANS 10400:XA section 4.2.1.b).
- 3.5.1.2. All units and systems shall be installed in accordance with the specific supplier requirements and instructions, and this shall be done by personnel with the required supplier certification.
- 3.5.1.3. All condenser/outdoor units shall be supplied and installed as per section 3.5.4.
- 3.5.1.4. All refrigerant and condensate piping shall be supplied and installed as per section 3.5.6.
- 3.5.1.5. Concealed evaporator/indoor units shall be supplied and installed as per section 3.5.2.
- 3.5.1.6. All control panels and remotes shall be supplied and installed as per section 3.5.3.

### 3.5.2. Concealed Evaporator/Indoor Units

Concealed evaporator/indoor units shall be supplied and installed in accordance with the specifications and details noted on the drawing and this document. Unless otherwise specified the following requirements apply:

- 3.5.2.1. All units shall be commissioned at the lowest fan speed which does not reduce the design cooling and heating capacity of the unit.
- 3.5.2.2. All ducting and fittings associated with the unit shall be of a galvanized steel construction, as per section 3.4.5, and flexible collars shall be fitted on both the suction and supply side.
- 3.5.2.3. All units and associated suction and supply ducting shall be insulated as per section 3.4.6.
- 3.5.2.4. All units shall be supplied with a black primary air filters installed in hinged return air grilles on the suction side of each unit.

### 3.5.3. Control Panels and Remotes

Control panels and remotes shall be supplied and installed in accordance with the specifications and details noted on the drawing and this document. Unless otherwise specified the following requirements apply:

- 3.5.3.1. Wired control panels shall be supplied unless the supplier does not include it as an option for a specified unit.
- 3.5.3.2. Any wiring associated with a control panel shall be run in a suitable conduit and draw box, and built/chased into the wall. It is preferable that conduit installation is done by the electrical sub-contractor where applicable, and no joints in the control wiring shall be acceptable.
- 3.5.3.3. Wireless remotes shall be supplied with a holder fixed to the wall. The remote shall be fitted with a flexible stainless steel wire or chain, and attached to the wall with a mechanical anchor with a sample approved by the engineer prior to installation.
- 3.5.3.4. Control panels and remotes shall be positioned adjacent to the light switches at the main entrance/door to the relevant space/room.

### 3.5.4. Condenser/Outdoor Units

Condenser/outdoor units shall be supplied and installed in accordance with the specifications and details noted on the drawing and this document. Unless otherwise specified the following requirements apply:

- 3.5.4.1. Condenser coils shall receive treatment to ensure cross hatch adhesion as per ASTM B3359-93 and corrosion durability of at least 5000 hours salt spray resistance as per ASTM B117. Coil treatment must be accompanied with a 3 year coil warranty.
- 3.5.4.2. All piping to- and from- the unit shall be built into the wall and exit directly behind the unit, or shall with prior approval of the engineer be installed in suitably sized weatherproof and painted galvanized trunking.
- 3.5.4.3. All units shall be installed at 1.8 m clear height. If the units are installed in the vicinity of any windows the final position and height must be confirmed with the engineer prior to installation.
- 3.5.4.4. All units shall be installed on robust galvanized steel brackets, properly braced and fixed with wall anchors.
- 3.5.4.5. All heat-pump or heat-recovery type condenser/outdoor units shall be fitted drain pans as per section 3.5.5.

### 3.5.5. Drain Pans

Drain pans shall be supplied and installed in accordance with the specifications and details noted on the drawing and this document. Unless otherwise specified the following requirements apply:

3.5.5.1. The pan shall be constructed from 1.2 mm thick 316L stainless steel, with the floor sloping from all sides towards the drain point. Alternative construction to be approved by engineer prior to installation.

3.5.5.2. PVC piping shall be connected to the drain hole, and piped to the nearest drain, or to within 100 mm of the ground in the absence of a nearby drain.

3.5.5.3. PVC piping shall be built into the wall and exit directly at the outlet, or shall be painted or otherwise concealed with permission from the engineer.

### 3.5.6. Refrigerant & Piping Specifications

Refrigerant piping shall be supplied and installed in accordance with the specifications and details noted on the drawing and this document. Unless otherwise specified the following requirements apply:

3.5.6.1. All copper tubes shall comply with the requirements of SABS 1453 with sizes according to SABS 460 class 2, and shall be de-oxidised and dehydrated.

3.5.6.2. All fittings for copper piping shall be copper based capillary solder fitting in accordance with SABS 1067. Only silver-, Afroz Silifos 14-, or 97/3 tin-copper- solder shall be used, along with a cold water soluble flux. Silver solders shall be in accordance with SABS 23.

3.5.6.3. All pipe sizes shall be so selected to produce moderately low velocities, while maintaining proper oil return to the compressor.

3.5.6.4. All piping shall be supported as per the values tabulated below:

Pipe Size (mm)	Max. Support Distance (m)	Pipe Size (mm)	Max. Support Distance (m)
≤ 10	0.6	42	2.5
10 – 18	1.0	54	2.75
22	1.5	67	3.0
28 – 35	2.0		

3.5.6.5. All refrigerant piping shall be insulated with a class-O fire rated closed cell insulation system, and the final installation shall be free from any cavities, opening, or tears. Insulation thickness shall be selected as per the values tabulated below:

Pipe Size (mm)	Minimum R Value (m <sup>2</sup> K/W)	Insulation thickness (mm)
≤ 60	1	9
60 – 80	1	13
80 – 114	1.5	25
≥ 114	1.5	

3.5.6.6. All suction refrigerant pipes and equipment operating below the ambient dew point shall be insulated and provided with a suitable vapour barrier.

### **3.6. Site supervision by contractor**

3.6.1. The contractor is responsible for supervision on this contract. The contractor shall replace the supervisor at his own cost if the aforementioned supervisor is unable to perform his duties satisfactorily.

### **3.7. Submissions by contractor**

3.7.1. The contractor shall take note that all equipment selections approved or not rejected by the engineer shall not relieve the contractor of his obligations to comply with the specification.

### **3.8. Performance of systems and equipment**

3.8.1. The systems and equipment layout designed by the engineer shall conform to his requirements with regards to installation and system performance. This suggests that the performance of the equipment in the system supplied and installed by the contractor, shall be in accordance with the design and performance figures as published by the manufacturers and/or suppliers.

3.8.2. The efficiency of the design of the specified system is not the responsibility of the contractor. It is however, the responsibility of the contractor to ensure that the quality of the workmanship and the installation of the equipment shall conform to the requirements of the engineer and to the satisfaction of the supplier or manufacturer.

3.8.3. It is furthermore accepted that the contractor has assured himself that all equipment supplied and installed under this contract shall perform within the given limits, as stated by the supplier/manufacturer, to conform the specification.

### **3.9. Guarantee**

3.9.1. The new equipment shall be guaranteed for a period of 1 year from date of handover to the owner, in accordance with the requirements of the contract.

### **3.10. Maintenance manuals and as-built drawings**

#### **3.10.1. Hard copies**

3.10.1.1. Four sets of maintenance manuals incorporating commissioning data and as-built drawings shall be provided on hard copy format.

#### **3.10.2. Electronic copies**

3.10.2.1. Maintenance manuals to be provided in Microsoft word format (2003 or later). Drawings to be provided as electronic files on a compact disc (CD) in Autocad format.

### **3.11. Commissioning and hand over**

3.11.1. A phased approach as per the bill of quantities must be followed for the installation and commissioning.

3.11.2. The engineer shall witness performance tests to demonstrate satisfactory operation. A condition of first delivery of the installation will be the submission in tabular form of the results of the tests on the performance of the system equipment.

3.11.3. Each piece of equipment individually and each completed system as a whole shall be correctly adjusted as required giving satisfactory performance. Control systems shall be adjusted and placed in operation.

The test results are to include but not be limited to the following:

- Electrical current readings for all motors.
- Air readings of all ventilation system fans including fan curves showing the operating point.
- A checklist showing that all equipment has been checked that the connections, electrical amps drawn etc. corresponds to manufacturer data for all the equipment installed.
- Commissioning test data on air diffusion equipment and grilles.

### 3.12. Co-ordination with other services

3.12.1. Co-ordinate the works with all other services and including existing services within the vicinity of the works.

3.12.2. Any existing services shown on the drawings are indicative only. Prior to any work being carried out, confirm location including that of any other existing services in the area of the works to be undertaken.

3.12.3. Where necessary, relocate, repair and replace any existing services within the vicinity of the works. If it becomes necessary to relocate, repair or replace any such existing services, obtain all the necessary consents and approvals from the relevant authorities.

3.12.4. Claims for variations, extensions of time, delay, disruption or other items, will not be allowed for failure to co-ordinate the works.

3.12.5. Any equipment that is installed without due regard to other trades, shall be relocated at no additional cost.

### 3.13. Tuition

3.13.1. Provide an experienced technical person/s who has a complete technical knowledge of the installation to instruct and demonstrate to the principal or his nominated representatives, in the location and method of operation and maintenance requirements of all components in the installation.

3.13.2. All operating manuals and as installed drawings shall be available prior to tuition being given.

## 4. Reference documentation

### 4.1. Tender drawings

Drawing Name	Description
17167-ParoWB-M-H-001	Ground Floor HVAC Layout
17167-ParoWB-M-H-002	First Floor HVAC Layout
17167-ParoWB-M-H-003	Second Floor HVAC Layout

## 5. Bill of Quantities

*(Bill of quantities on following pages)*