AIR-CONDITIONING AND VENTILATION INSTALLATION

FOR

THULASIZWE CLINIC

PROJECT SPECIFICATION

SECTION 1 : GENERAL

1. GENERAL

The project and standard drawings form part of the project specification and shall be read in conjunction with the project specification.

Conflicts, errors or discrepancies found in this specification or drawings shall be brought to the Engineer's attention for resolution.

Any deviations from the specifications, drawings and/or equipment specified shall be listed together with the alternatives offered and shall be submitted as part of the tender. If no deviations are listed, it will be assumed that the Tenderer complies with all the relevant technical parts of this specification.

All installations shall be complete in all respects and the Contractor shall allow for the completion and successful operation of the complete installation, irrespective of whether every separate item is specified or not.

2. SITE

The site is situated in King Dinizulu Highway, Thulasizwe, Ceza, KZN.

Tenderers are advised to visit the site and acquaint themselves with the nature and extent of the work involved before submitting their tenders.

3. COMPLETION DATE

Completion dates are stipulated in the preliminaries included in this document. The Contractor will be required to keep up with the main contract in accordance with the main contractor's program and to complete the mechanical installation concurrently with the main contract.

4. PROGRAM

Directly after acceptance of his tender, the Contractor shall submit time schedules for each activity for which he is responsible to the main contractor, for the inclusion thereof in the main contractor's program.

A copy of the program (and revisions thereto) shall be submitted to the Engineer well within time and at regular intervals.

The following items shall be programmed in consultation with the Main Contractor:

- Working drawings

- Approval of working drawings
- Equipment detail submission for approval
- Ordering of material
- Ducting installation
- Piping installation
- Approval of first fix
- Plant equipment installation
- Second fix
- Electrical installation
- Commissioning and testing
- Final inspection

5. FINISHING AND TIDYING

In view of the intense concentration of construction activities likely to be experienced during the contract period, progressive and systematic finishing and tidying will form an essential part of this contract. On no account must spoil, rubble, materials, equipment or unfinished operations be allowed to accumulate in such a manner as to unnecessarily impede the activities of other and in the event of this occurring, the Employer shall have the right to withhold payment for as long as may be necessary in respect of the relevant works in the area(s) concerned without prejudicing the rights of others to institute claims against the Contractor on the ground of unnecessary obstruction.

Finishing and tidying must be done on a daily basis and not simply be left to the end of the contract. All finishing and tidying shall be carried out to the best advantage of the project as a whole.

6. SCAFFOLDING AND PLANT

All plant required for the execution of the contract shall be supplied by the Contractor under this contract.

The Contractor shall provide his own scaffolding. For installation purposes the Tenderer shall allow for his own lifting equipment, cranes etc. which may be necessary to complete the installation as none of these facilities will be available on site.

7. SUPERVISORY STAFF AND IDENTIFICATION

At all times while on the premises, all artisans and labour members of the mechanical contractor’s and subcontractor’s staff will wear clothing adequately marked with the relevant contractor's name.

The work shall be done by, or at all times be under the personal supervision of a qualified artisan (or qualified technician) in the respective trade. Details of this operation and prospective work shall be given at the time of tendering in a covering letter.

8. QUALITY OF MATERIALS AND WORKMANSHIP

All materials shall be new, undamaged and free from rust or other defects. Only material of the best quality, which has been approved by the Engineer, shall be used.

The Contractor shall, upon the request of the Engineer, furnish him with documentary proof to his satisfaction that the material is of the quality specified. Samples of materials for testing, if required, shall be supplied by the Contractor, free of charge.

Where applicable, all material shall be in accordance with the relevant standard specifications of the South African Bureau of Standards and the British Standard Specifications.

The installation shall be carried out according to the latest modern engineering practices.

The Engineer reserves the right to reject any work or part thereof that, according to his judgement, does not meet the highest standards of material and workmanship and to enforce replacement of the work at the expense of the Contractor.

9. RATING OF EQUIPMENT

The Contractor shall supply the sizes and rating of all the equipment offered to the Engineer for approval prior to purchasing or ordering such equipment.

All equipment offered shall operate well within the manufacturer’s ratings, and equipment to be operated beyond these limits will not be considered.

10. SPACE REQUIREMENTS AND ACCESS

Tenderers shall ensure that the equipment offered by them can be installed in the available space as shown on the drawings. Should it be found at a later stage that the equipment offered does not fit, all costs arising from the rectification of this problem shall be for the Contractor’s account.

The equipment shall be installed in such a manner that complete access is provided for operating and maintenance purposes.

Tenderers shall also ensure that the equipment offered by them will pass through available building openings. Large equipment shall be made up in sections and each section shall be small enough for access through doors and other building openings. All additional costs involved for the modification of equipment or to change the make of equipment in order to allow access shall be for the account of the Contractor.

11. REGULATIONS AND STANDARDS

The equipment, installation, commissioning and maintenance shall in all respects comply with the following authorities and regulations:

a) The Occupational Health and Safety Act, Act No. 85 of 1993.

b) Local Municipal Regulations, by-laws and Ordinances.

c) Local Fire Department Regulations.

d) SANS 10400: 1990: The application of the National Building Regulations.

e) Local Electrical Supply Authority Regulations.

f) The wiring of premises Part1: Low-voltage installations, SANS 10142-1 as amended.

All losses, costs or expenditures, which may arise as a result of negligence to comply with any regulation applicable to this service as specified above, shall be for the account of the Contractor.

Where trade names and references to catalogues are found in the specification, the intention is to set a particular standard of equipment. Where “other approved” equipment is specified, the Tenderer shall obtain written approval from the Engineer before he may deviate from the specified equipment. This approval must be obtained at tender stage.

The Contractor shall work strictly according to this specification and shall ensure that only the best quality material is used, and that the installation is handed over as a complete working system.

12. DRAWINGS

The dimensions and positions of equipment shown on the Engineer’s drawings are schematic and for tender purposes only. The drawings are not suitable for manufacturing purposes. The responsibility for dimensional and layout accuracy remains with the Contractor. The exact positions will be pointed out on site where necessary.

The following drawings shall be submitted by the Contractor to the Engineer for approval, within four (4) weeks of acceptance of the tender:

a) **Builder’s Work Drawings**

All building requirements are to be indicated on these drawings to meet the dimensional requirements of the equipment and materials to be installed by the Contractor.

b) **Mechanical Drawings**

These are workshop and equipment layout drawings required for the manufacture and installation of equipment, showing detailed dimensions.

c) **Electrical Drawings**

These include switchboard layouts, circuit diagrams, interconnection diagrams, and cable and equipment schedules.

Any work done by the Contractor without an approved drawing shall be at the Contractor’s own risk, and any changes required to conform with the contract documents or co-ordinate his work with other trades, shall be for the account of the Contractor.

The approval of drawings by the Engineer shall not relieve the Contractor of his responsibilities to carry out the work in terms of the contract documents.

The mechanical and electrical drawings shall be updated during the contract period and shall be included in the operation manual at the end of the contract period as “as built” drawings.

13. OPERATION MANUALS AND MAINTENANCE INSTRUCTIONS

The Contractor shall submit three (3) copies of operation and maintenance manuals to the Engineer.

Manuals shall consist of:

a) Comprehensive literature of the different components of the installation.

b) Paper prints of all approved drawings and diagrams where applicable.

c) Start-up and shutdown procedures.

d) Commissioning data of all equipment in tabulated form.

e) Prescriptions for routine tests, which shall be performed by the user together with the time when such tests shall be, performed (e.g. pressure tests).

f) Schedule of apparatus and equipment complete with model numbers, optional extras, modifications, electrical requirements, etc.

g) Detailed daily, weekly, monthly, quarterly, bi-annual or annual preventative maintenance procedures where applicable.

h) Manufacturer's catalogues.

i) List of spares for all equipment.

j) Suppliers telephone numbers and addresses.

k) Wiring diagrams.

l) Test certificates.

The operation manuals shall be sturdily bound in a strong hard cover. Material in the manual shall be clear, legible and well arranged and provided with an index.

The above manuals shall be available three weeks before first handover / practical completion of the installation and no handover shall be considered without these manuals.

14. MAINTENANCE AND GUARANTEE

All equipment supplied and work done as part of this contract shall be maintained and guaranteed for a period of one year from date of practical completion.

The Contractor is responsible for all material and labour during this period.

The Contractor shall visit the installation uninterrupted and do the scheduled maintenance as prescribed in the operating instructions. On completion of the monthly visit a full report shall be prepared and submitted to the Engineer within seven (7) days from the visit.

In case of a breakdown, the Contractor shall react within reasonable time and repair the installation to the satisfaction of the Engineer. Should the Contractor, in the discretion of the Engineer, not react within reasonable time, the Engineer shall commission another Contractor and the cost thereof shall be recovered from the defaulting Contractor.

15. PAYMENT CLAIMS

In addition to the conditions of contract, the Contractor shall attach to his application for payment an explanation of material cost and labour cost. The following information is required with respect to material and labour:

- Estimated percentage delivered/completed at date of the previous claim.
- Estimated percentage delivered/completed at date of current claim.
- Total cost claimed at date of previous claim.

16. PAINTING

Where applicable the following painting specifications shall apply:

Iron and steel surfaces shall be properly cleaned by removing all dirt, oil, scale and rust by brushing and sanding until a clean shiny surface is obtained.

Hereafter a metal primer shall be applied.

Galvanized surfaces shall be cleaned with a galvanizing cleaning agent and then washed with clean water to remove the factory applied protection against white rust. Hereafter a calcium plumbate primer shall be applied, followed by an undercoat between 24 and 72 hours after application of the primer.

Other surfaces shall be cleaned by removing all dirt and a primer as specified by the paint supplier for the particular surface shall be applied.

The primer coat shall be followed by a matt undercoat and a final topcoat of high gloss enamel of an approved colour.

Each layer of paint shall be clearly distinguishable from each other by means of different colours and each layer shall be properly sanded before the following coat is applied.

All paint shall at least be of SABS quality for industrial use and shall be approved by the Engineer.

Equipment shall be painted according to the National Colour Standards, SANS 1091.

17. DAMAGE AND PROTECTION OF WORKS

The Contractor shall take all precautions necessary for the protection of life, equipment and property in connection with the works during installation.

The Contractor shall be held completely responsible for any damage of equipment during transport and installation, as well as any damage to the building and shall repair any such damage at his own expense.

Where equipment cannot be repaired to an “as new” condition, it will be completely replaced at the expense of the Contractor.

Equipment delivered to site shall be stored in a well-protected area where it cannot be damaged by either the weather or other trades.

18. WELDING

Welding shall be carried out in accordance with the current edition of SANS 10044 Parts 1 to 2 where applicable. All welding shall be performed according to the latest technology and where exposed, it shall be smoothly finished off.

19. BUILDING WORK AND REMOVAL OF EQUIPMENT

The following work shall be carried out by the builder/main Contractor.

a) Drilling and cutting of necessary holes in the concrete, brickwork, ceilings and wooden doors, including making good to match finish.

b) Concrete plinths for installation of equipment.

c) Waterproofing of roof penetrations and plinths.

d) Provide drain points where required.

20. TESTING

The plant shall be tested and operated to meet the performance figures and duties specified. All safety features and interlocks shall be tested.

Pressure tests for water and piping shall be done at a test pressure of 1.5 times the maximum working pressure at the lowest point in the system, but not less than 700 kPa. All instrumentation, which could be damaged during the test, shall be removed from the pipe system.

The relevant system shall be filled with water and all high points shall be vented at least 24 hours before the test. The duration of the pressure test shall be 2 hours, after which no water leaks shall be visible and no pressure drop shall occur after corrections have been made for changes in ambient temperature during the test period.

Pressure tests shall be completed prior to insulating or covering piping. If leaks are found, welded connections shall be cut out and re-welded.

Rectified piping shall be retested.

21. COMMISSIONING

The installation shall be commissioned in accordance with the relevant codes and recognised commissioning procedure or code approved by the consulting engineer:

The Contractor shall submit a commissioning program to the Consulting engineer at least two weeks prior to the commencement of commissioning and at the same time shall notify the consulting engineer of the code or procedure to which the plant will be commissioned.

The results of all checks and measurements shall be recorded in writing during the commissioning period.

Commissioning records shall be handed over to the Consulting engineer prior to the first acceptance of the plant.

The commissioning records shall also be included in the operation manuals.

22. STAFF TRAINING

The Contractor shall be responsible for the training of the Client's site staff after the commissioning has been completed. The site staff shall receive enough instruction to ensure that they are fully conversant with the equipment concerned. The operating manuals shall be used during training. Upon completion of the training exercise the contractor is to obtain the client's representative's written acceptance of this handover tuition, thus acknowledging his complete understanding of the operational procedures for this installation. Site staff shall be instructed on:

a) the general operating method of the plant;

b) starting and stopping instructions;

c) stopping the plant in an emergency and warning against restarting after an emergency;

d) positions and normal settings of control equipment;

e) safety measures;

f) operational checks on gauges, flow switches, indicator lights, etc.;

g) name, address and telephone number of competent person responsible for the maintenance of the plant.

23. SCOPE OF WORK

The specification covers the following:

The supply, delivery, installation and commissioning of:

- Midwall Split DX Air Conditioning Units
- Bathroom Extraction Systems
- Fresh Air Ventilation Systems

AIR-CONDITIONING AND VENTILATION INSTALLATION

FOR

THULASIZWE CLINIC

PROJECT SPECIFICATION

SECTION 2 : HIGH / MID WALL SPLIT TYPE UNITS

1. SCOPE

The following installations shall be specified under this section of the project specification: High / mid-wall split type units:

- AC-01
- AC-02
- AC-03

2. DESIGN CRITERIA

DESIGN DATA	
Outdoor Summer Temperatures	31°C Db/23°C Wb
Outdoor Winter Temperatures	2°C Db/1°C Wb
Indoor Conditions	23°C Db/60% RH
Altitude Above Sea Level	972 m

3. APPLICABLE STANDARDS

The air-conditioning units and installation in general shall be in accordance with:

- SANS 1125 : Room Air Conditioners and Heat Pumps
- SABS 0147 : Refrigerating Systems including Plants associated with Air-Conditioning Systems
- SANS 60335-2-40 : Household and Similar Electrical Appliances – Safety. Part 2 – 40: Particular requirements for Electrical Heat Pumps, Air Conditioners and Dehumidifiers
- SANS 10142-1-2003 : The Wiring of Premises Part 1: Low-Voltage Installations
- SABS 1453 : Copper Tubes for Medical Gas and Vacuum Services

4. HIGH/MID WALL SPLIT TYPE UNITS

4.1 GENERAL

The units shall be of the heat pump type.

The air-conditioning units shall be standard factory assembled, piped and wired. The units shall be thoroughly tested for all operating conditions. Spares shall be freely available in South Africa. On request, the Contractor shall provide the Engineer with performance test certificates.

The air-conditioning units and installation in general shall be in accordance with the high / mid wall unit's supplier's recommendations. Any discrepancies between this specification and the supplier's recommendations that may influence the unit's performance or guarantee shall be clarified with the Engineer during tender stage.

The electrical power requirements to the condensing units shall be:

- Single Phase when the cooling capacity of the unit is less than 10 kW.
- Three Phase when the cooling capacity of the unit is more or equal to 10 kW.

The indoor unit and condensing unit shall be interconnected with refrigerant piping, electrical wiring and interlocking control cabling. The pipe and cable connections shall be made in accordance with the unit supplier's recommendations.

Each condensing unit with connected evaporator unit shall be clearly labelled to identify different split units.

4.1.1 Generic Unit Requirements

Mid wall units shall consist of a direct expansion, indoor fan coil evaporator unit and a separate, remote and externally located, air-cooled, condensing unit.

Heating shall be by means of heat pump action by the reversal of the cooling cycle. All the necessary control equipment, valves and piping required to perform this function shall be supplied as part of this work.

A defrosting system shall be provided that will defrost the condensing coil during the winter months when heating is required. The defrosting system shall be a proven system that functions automatically without affecting the room temperature.

The evaporator unit shall be equipped with an easy accessible washable filter, a 3 speed adjustable cross flow fan driven by an induction motor and evaporator coils manufactured from seamless copper tubing mechanically bonded to aluminium.

Mid wall split indoor units shall have integral condensate drain tray with drain hose connections.

The compressor unit shall be of the hermetic reciprocating type, powered by an induction motor, and installed with anti-vibration mounts such as rubber or spring isolators. The compressor shall be equipped with crankcase heater.

The condenser cooling fan shall be of the direct driven multi-wing, dynamically balanced propeller type axial flow fans. The outdoor unit shall be of the horizontal blow type.

The outdoor unit casing shall be manufactured from mild steel plate and shall be corrosion protected as follows or to a method as approved by the Engineer:

- Galvanised
- Electro Plated

The outdoor unit shall be colour coated as follows or to a method as approved by the Engineer:

- Acrylic Resin Powder Coated
- Polyester Powder Coated

For reverse cycle units, a proper galvanised steel drip pan with drainage piping or drain piping connected to the integral drain pan shall be provided for the condensing units.

The high / mid wall unit shall have an auto swing vane function that allows the vane to swing up and down automatically. An auto-flap shutter shall close automatically when the unit is turned off.

The control system shall be such that the unit will automatically change from heating to cooling and vice versa. A time delay relay shall prevent the compressor from restarting immediately when changing from heating to cooling and vice versa.

The “auto restart after power failure” option shall be available on all units’ settings. The units shall also be able to operate in a “fan only” mode.

Electrical interlocking shall be provided to ensure that:

- Compressor cannot run without both evaporator and condenser fans running.
- It shall not be possible to switch cooling and heating on simultaneously.

4.2 PERFORMANCE SPECIFICATIONS

Cooling and heating capacities are room conditions and all equipment shall be de-rated to meet these requirements.

De-rating shall be done to compensate for the following:

- Altitude above sea level
- Refrigerant pipe lengths
- Design conditions specified

All units shall be capable of meeting total and sensible cooling requirements. Tenderers shall provide proof of de-rated capacities with their tender. All capacities specified are to be achievable at medium evaporator fan speed.

4.3 PROTECTION AND SAFETY DEVICES

Thermal protection shall be provided for the compressor, indoor and outdoor fan motors. Over current relay shall be provided for the compressor, indoor and outdoor fan motors to ensure over current protection.

Protection fuses shall be provided for all control circuits.

The compressor shall have high and low refrigerant pressure protection.

The indoor and outdoor units shall comply with the safety requirements as set out in:

- SANS 60335-2-40 : Household and Similar Electrical Appliances – Safety. Part 2-40: Particular Requirements for Electrical Heat Pumps, Air-Conditioners and Dehumidifiers

4.4 ELECTRICAL

Generally the power to high/mid wall units shall be provided by the electrical contractor in a weather proof isolator mounted within 1 m from the condensing unit. The mechanical contractor shall do the entire electrical installation from the isolator to the condensing unit and the indoor unit.

Where the electrical contractor provides a cable only to a distribution board that serves a group of air-conditioning units, the mechanical contractor shall provide the distribution board, connect the incoming power cable and shall do all the electrical wiring from the distribution board to the condensing units and the indoor units.

In all instances the mechanical contractor shall provide isolators as required. All electrical and control cables shall be neatly strapped to the refrigeration piping or shall be mounted in a galvanised cable tray.

Where applicable, Section 1.3 (electrical) of this project specification shall also apply to this section of the specification.

The entire electrical installation shall comply with:

- SANS 10142-1-2003: The Wiring of Premises Part 1: Low-Voltage Installations

On completion, the Contractor shall issue a compliance certificate for the entire electrical installation.

Electrical and control cables mounted between indoor and outdoor units shall be installed without joints in the cable and shall be of the UV protected type.

4.5 CONTROLS

Controls shall be of the hard wired, wall mounted electronic type. Controls shall be of the same manufacture as the air-conditioner. Controls shall be mounted over a flush mounted 100 mm x 50 mm electrical box. Control wiring shall be installed in a 20 mm electrical conduit from the controller to the air conditioning unit. The conduit and outlet box shall be chased into the wall by the Electrical Contractor. Controls shall have the following minimum functionality:

- Manual ON/OFF
- ON/OFF by 24 hour / 7 day timer
- Room temperature display
- Room temperature adjustment
- Cooling / heating / ventilation selection
- Automatic change over between cooling and heating

4.6 REFRIGERANT CIRCUITS

Refrigerant piping shall be in accordance with the following standards:

- SABS 1453 : Copper Tubes for Medical Gas and Vacuum Services
- SABS 0147 : Refrigerating Systems including Plants associated with Air-Conditioning Systems

Fittings shall be copper based capillary solder fittings in accordance with SABS 1067.

All soldered joints on proprietary manufactured units shall be carefully checked and remade if found damaged in transit.

Pipe size selections shall be such as to produce moderately low velocities whilst, nevertheless:

- Ensuring proper oil return to the compressor and minimizing lubricating oil being trapped in the system.
- Ensuring practical lines without excessive pressure drops and with proper feed to evaporators.
- Preventing liquid refrigerant from entering the compressor during operation and at shutdown.

Refrigerant piping shall be sized and fitted with the necessary oil traps strictly in accordance with the unit manufacturer's requirements.

All refrigerant pipelines shall be insulated with the "Armaflex" type, lightweight, elastomeric nitrile rubber tube insulation. Insulation thickness shall be 13 mm.

Suction and liquid pipelines shall be insulated separately and joints on insulation shall be glued with the insulation manufacturer's recommended adhesive to create a vapour barrier.

The installation of trunking and trays shall form part of this mechanical contract.

5. INSTALLATION REQUIREMENTS

5.1 INSTALLATION OF INDOOR AND OUTDOOR UNITS

During installation, care shall be taken to ensure that no vibrations are carried over to structures to which the indoor and outdoor unit is fixed.

Outdoor condensing units shall be installed on wall mounted brackets and / or a concrete slab as indicated on the project drawings.

Where installed on wall mounted brackets, the condensing unit shall be securely bolted to the mounting bracket with adequately sized fasteners.

Where installed on a concrete slab, the condensing unit shall be fitted on top of neoprene vibration isolating pads and 450 mm square concrete paving slabs.

5.2 INSTALLATION OF CONDENSATE DRAIN PIPES

If an outdoor unit (heat pump type) is mounted against a wall more than 1 m above ground / floor level, the unit shall be fitted with an uPVC drain pipe neatly saddled to the wall. Drain pipe sizes for outdoor condensing units shall be to the supplier's specification.

Condensate drain pipes shall always run together with refrigerant pipes and shall always be installed in the same trunking and on the same cable trays for as far as the installation permits. Surface mounted drain piping shall only be allowed where condensate drain pipes run in a different direction to either a service duct, waste water pipe or any other location as indicated on the project drawings. Surface mounted drain piping shall be secured to the wall by means of galvanised steel saddles at no more than 1 m intervals.

The high / mid wall units shall be mounted on the inside of exterior walls and the mechanical contractor shall drill sufficiently sized holes through which refrigerant pipes, drain pipes and cable wires shall penetrate directly behind the indoor unit. Drain pipes running from the indoor unit through the wall shall be adequately sloped to ensure positive drainage.

All condensate pipes running from indoor units to waste water pipes, outlet gullies or open wastewater points shall be fitted with a u-trap at a location as indicated on the project drawings.

uPVC pipes shall be used for drain piping from indoor units. Drain pipe sizes for indoor units shall be ∅ 32 mm for all unit sizes.

The first 5m of drain piping shall be insulated with "Armaflex" type, lightweight, elastomeric nitrile rubber tube insulation. Insulation thickness shall be 13 mm.

Horizontal mounted drain pipes shall be installed at a slope of 20 mm per 1 000 mm, ensuring positive drainage.

Where drainage piping or control cabling is required to be installed flush-mounted, positioning and chasing shall be done in good time to meet construction programs. Drain pipes shall run and connect to waste water pipes as indicated on the project drawings. The connection between the drain pipe and waste water pipe shall be an airtight sealed connection that allows positive drainage of condensate.

Drain pipes shall run together with the refrigerant pipes to the outside unit where the condensate shall be drained.

All condensate pipes running from indoor units to wastewater pipes, outlet gullies or open waste water points shall be fitted with a U-trap at a location as indicated on the project drawings.

uPVC pipes shall be used for drain piping from indoor units. Drain pipe sizes for indoor units shall be ∅ 32 mm for all unit sizes.

The first 5m of drain piping shall be insulated with "Armaflex" type, lightweight, elastomeric nitrile rubber tube insulation. Insulation thickness shall be 13 mm.

In ceiling voids, drain pipes shall be installed in galvanized cable trays. Where drain piping does not run with refrigeration piping in the same cable trays, 76 mm galvanised "Cabstrut" light duty cable tray shall be used. Drain piping shall be fixed to the cable tray with suitably sized cable ties installed at 500 mm intervals.

Horizontal mounted drain pipes shall be installed at a slope of 20 mm per 1 000 mm, ensuring positive drainage.

Where drainage piping or control cabling is required to be installed flush mounted, positioning and chasing shall be done in good time to meet construction programs.

5.3 INSTALLATION OF REFRIGERANT PIPING

Refrigerant piping shall be arranged so that normal inspection and servicing of the compressor and other equipment is not hindered. Locations where copper tubing will be exposed to mechanical damage shall be avoided. Hangers and supports where piping goes through walls shall be installed to prevent transmission of vibration to the building.

Refrigerant piping in ceiling voids and mounted internally against walls shall be installed in 101 mm wide galvanised steel Cabstrut light duty cable trays (per unit). Pipes shall be strapped over insulation to cable trays at 500 mm intervals with suitably sized cable ties. Cable trays shall be 152 mm wide where drain pipes run together with refrigerant piping (per unit).

Externally mounted refrigeration pipes and drain pipes shall be mounted in Cabstrut P9000 cable trunking (127 mm x 76.2 mm). Cable trunking shall be complete with clip on covers. Pipes and cables shall be strapped together every 500 mm with suitably sized cable ties and loosely fitted in the trunking. The trunking shall be manufactured from galvanised steel and epoxy powder coated to a colour as specified by the Engineer.

Any insulation material not covered by the trunking and exposed to the elements shall be neatly strapped with cable ties to minimise the possibility of dirt and water entering between the insulation and refrigeration pipes.

AIR-CONDITIONING AND VENTILATION INSTALLATION

FOR

THULASIZWE CLINIC

PROJECT SPECIFICATION

SECTION 3 : VENTILATION SYSTEMS

1. SCOPE

The following installations shall be specified under this section of the project specification:

- Fresh Air Supply Systems : SAF-01
- Extraction Systems : EAF-01, 02 & 03

2. DESIGN CRITERIA

DESIGN DATA	
Outdoor Summer Temperatures	31°C Db/23°C Wb
Outdoor Winter Temperatures	2°C Db/1°C Wb
Indoor Conditions	23°C Db/60% RH
Altitude Above Sea Level	972 m

3. APPLICABLE STANDARDS

The air-conditioning units and installation in general shall be in accordance with:

- SANS 1424-1987 : Filters for use in Air-Conditioning and General Ventilation
- SANS 1238:2005 : Air-Conditioning Ductwork
- SANS 10173:2003 : The Installation, Testing and Balancing of Air-Conditioning Ductwork
- SANS 60335-2-80 : Household and Similar Electrical Appliances - Safety Part 2-80 : Particular Requirements for Fans
- SANS 10108 : The classification of hazardous locations and the selection of apparatus for use in such locations

4. VENTILATION FANS

4.1 GENERAL

The combination of fan and attenuators shall be such that the specified noise levels are achieved.

Where no pressure requirements are indicated, the Contractor shall estimate the fan static pressure requirements for the system lay-out and tender accordingly. Where filters are included in the system, the static pressure losses through filters shall be estimated at ***150*** Pa through each stage of filtration.

Ventilation and extraction fan duties as specified on the tender drawings shall be checked against the respective system's design resistance once all information on the selected system is available. Where fan duties are found inadequate, the contractor shall notify the Engineer before ordering the equipment.

Fans shall be selected to operate at or as close to maximum efficiency as possible.

Attenuators shall be mounted directly onto the fan casing with flexible connections between the ducts and attenuators.

Fans shall be fitted with the manufacturer's nameplates permanently fixed to the casing in a prominent position, clearly indicating manufacturer, model number, size, speed, maximum operating speed, maximum power absorbed and serial number.

Fan air in/outlets not connected to ducting or equipment shall be protected with easy removable safety wire mesh screens.

Indicating arrows for both direction of rotation and direction of airflow shall be provided on fan casings.

All fans shall be installed in accordance with the manufacturer's requirements and recommendations.

All fans shall be mounted on anti-vibration mountings or supported from anti-vibration hangers.

Bearings shall be of the ball or roller type and shall be quiet in operation. They shall be sized to give a long life (not less than 100 000 hours) at the loads imposed by the application.

Belt guards shall be arranged to permit lubrication and use of speed counters with the guards in position. Belt guards shall have adequate ventilation for belt cooling.

The construction and design of electrical apparatus for ventilation equipment in hazardous environments shall comply with the relevant SANS specification, e.g. SANS 10108. The electrical installation shall comply with SANS 60335-2-80: Household and similar electrical appliances – Safety Part 2-80 Particular requirements for fans.

4.2 IN-LINE MIXED FLOW FANS

In line mixed flow fans shall be suitable for duct installation as indicated on the project drawings for the relevant ventilation and/or extraction system(s). Mixed flow fans shall be manufactured from a self-extinguishing material, be IP54 protected and be equipped with fan motor overload protection.

Fans shall have compact overall dimensions with the overall diameter only slightly larger than the ventilation duct.

In-line mixed flow fans shall have two speed settings and shall be sized and selected so as to meet the required fan duty at the lower speed setting.

To minimise the transmission of vibration of fan noise, fans shall be resiliently mounted on rubber cushions or anti-vibration hanger rods.

Fan duties shall be as follows:

Fan Reference Number	Fan Duty (ℓ/s @ Pa)
SAF-01	15 ℓ/s @ 120 Pa Total
EAF-01	247 ℓ/s @ 80 Pa Total
EAF-02	419 ℓ/s @ 120 Pa Total
EAF-03	110 ℓ/s @ 80 Pa Total

5. DUCTING

5.1 GENERAL

Sheet metal ductwork shall be manufactured in accordance with SANS 1238, and installed balanced and tested as set out in SANS 10173. The installation and manufacture of ductwork shall strictly be in accordance with SANS standard specifications with specific attention given to the following:

- Changes in size and shape of ducting: refer to SANS 1238, Section 6.3.
- Access openings, doors and covers: refer to SANS 1238, Section 5.3.
- Sealant requirements: refer to SANS 1238, Section 5.6.
- External ducting insulation: refer to SANS 10173, Section 5.4.
- Material thickness and duct stiffening for low pressure ductwork: refer to SANS 1238, Section 6 for rectangular ductwork and SANS 1238, Section 7 for circular ductwork.
- Radius and square bends as well as turning vanes: refer to SANS 1238, Section 6.4.
- Unless the sheet-metal ductwork is inherently corrosion protected, all sheet-metal shall be protected against corrosion as outlined in SANS 1238, Section 8.

It shall be the responsibility of the installing contractor to ensure proper assembly and sealing of sheet-metal ductwork and insulation strictly in accordance with SANS specifications.

The air duct system shall be of the low pressure type and the ductwork shall be manufactured of galvanised mild steel with general material requirements as set in Section 5.1 and 5.2 of SANS 1238. The ductwork shall either be circular or rectangular in cross-section as indicated on the project drawings.

The first dimension given on the drawings for rectangular ductwork shall be read as the width on plan and the depth on section, and the second dimension shall be read as the depth on plan and the width on section.

The duct dimensions shown on the drawings are sheet metal dimensions. All final dimensions shall be checked on site, or verified by means of architect's working drawings and structural drawings, before the fabrication of the ducting.

Sealing membranes and adhesives for affixing insulation shall meet the indexes for surface spread of flame, heat contribution and smoke production as set out in Section 4 of SANS 1238.

The inner surfaces of ducting shall be smooth and no internal insulation shall be used.

Dampers, sound attenuators, duct splitters and turning vanes shall be installed where indicated on the drawings.

Flexible connections shall be provided between all fans, sound attenuators and ducting.

Flexible connections exposed to weather shall be provided with protecting galvanised sheet steel cover strips. The material used for flexible joints shall comply with the requirements as set out in SANS 1238, Section 5.5.

Ducting shall always be installed in such a way, that, especially in plant rooms, maximum height between the floor and the underside of ducting is achieved.

The installation and testing of hangers shall comply with the requirements as set out in SANS 10173. All hangers shall be treated against corrosion and shall be painted.

Reinforcement, duct stiffening and fastening accessories shall be galvanised and installed where required. Only duct accessories manufactured from compatible materials, which comply with SANS 10173, shall be installed with the ductwork. Tie rods shall be manufactured from galvanised steel. Rivets, screws, bolts and other fastening equipment shall be corrosion proof.

5.2 LONGITUDINAL SEAMS AND TRANSVERSE JOINTS

Pieces of ductwork shall be joined with the necessary sealants, as applicable, as set out in SANS 10173, Section 5.

5.1.1 Rectangular Ductwork

Longitudinal seams and transverse joints for rectangular ductwork shall be in accordance with SANS 1238, Section 6.

As an alternative to transverse joints specified in SANS 1238, other flanged joints such as MEZ-flanges will also be considered provided that they meet the SANS requirements.

MEZ-flanges or equivalent products shall be manufactured from cold rolled steel and hot-dip galvanised after manufacture.

5.1.2 Circular Ductwork

Longitudinal seams and transverse joints for circular ductwork shall be according to SANS 1238, Section 7.

THE HANGING AND SUPPORTING OF DUCTWORK

Hangers and supports for rectangular and circular ductwork with no insulation shall comply with SANS 10173, Section 5.3 “Ductwork with no vapour barrier”. The hanger and support types used for ducting with insulation may be used.

5.3 FLEXIBLE DUCTING

Flexible ducting shall comply with the requirements as set out in SANS 10173, Section 5.7. Flexible ducting shall be proprietary manufactured with a fire rating to SABS 0177 Part 3 Class 1. The flexible ducting shall have an adequate working pressure and temperature range to suit the application of the installation.

Flexible ducting shall at all times be kept to a length not exceeding 1.5m. Flexible ducting shall not have more than the equivalent of one 90° bend and bends shall be of maximum possible radius. Flexible ducting shall be supported with sufficient and correct brackets that will ensure maintenance of shape.

Flexible ducting shall be provided between air terminals, diffusers and all locations as indicated on the project drawings.

The inner core shall be of aluminium laminate with a heavy duty steel helix core.

5.4 TESTING OF DUCTWORK

All ducting shall be leak tested in accordance with SANS 10173, Section 4.3. No ducting shall have leakage rates in excess of 5% of the required air flow rate in any section of ductwork or in excess of the SANS permissible leakage rates, whichever is the smallest.

6. AIR TERMINALS AND DAMPERS

Where selected by the contractor, air diffusion equipment shall be selected in accordance with the manufacturer's recommendations, capable of passing the specified air quantity at the appropriate throw without creating excessive resistance, noise or local draughts. All air diffusing equipment shall be capable of meeting the NC level requirements, as specified in Section 1.2 - Sound Control, for the space environment where the equipment is installed.

In all instances where spigot boxes (plenums) are used for the connection of air diffusion equipment, the inside surfaces shall be painted black to prevent visibility of the internal surface from ground level.

During commissioning of the system, each grille, diffuser, valve etc. shall be set to deliver the specified air quantity. It is the Contractor's responsibility to check regenerated noise levels of grilles offered against the overall acoustic performance of the system required. Noisy grilles that exceed the NC level requirements of the given space shall be replaced at the Contractor's expense with more suitable types.

7. DOOR AND TRANSFER GRILLES

Transfer air grilles shall be complete with fixed curved blades and outer frame on both sides of the wall or partition. Transfer air grilles shall be of aluminium extruded type, naturally anodised or epoxy powder coated to a colour as specified by the Engineer. Openings in walls where transfer grilles are to be installed shall be provided by the Building Contractor.

Door air grilles shall be installed in wooden doors only. In cases where steel and glass doors are used, transfer grilles or transfer ducting as an alternative shall be installed. Door air grilles shall be of the chevron-blade type. Door air grilles shall be manufactured from extruded type 5OS anodised aluminium, naturally anodised or epoxy powder coated to a colour as specified by the engineer.

Transfer ducting shall comprise of galvanised sheet metal ducting and aluminium curved blade intake and outlet transfer grilles. Flexible ducting shall not be used as transfer ducting.

8. WEATHER LOUVRES

Weather louvres shall be manufactured of extruded aluminium sections and finished in a colour as approved by the Engineer. Louvres shall be of the Europair type WL or other approved.

Weather louvres shall be constructed with drip edges to blades and rigid frames to enable building in.

Weather louvres shall be watertight and shall prevent the entrainment of raindrops at a face velocity of up to 3 m/s.

Galvanized expanded metal or wire mesh screens with 12 mm opening sizes shall be fitted behind the blades of each weather louvre.

Top and bottom blades shall be fitted flush with the frame and be smooth without grooves, channels or recess where dirt or water can collect.

The free area through the louvre available for airflow shall be a minimum of 65 % of the nominal area of the louvre.

9. FIXING OF WALL-MOUNTED GRILLES AND LOUVRES

All wall-mounted grilles and louvers shall be fixed to a hard wood frame. The timber frames shall be supplied with the grilles as part of this installation.

The timber frames shall be manufactured in such a way that the grilles fit into them and such that the flanges of the grilles extend past the outer edge of the frames by approximately 5 mm. The timber frames shall be provided with the necessary cleats with which to mount them in brick or concrete walls. The depth of the timber frames shall be similar to the walls in which they are fitted.

The frames shall be supplied to the builder in good time so that they can be built into the walls. Should the mechanical contractor fail to do this, the frames shall be let into the walls afterwards and all builder's work, making good and painting shall be for the account of the mechanical contractor.

10. SUPPLY AIR DIFFUSERS AND GRILLES

Where Europair type SD or DD grilles are specified on the project drawings, the supply air grilles shall be manufactured of extruded type 5OS anodising grade aluminium and shall be provided with opposed blade volume control dampers, unless specified otherwise on the project drawings. Volume control dampers fitted with supply air grilles shall conform to SANS 1238, Section 6.5 requirements. The blades shall be adjustable from the front of the grille.

Where Europair type CD Ceiling diffusers are specified on the project drawings, diffusers shall be manufactured from extruded type 5OS aluminium, naturally anodised or epoxy powder coated to a colour as specified by the engineer. Europair type CD Ceiling diffusers shall be complete with an opposed blade damper, plenum box with spigot and ceiling plate. CD type diffusers shall have a standard flat frame with blade spacing and distribution pattern as indicated on the standard drawings.

Where Europair type FGR diffusers are specified on the project drawings, diffusers shall be manufactured from Fibre Glass Matt and approved SABS Fire Retardant resin painted to a colour as approved by the engineer. The face plate shall be adjustable for air balancing

Where Europair type CVD and CCVD diffusers are specified on the project drawings, diffusers shall be manufactured from steel and powder coated to a colour as specified by the engineer. Diffusers shall be equipped with a locking bracket to lock the adjustable radial disc once the system has been balanced.

Diffusers shall be installed at the locations where indicated on the project drawings. The Contractor shall install insulated flexible ducting of length not exceeding 1.5m and of the same diameter as the diffuser, extending from the supply duct to the diffuser. Spigots shall be attached to the ducting and sealed with silicon sealer around the outer perimeter of the joint. Flexible ducting shall be strapped to the diffuser and spigots with steel straps to form an airtight connection.

Alternatively, where indicated on the project drawings, diffusers shall be “hard” connected to ducting with rivets or taper screws and sealed with silicone sealer to form an airtight connection. All diffusers shall be capable of meeting the discharge pattern and throw requirement as set out on the project drawings.

11. EXHAUST DISC VALVES

Disc valves shall be supplied and installed in the ceilings of the ablution areas and connected to the extract ducts by means of sheet metal spigots and flexible ducting.

The disc valves shall consist of a ring and central disc, which when rotated shall adjust the volume through the outlet. During commissioning of the system, each disc valve shall be set to exhaust the specified air quantity.

Disc valves in ceilings shall be of the polypropylene type, in a finish to match the ceiling colour. The valves shall be of the Europair DVK type or other approved.

12. VOLUME CONTROL DAMPERS

Volume control dampers shall be installed in branch ducting to ensure a balanced air flow to all duct sections.

Damper blades, links and damper frames shall be of rigid construction and manufactured from galvanised steel. Dampers shall comply with SANS 1238.

Dampers for positive volume control purposes shall be manual or electric actuator driven as specified. Dampers shall be of the link or gear type.

A manually adjustable damper shall be fitted with an external adjusting lever in an accessible position. The lever shall be mounted on a square shaft and fitted with a locking mechanism that clearly indicates the current position of the blade. "OPEN", "CLOSED" and "OPERATING POSITION" shall also be clearly marked on each damper.

The inside cross-sectional area of the damper shall be equal to that of the connecting ductwork, and shall conform to the same standards of air-tightness as the rest of the ductwork system. The damper shall be fitted to the ducting in which it is installed by means of a flanged connection.

Dampers creating unacceptable vibrations and noise levels will be rejected and will need to be replaced at the Contractor's expense.

Multi-vane control dampers shall be of the opposed blade type.

13. FIRE DAMPERS

Fire dampers shall be installed where indicated on the drawings.

Fire/smoke control dampers shall comply with SABS 193 as amended and shall be SABS marked with proven low leakage in the closed position.

Fire dampers shall be flanged both sides, and an access panel shall be provided in ducting at each fire damper, preferably on the upstream side of the damper.

Fire damper markings shall be as follows:

a) Manufacturer's name or trade name or trade mark.

b) Fire resistance rating, in hours.

c) Vital instructions regarding installation, direction of airflow, mounting position.

The open or closed status of the damper shall be clearly indicated outside the casing for inspection purposes.

Fire dampers shall have at least a 2 hour resistance rating when tested in accordance with SABS 193.

Fire dampers shall be fusible link operated.

Labels shall be installed on the ceiling grid below all fire dampers indicated their positions, and reading: "Fire damper above".

Dampers shall be sized so that the nominal free air area when in the open position is not less that the connected duct free air area.

Fire dampers shall be installed according to the manufacturer's and SABS requirements and recommendations.

Fire dampers shall be installed as to form part of a continuous barrier to passage of fire when in a closed position.

Where a fire damper cannot be fitted immediately adjacent to the fire wall, the section of ducting between the damper and the wall shall be of at least the same metal thickness and fire rating as the damper casing.

Dampers shall be self-supporting in case of duct destruction due to heat. Care shall be exercised that the supporting frame be installed so that the closing device is accessible.

Sheet metal sleeves shall be provided for housing the fire dampers where fire dampers are mounted in walls.

These sleeves shall be built into the walls by the building contractor. Retaining angles shall be installed on the four sides of the fire damper sleeve on both sides of the wall.

The angles shall be fastened to the sleeves only, and not to the wall. The retaining angles shall lap the masonry by a minimum of 25 mm around the entire opening.

Recommended minimum angle sizes are:

Largest dimension of fire damper	Angles
Up to 1 200 mm	38 x 38 x 3,2 mm
1 200 mm to 1 800 mm	44 x 44 x 2 mm
Over 1 800 mm	51 x 51 x 4,8 mm

Clearance shall be provided between the sleeve and the masonry opening on the top and at the sides of the fire damper to allow for expansion. Allow a gap of 1 mm for each 100 mm of sleeve width or depth, but the gap shall not exceed 15 mm.

All fixing and installation materials, i.e. bolts and nuts, rawl-bolts and mortar works shall be as per fire damper manufacturer's specification and shall not affect the fire rating of the fire damper installation. Combustible materials such as plastic or similar rawl-bolts and plugs are not permitted.

14. AIR FILTERS

14.1 GENERAL

Air filters of the make, type and size as specified on the drawings shall be installed.

Filters installed close to exposed air inlets, shall be protected by means of weather louvres and wire mesh screens.

Filter holding frames shall be of approved manufacturer with standardized dimensions to enable replacement with equivalent filters of all recognized manufacturers.

Construction and manufacture of all components shall be such that under no circumstances any un-filtered air can by-pass filters or filter banks.

Sufficient space shall be allowed in front or behind filters, to enable inspection and servicing.

14.2 FILTER MEDIA

Washable filter media shall be fitted behind hinged return air grilles where indicated on the project drawings.

The filter media shall be of the Peter McLeod PM 100 type, 100 grams / m² density and 5 mm thick.

The filter media shall be of the synthetic type and shall be capable of arresting lint of the return air. The filter media shall fit and extend past the outer perimeter of the wire mesh in the return air grille such that the bypass of unfiltered air is avoided.

The filter media shall be fire proof. Glass fibre filter media type shall not be acceptable

15. PRIMARY PLEATED FILTER

Primary filters shall be of the 50 mm pleated washable panel type and of the Peter McLeod Manufacture. The media shall be synthetic and shall be of the self-supporting type. The media shall fit into and extend to seal all round in the panel frame to ensure that no air bypasses the media. The filter outer panel frame shall be of galvanised steel.

All filter accessories including the channel filter holding frames and clips shall be standard products of the filter manufacturer. Filter holding frames shall be manufactured from galvanised steel. Filter holding frames shall be bolted or riveted together, where necessary, and shall be suitably reinforced in larger arrangements to withstand all possible operating conditions.

An airtight seal shall be provided where filter holding frames are joined together. All metal parts shall be sufficiently protected against corrosion.

Primary filter panels shall fit into channel holding frames with sealing gaskets located between filter panel and channel holding frame. Where the channel holding frames are located on the downstream side of the filter, at least two spring loaded clips shall be used to ensure a positive seal against the edge gaskets and to keep filter panel in place.

Where the channel holding frames are located at the upstream side of the filter, at least four spring loaded clips shall be used. All clips shall be from stainless steel.

The primary filter shall be of filtration class G3 have an average ASHRAE arrestance of 90 %, SABS tested. The dust holding capacity shall not be less than 150 g per square meter. The initial (clean) and final (dirty) resistance of the filter shall be 65 Pa and 250 Pa respectively.

The above-mentioned features shall be based on a rated face velocity of 2.5 m/s.

16. ELECTRICAL

The electrical contractor shall provide a weatherproof isolator within 1m from the ventilation fans. The mechanical contractor shall do the entire electrical installation from the isolator to the fans.

Where ventilation fans are required to be interlocked with air conditioning units, the mechanical contractor shall provide a control DB-board as indicated on the project drawings. The electrical contractor shall do all wiring to the control DB-board. The DB-board shall be complete with all switching and safety equipment as specified in Section 1.3, Electrical. The mechanical contractor shall do the entire electrical installation from control DB–board to the corresponding AC units and ventilation fans.

17. CONTROL

Generally, ventilation fans shall be supplied with a 24 hour, 7 day timer or shall be switched on/off with the light switch, whichever the case; the mechanical contractor shall be responsible for the supply and wiring of the necessary equipment.

Where fans are required to be interlocked with air conditioning units, the mechanical contractor shall provide the control DB with the necessary relays and control equipment. The ventilation fan shall switch on and off with the corresponding air conditioning unit. The control panel shall be labelled as indicated on the project drawing.