

ELECTRICAL & MECHANICAL SPECIFICATION

Volume 2 of 3: 2nd Part F

MECHANICAL SPECIFICATIONS

NEWCASTLE SAPS

REPAIRS & RENOVATIONS TO DECENTRALISED TRAINING FACILITY

AIR CONDITIONING AND VENTILATION

SUPPLEMENTARY TECHNICAL SPECIFICATION

1. GENERAL

This specification consisting of 37 pages numbered consecutively is for the supply, delivery and installation of Air Conditioning and Ventilation Installations and is to read as forming part of the Department of Public Works Standard Specification for Air Conditioning and Ventilation Installations, Issue XI, 1998. The clauses referred to herein are clauses of the Standard Specification, relevant clauses not specifically mentioned shall also apply.

All equipment and installations detailed in this specification shall comply with the requirements of the Occupational Health and Safety Act 85 of 1993.

The Department's Standard Specification for Electrical Installations and Electrical Equipment pertaining to Mechanical Services, Issue IXa, December 1999, shall also apply to this contract.

Where conditions are at variance, this supplementary specification will have preference over both Standard Specifications and drawings.

Copies of the Standard specifications are obtainable from the Director-General: Public Works, Private Bag X 65, Pretoria, 0001. All Standard Specifications are also available on the Department's Website [www.publicworks.gov.za].

2. CONTRACT PRICE ADJUSTMENT AND VALUE ADDED TAX

The contract sum will be adjusted in accordance with the **Contract Price Adjustment Provisions** (CPAP) as set out in the CPAP Manual and Reference guide as prepared by the Joint Building Contracts Committee (JBCC) series 2000, Code 2105, dated May 1998 and any amendments thereto.

For the purposes of contract price adjustments for this Contract, work group 170 will be used and the index to be used will be that excluding Value Added Tax.

The following items of equipment shall be priced separately and adjusted on the basis of net cost in terms of clause 3.4.3 to 3.4.5 of the aforementioned document.

- (a) Air-conditioning units.
- (b) Ventilation fans

3. COMPREHENSIVE CONTRACTS

Only specialist sub-contractors who have previously successfully completed mechanical installations of the extent and type specified in this document should be considered.

NOTE: *No changes in make, type or capacity of equipment specified in the schedule of particulars shall be allowed after acceptance of the tender without the written approval of the Department.*

4. **FINAL DELIVERY**

Final delivery shall be as prescribed in clause 1.2 of PW 379.

5. **PERIOD OF LIABILITY**

The period of liability shall be as prescribed in clause 2.1 of PW 379.

6. **MATERIAL AND WORKMANSHIP**

All materials and equipment used shall be new, free from rust, defects, undamaged and be suitable for the purpose for which it will be used. Materials shall comply with the latest issue of the relevant SANS or BS specification where applicable.

If any material or workmanship is not to the satisfaction of the Department, it shall be rectified and/or replaced at the contractor's cost and all rejected material shall immediately be removed from site.

The contractor is responsible for the correct and complete erection of the installation and inspections executed by the Department do not exempt the contractor of this obligation.

7. **MANUFACTURER'S RATINGS**

All equipment shall be able to work within the rated capacity, as determined by the manufacturer. Any equipment offered for use out of these limits will not be considered.

Contractors shall hand in the rated capacities of all equipment as well as descriptive literature with the tender documents.

8. **ALTERNATIVE OFFERS**

The tenderer is advised to offer the installation strictly in accordance with this specification, and if he so desires, he can submit an alternative for any possible deviation.

No tender will be disqualified or not be considered for acceptance on an equal basis with all other tenders solely on the basis of the inclusion of proprietary items which are not specifically mentioned in the tender documents, standard specifications etc. pertaining to this tender, as being acceptable, or in any other context.

Tenderers are to note that for tenders to qualify for acceptance, the properties of the equipment offered must comply with the requirements described in the technical specification and/or standard specifications etc. pertaining to this tender. The suitability of any equipment offered in a tender offer will be judged solely on its quality and performance as specified. Tenderers must, therefore furnish sufficient information to be able to determine the effectiveness, efficiency, durability and other qualities in terms of the specified qualities.

This tender is based on a system designed for the purpose stated in the scope of contract, to perform to specific criteria under specific conditions and to conform to parameters which relates to the effectiveness, efficiency, durability etc. This is to be the final basis of consideration of tenders for acceptability.

Tenderers who are confident that a suitable system, which complies to or exceeds the effectiveness, efficiency, durability and other properties in terms of the specified qualities, are invited to offer such alternative designs. It is, however stressed that the full responsibility rests with the tenderer to amply substantiate, to the satisfaction of the State Tender Board, that the alternative offered will in no way be inferior to the system specified and that initial capital lay-out as well as maintenance and operating cost will not be affected to the disadvantage of the State.

Alternative offers must be accompanied by full details, such as drawings and pamphlets and also a separate Schedule of Prices.

9. **SIMILAR OR EQUAL**

Any trade name mentioned merely serves as a guideline and does not indicate preference for that specific make. Tenderers are at liberty to offer any other equipment and/or materials, which complies with the specification requirements.

10. **DRAWINGS**

The drawings that accompany this specification (if any) are schematic and do not necessarily indicate the exact position, size or detail the construction of equipment. Tenderers must satisfy themselves that the equipment offered by them will fit into the available space and can be positioned so that access for maintenance, repair or removal is not encumbered.

NOTE: **All final dimensions are to be verified on site prior to any equipment or material being ordered or manufactured.**

11. **BUILDERS WORK**

All building work such as cutting of openings, making good, bases for equipment, etc. shall be included for in this tender and tenderers must allow for it in their tender price.

12. **PAINTING**

All exposed steel surfaces, excluding new galvanized and stainless steel shall be painted. All steel surfaces to be painted shall be prepared according to SABS 064 (Code for the preparation of steel surfaces for painting). Thereafter the surfaces shall be painted with a zinc chromate primer to SABS 679 type 1, followed by one coat of universal undercoat and one final coat of high gloss enamel paint to SABS 630 Grade 1, the colour of which shall be determined by the Department's Representative.

13. **TESTING AND COMMISSIONING**

The Contractor shall test the installation as a whole in accordance with clause 1.18 of the Particular Specification. The commissioning of the installation shall be in accordance with clause 1.14 of the Particular Specification.

14. **OPERATING AND MAINTENANCE MANUAL**

The Contractor shall prepare and supply comprehensive manuals for the successful operation and maintenance of the installation. A draft of the manual shall be submitted to the Engineer after commissioning, for approval. The draft shall then be corrected, if required, and THREE (3) Hard copy and TWO (2) Electronic sets of the manual shall be submitted before first delivery of the plant will be considered.

Manuals shall be prepared in the same language as the contract document. These manuals shall be bound in hard file covers with clear titles and indices and shall contain the following information as a minimum, in the sections indicated:

Section I : System description

A comprehensive description of the system, including schematic diagrams.

Section II : Commissioning data

The results of all checks and measurements as recorded during the commissioning period, shall be compiled in such a manner that every check and measurement is clearly defined.

Section III : Operating instructions

1. Plant running check list and frequency of servicing
2. Safety precautions to be taken.
3. Manual and automatic operation.
4. Operator's duties.
5. Lubricating oils and service instructions.
6. Pre-start checklist for each system.

Starting and stopping procedures.

Section IV : Mechanical equipment

1. Description of all major items of equipment with the make, model number, names, addresses and telephone numbers of the supplier, manufacturer of their agents.
2. Design capacities of all equipment including selection parameters, selection curves, capacity tables, etc.
3. Manufacturer's brochures and pamphlets.
4. Schedule of spares with part numbers recommended to be held in stock by the Department.

Section V : Maintenance instructions

1. Schedule of maintenance particulars, frequency of service and replacements.
2. Troubleshooting guide.
3. Part number of all replacements items and spares.
4. Capacity curves of pumps, fans and compressors.
5. Serial number of main items of equipment.

Section VI : Electrical equipment

1. Schedule of equipment indicating manufacturer, type, model number, capacity and address and telephone number of suppliers.

2. Maintenance instructions.
3. Manufacturer's brochures and pamphlets.
4. Complete "as built" circuit diagrams and diagrammatic representation of interconnections of electrical equipment.
5. Compliance Certificate for Electrical Installation.

Section VII : Instrumentation and control

1. Description of each control system.
2. Schedule of control equipment indicating make, type, model number, rating, capacity and name, address and telephone number of supplier.
3. Maintenance instructions.
4. Manufacturer's brochures and pamphlets.

Section VIII : Drawings

1. Paper prints (reduced if so desired) of all "as built" mechanical and electrical Contractor's drawings shall be submitted.
2. Wiring diagrams, framed behind glass shall be mounted adjacent to each relevant control panel.
3. All Manuals, drawings and wiring diagrams to be submitted in electronic format as well:
2 Sets

15. **SCOPE OF WORK**

This specification is for the inspection, repair, servicing, removal of redundant equipment, supply, delivery, erection and commissioning of the following:

- (a) Six (6) separate air conditioning installations, (zones) comprising variable refrigerant (VRV/VRF) heat recovery systems incorporating centralised air cooled outdoor units coupled to individual indoor units of appropriate configuration to suit the occupied space, that regulate the air temperature required within the individual office, either heating or cooling simultaneously according to demand. All units shall be provided complete with hard wired remote controllers. All drains shall be provided as part of this Contract. All electrics, controls to make all the above systems operate correctly.
- (b) Miscellaneous supply and extract ventilation systems.
- (c) Unitary air conditioning to the Server Rooms with 100% backup.
- (d) Dehumidifier units to the Fire Arms and Ammunition Strong Rooms.

All air-conditioning and ventilation installations shall be complete with electrical connections and controls. The Contractor shall provide and complete all the installations according to the Particular Specification as minimum requirements, this Project Specification and according to the drawings.

The following drawings form part of this specification and shall be read in conjunction with the other specifications:

DRAWING NO.	DESCRIPTION
300246 NM-AC1	M304147 AC1 Ground Floor Airconditioning & Ventilation Layout
300246 NM-AC1	M304147 AC1 Floor Plans 1 st – 3rd Airconditioning & Ventilation Layout

16. **DESIGN CONDITIONS**

The design conditions for Newcastle are as follows:

AMBIENT

Summer 35° C db / 22.0° C db

Winter 1.6° C db

INSIDE

Summer

All Areas 22° C db

Winter

All wards 22° C db

No humidity control necessary.

17. **VARIABLE REFRIGERANT HEAT RECOVERY AIR CONDITIONERS**

Supply and install two (2) variable Refrigerant Volume Heat Recovery air-conditioning systems consisting of a multiple outdoor units, and twenty seven (27) indoor units, with cooling capacities shown, and reverse cycle heating in the positions as indicated on the drawing. These systems and all pertaining equipment must operate using 410A refrigerant.

The evaporating units and heat recovery or BS controller units shall be suitable for a single phase, 220V, 50Hz, AC power supply. The condensing units shall be suitable for three phase, 380V, 50Hz, AC power supply.

The Condensing units shall be matched to the indoor units and shall be installed on a concrete plinth on the ground floor as indicated on the drawings.

18. **OUTDOOR UNITS**

The outdoor units shall be a factory-assembled unit tested, and charged with refrigerant, housed in a sturdy weatherproof casing constructed from rustproof mild steel panels coated with a baked enamel finish.

The outdoor units shall make use of inverter scroll hermetic compressor(s) and salt resistant cross fins and copper heat exchanger.

The connectable range of indoor units shall be from, 2.3kW to 12.0kW cooling capacities, with outdoor units.

The outdoor units shall not produce more than 61 dB(A) when noise levels are measured in an anechoic room.

The outdoor unit shall be modular in design and therefore allowing side-by-side installation.

Compressor

The compressor shall be of highly efficient hermetic scroll type and equipped with inverter control capable of changing speed in accordance to the cooling or heating load requirement.

The outdoor unit shall have multi-step capacity control to meet load fluctuation and indoor unit individual control.

Fans

Condenser fans shall be propeller type with inverter controlled and directly driven by electric motor.

Heat Exchanger

The heat exchanger shall be constructed with copper tubes mechanically bonded to copper fins to form a cross fin coil. The copper fins shall be covered by anti-corrosion resin film.

Refrigerant Circuit

The refrigerant circuit shall include liquid and gas shut off valves and a solenoid valves.

All necessary safety devices shall be provided to ensure the safety operation of the system.

Safety Devices

The following safety device shall be part of the outdoor unit:

- High power switch
- Overload relay
- Inverter Overload Protector
- Fusible Plugs
- Over-Heat Protection

19. **INDOOR UNITS**

Each indoor unit shall be of the "Round Flow Cassette" type. They shall have an electronic control valve which controls refrigerant flow rate in response to load variation of the room. The fan shall be of the dual suction multi blade type and statically and dynamically balanced to ensure low noise and vibration free operation.

The address of the indoor unit shall be set automatically in case of individual and group control. In case of centralized control, the liquid crystal display remote controller shall set the address.

Refrigerant Piping

The interconnecting refrigerant tubing between the condenser unit and the evaporating units shall be of the best quality seamless, dehydrated, deoxidised refrigerant class copper tubing manufactured according to ASTM B 280-88; ASTM B 743-88, and suitably sized for the unit installed and for system pressure. Pipe sizes are indicated on drawings, these must be confirmed with the Engineer before ordering.

All copper piping joints shall be done as stipulated in the equipment manufactures specifications. All fittings shall be of copper or brass, refrigeration quality brazing. Soft soldered fittings or joints will not be acceptable. Before brazing refrigerant piping, nitrogen gas has to be passed through the piping to expel air from the piping. The correct nozzle tip has to be selected when brazing a certain size of refrigerant piping, as according to equipment manufactures specifications.

Copper pipe splits, which are required before each evaporating unit, may only be achieved by using OEM's pre-manufactured Refnet joint, as stipulated in the manufactures specifications. No other method shall be used.

Copper piping that is to be housed in the ceiling shall be supported by a cable tray, opposed from suspended from roof trusses.

The end of each piece of copper piping must be covered. "Pinching" is the most effective method and there for must be used, however "taping" is a simple method, which may be used during the term of site works.

The suction and liquid lines shall be completely insulated against ambient temperatures to prevent condensation drip by using good quality insulation such as "Thermoflex", "Primaflex" or other approved. The non-drip tape type of pipe insulation will not be acceptable. All joints are to be sealed with "Lasso tape".

The tubing shall be neatly saddled throughout the entire pipe run using copper saddles spaced at intervals of not more than one metre apart.

The copper saddles shall be of the same diameter of the insulation so as not to squeeze the insulation to the piping and minimising the effective cross sectional area of insulation.

Kinked or flattened copper tubing is to be discarded, as it is not acceptable. Any length of tubing, which is damaged in this manner, shall have that section cut out of the length and suitably re-joined.

The pipe runs shall be neat and the best quality workmanship shall be employed.

Care shall be taken to ensure proper oil return to the compressor. The copper tubing shall be connected to the condensing unit and the air-handling unit by means of quick-coupler type connections fitted with "schrader" valves for testing, purging and recharging

Condensate

Condensate drain piping shall be of Poly Cop and shall be connected into the drained system supplied by the Civil Contractor.

The condensate piping shall be run at a gradient of 10 mm in 1000 mm and be neatly saddled throughout the entire pipe run using plastic saddles spaced at intervals of not more than one metre.

Condensate drain piping should be sized strictly according manufacture's specifications.

Commissioning

Unit Supplier/Manufacture of condensers and evaporators must do commissioning of Variable Refrigerant Systems.

The Contractor shall notify the Engineer in writing at least seven working days prior to the test.

The Engineer will certify acceptance of all tests. Such certification does not in any way alter the responsibilities of the Contractor under this contract.

An indoor unit shall be supplied and installed by the Contractor in the office indicated on the drawing. The quoted value for the unit is the minimum required cooling capacity thus the unit on offer shall be capable of cooling capacity greater or equal to that on the drawing. The unit shall have reverse cycle heating and of capacity of at least 70% of the cooling capacity.

21. DESCRIPTION

All equipment on offer shall be new, undamaged, free of rust or other defects, with capacities indicated on the drawings, and shall be of the best quality. Materials shall comply to the relevant SANS of BS specifications where applicable. The Contractor shall upon the request of the Engineer, furnish him with documentary proof to his satisfaction that the equipment is of the quality specified.

Spares and other servicing material shall be readily available in stocks within South Africa. Clause 2 of the Particular specification shall serve as the prerequisite of the equipment on offer.

- (a) The indoor Air Conditioning unit's Components shall be treated with an antibacterial formula in order to keep the unit clean, block development of odors, prevent proliferation of fungi and bacteria inside the unit and to prolong the unit's life span. For a rust-free lifetime all components shall include an antirust coating. The front panel shall be detachable and washable grille in order to facilitate cleaning with water.
- (b) The cabinet, encasing outdoor unit's components, shall be fabricated from engineering plastic material to avoid rusting. All encased metal components shall

be coated with anti-rust materials to prevent rust and to increase their durability and life span.

- (c) The Scroll Compressor shall be quiet and efficient in operation. It shall be mounted on anti-vibration rubber bases to cut out annoying noises and be noise insulated.
- (d) Allow for adequate refrigerant charge relative to refrigerant piping lengths and as recommended by the manufacturer. The refrigerant must not be subject to a phasing out program under the Montreal Protocol.
- (e) The units shall cleanse the air stream through the indoor unit along three stages. Firstly, coarse particles such as dust must be removed from the intake stream. Secondly, minute or finer particles such as micro-organisms must be prevented from passing. Lastly, air shall be further cleansed and deodorized before entering the heat exchanger.
- (f) All air Filters shall be easily removable to facilitate cleaning and treated with an antibacterial agent in order to catch small dust particles in the air, micro-organisms and deodorize the air.
- (g) Remote Controls are to be mounted as shown on the drawings 1500 mm above the floor level. They are preferably to be flush mounted in the wall and wired to the air-handling sections with the interconnecting control wire ran in suitable sleeves chased into the wall.
- (h) All exposed condensate drain pipes from the air handling, condensing sections, and BS Boxes shall be of Poly Cop only, set to falls and sized to suit the drain connections, however, no smaller than 22 mm diameter for cleaning purposes. To avoid dripping all drain lines shall be of lengths such that they drain at ground level, or nearest approved drain points, and shall be painted to match outside walls.
- (i) All drain pipes, from ducted units, shall be clamped onto the cassettes and the connection shall be sealed. All drain piping shall be set to a gradient of 3:100 or more. Allow for hangers at a pitch of approximately 1.2m in order to ensure precise drain pipe gradients

In case of grouped drain pipes from multiple units the piping shall be faced downwards when joining into the main drain pipe

22. INSTALLATION

The exact positions of the units shall be coordinated with the Architect and Engineer. The installation as a whole shall be erected in a workmanlike manner, to the satisfaction of the Engineer, and shall include all materials to complete the installation as specified.

- (a) All mid-wall indoor units shall be securely fixed to the walls at high level, in the positions indicated with loose bolt type "Rawl" bolts. Ducted indoor units shall be suspended, for their brackets, using threaded rods affixed onto the roof structure. Include anti-vibration material in between a nut and the ducted unit additional supports may be required due to the wide distance between trusses.
- (b) Outdoor units shall be mounted on painted brackets, bolted onto plinths using rawl bolts, such that they are 200mm away from walls at the positions indicated on the drawings. The exact positions of the outdoor units and the final colour of mounting brackets must be approved by the Architect and the exact dimensions of plinths to be confirmed on site and in conjunction with units on offer.

- (c) Interconnecting refrigerant piping and cables shall be run together in the same trunking above the ceiling, through the external wall to the condensing sections. All piping shall be appropriately insulated and supported off the roof structure on suitable supports. All refrigeration piping lengths shall not exceed manufacturer-recommended lengths. The Contractor shall ensure that there is no dirt or moisture within the refrigerant piping and that all connections are air tight to avoid refrigerant leakage.
- (d) The units shall be wired directly into the air-conditioner isolators provided adjacent to the unit's outdoor units. The power cables between the isolator and the air-conditioning unit shall be run in suitably sized "Ega" tube mini trunking, screwed and glued to the wall. The electric cables between outdoor and indoor units to run in the same cable tray as the refrigeration piping. The Contractor shall provide and do all of the electrical wiring.

23. OPERATION

A Computerized Control shall control several functions to improve reliability such as freeze up protection, detecting thermistor abnormalities, filter clean reminder, self-diagnosis, dehumidification and automatic cool/heat change over switch.

When the automatic operation mode button is pressed, the optimum mode (cooling, heating, soft dry) and optimum fan speed is to be selected according to the input from the intake-air sensor. This selection shall also be able to be performed manually.

The airflow direction louvers shall swing automatically or be adjustable manually. The louvers shall automatically shut down when the unit is switched off to maintain the neat appearance. The unit shall incorporate a specially treated slide-in slide-out filter to prevent build-up of mould.

Computerized PID control shall be used to maintain a correct room temperature. Units shall be equipped with a self-diagnosis for easy and quick maintenance and service. The LCD (Liquid Crystal Display) remote controller shall memorize the latest malfunction code for easy maintenance. The air-conditioning evaporating units shall be fitted with the following controls:

- i) A main on/off switch to control the unit.
- ii) An adjustable cooling thermostat to control room temperature as required.
- iii) A variable fan speed control switch.
- iv) An automatic de-ice thermostat is to be fitted to the condensing section of all units.
- v) A manual/re-set type no volt relay shall be fitted to all units.

In automatic mode the optimum mode (cooling or heating) and optimum fan speed is to be selected according to the input from the intake air-sensor. This selection shall also be able to be performed manually.

The remote controls are to be mounted adjacent to the units 1500mm above floor level and screwed to and including plugs in the wall. The remote controls are to be wired to the air-handling sections with the interconnecting control wire run in "Ega" tube mini trunking. A loose controller is not acceptable.

When the automatic operation mode button is pressed, the optimum mode (cooling, heating, soft dry) and optimum fan speed is to be selected according to the input from the Intake-air sensor. This selection shall also be able to be performed manually.

The airflow direction louvers shall swing automatically or be adjustable manually. The louvers shall automatically shut down when the unit is switched off to maintain a neat appearance.

24. System Remote Controller

This shall control several functions to improve reliability such as freeze-up protection, detecting thermostat abnormalities, filter clean reminder, self-diagnosis, dehumidification and automatic cool/heat change over switch. A multi-functional centralized controller (central remote controller) shall be supplied and installed for each system.

It shall be able to control up to 50 indoor units with the following functions.

- a) Temperature setting for each zone, or group, or indoor unit.
- b) On/off as a zone or individual unit.
- c) Indication of operating condition.
- d) Select one of 10 operation modes for each zone.
- e) The controller shall have wide screen liquid crystal display and can be wired by non-polar 2-wire transmission cable to a distance of 1km away from the indoor unit.

Schedule Timer

A schedule timer shall be supplied and installed for each system.

It shall be able to set operation schedule of up to 50 indoor units.

The operation schedule shall include twice on/off a day and holiday.

It shall be able to set 8 pattern of schedule combined with centralized controller

25. DUCTING

Ducting shall be manufactured according to SANS 1238 and installed, tested and commissioned according to SANS 10173.

Ducting to all systems shall be manufactured from galvanised mild steel and shall be flanged with mezz flanges.

Manually adjustable volume control dampers shall be installed where indicated on the drawings.

Fire dampers of the Curtain type with fusible/bimetallic link similar or other approved to Europair Fireblock 5500 Type C shall be installed where indicated on the drawings.

All supply and return air ducting shall be insulated externally. Internal insulation shall not be acceptable.

Ducting mounted externally shall be insulated, clad with galvanised sheet metal and weather sealed.

Insulation shall be in accordance with SANS 10173 code of practice for the installation, testing and balancing of air conditioning ductwork. The following insulation shall be installed:

- Internally mounted ductwork: Europair External duct wrap 25mm thick with a minimum density of 25kg/m³ or similar or other approved.

Externally mounted ductwork: External 40mm thick polystyrene with a minimum of 48kg/m³ wrapped in Ventureclad or similar or other approved.

26. INSTALLATION : SPLIT TYPE AIR-CONDITIONING UNITS

The exact positions of the units shall be as per the drawings. The installation as a whole shall be erected in a workmanlike manner, to the satisfaction of the Engineer, and shall include all materials to complete the installation as specified.

- (a) All mid-wall indoor units shall be securely fixed to the walls at high level, in the positions indicated with loose bolt type "Rawl" bolts. Cassette type indoor units shall be suspended, from their brackets, using threaded rods affixed onto the roof slab. Include anti-vibration material in between a nut and the cassette unit.
- (b) Outdoor units shall be mounted on painted brackets, bolted onto plinths using rawl bolts, such that they are 200mm away from walls at the positions indicated on the drawings. The exact positions of the outdoor units and the final colour of mounting brackets must be approved by the Architect and the exact dimensions of plinths to be confirmed in conjunction with units on offer. All exposed coils to have galvanised mild steel weld mesh hail guards with hole size of 10mm x 10mm maximum, the mesh to be finished off with a 25mm galvanised Sheetmetal frame all round mesh and fixed to unit frame with self-tapping nickel-plated screws, care must be given not to damage unit coil.
- (c) Interconnecting refrigerant piping and cables shall be run together in the same trunking above the ceiling, through the external wall to the condensing sections. All piping shall be appropriately insulated and supported off the roof structure on suitable supports. All refrigeration piping lengths shall not exceed manufacturer-recommended lengths. The Contractor shall ensure that there is not dirt or moisture within the refrigerant piping and that all connections are air tight to avoid refrigerant leakage.
- (d) Each air-conditioning unit shall be wired to its own air-conditioner isolator, provided by the contractor, and fitted adjacent to the outdoor unit. Power cables between the isolator and the air-conditioning unit including all other visible wiring shall be laid in galvanized metal trunking, painted to match the outside walls, or fastened with cable straps onto cable trays provided and installed by the contractor as indicated on the drawings. The contractor shall provide and do all of the electrical wiring.

27. OPERATION : SPLIT TYPE AIR-CONDITIONING UNITS

A Computerized Control shall control several functions to improve reliability such as freeze up protection, detecting thermistor abnormalities, filter clean reminder, self-diagnosis, dehumidification and automatic cool/heat change over switch.

When the automatic operation mode button is pressed, the optimum mode (cooling, heating, soft dry) and optimum fan speed is to be selected according to the input from the intake-air sensor. This selection shall also be able to performed manually.

This controller shall be hard wired to the indoor unit and shall not be infra-red type controller.

The airflow direction louvers shall swing automatically or be adjustable manually. The louvers shall automatically shut down when the unit is switched off to maintain the neat appearance. The unit shall incorporate a specially treated slide-in slide-out filter to prevent build-up of mould.

28. MID-WALL SPLIT TYPE AIR-CONDITIONERS

Nine (9) mid wall split type air-conditioners of the heat pump type shall be supplied and installed in the positions as indicated on drawing No's 300246NM-AC1 & AC2 unit shall have a minimum cooling capacity as shown on the drawings

The unit shall consist of a direct expansion fan coil unit installed at high level on wall and a separate externally located air-cooled condensing unit mounted on cantilever brackets.

The fan coil unit shall be complete with suitable filters, multi-speed recirculation fan, adjustable directional air discharge grille and direct expansion cooling coil fitted into an appropriate cabinet.

The condensing unit shall be complete with compressor, air-cooled condenser and condenser fan fitted into an appropriate cabinet. The condensing unit shall be weatherproof and able to withstand the elements.

The unit shall be provided with interconnecting refrigerant circuits (insulated) and electrical wiring between components.

As refrigerant, preference will be given to units supplied with a more ozone friendly refrigerant such as e.g. R407C. Any additional refrigerant charge shall be allowed for.

Units with insufficient capacities shall not be accepted and must be de-rated for altitude.

The unit shall be standard factory manufactured. The maximum noise level within the room shall not exceed NC 25. Equipment noise levels shall be specified in detail in the Schedule of Particulars.

The indoor unit must be provided with a drip tray to facilitate condensate removal. An $\varnothing 22$ mm Copper condensate drain pipe shall be provided and shall lead to the nearest suitable drain point.

The unit shall have a remote infrared controller to operate unit, this to have a mounting bracket in position shown on drawing No's 300246NM-AC1 & AC2.

29. OPERATION : FANS

The fan performance shall be affected by the use of ducting, grilles, and other ancillaries thus the Contractor must make sure that on completion of the installation the minimum air flow rates are achieved. The formation and collection of condensation within ducting should be avoided.

30. ELECTRICAL WORK

GENERAL

This specification covers the general items of electrical equipment associated with Mechanical Installations. All materials and installation of such materials shall comply with the following:-

- i) the regulations for the wiring of premises SANS 10142;
- ii) the Occupational Health and Safety Act, (Act 85, 1993);
- iii) the Local Supply Authority's Regulations and Fire Insurance Regulations;
- iv) appropriate South African Bureau of Standards Specifications, or where not available, the British Standard Specification and amendments thereto;
- v) any special conditions implied in this specification.
- vi) the code of practice for Wiring of Premises SANS 10142 as amended.
- vii) the local Bye-laws and Regulations.

31. CONTROL PANELS

The control panel/panels shall be of the floor or wall mounted type, robustly fabricated of 2mm galvanised mild steel sheet, with fascia plates behind lockable doors.

All metalwork shall be suitably treated against corrosion and shall be coated with a self-etching primer, two coats of metal primer, and finished, internally one coat, externally two coats, with a good quality hard gloss enamel of an approved colour. The final coat colour shall be a standard B.S. colour readily matchable. No hammer tone or similar will be accepted.

All control equipment is to be chassis mounted behind a hinged fascia plate through which only circuit breaker toggles, reset buttons, etc., protrude. Equipment shall not be fixed to the fascia plate. Alarm pilot lights, timing units and ammeters shall be mounted in a panel above the doors, all other equipment being behind the doors. The control/panel/panels shall be complete with main isolator/s that can be operated without opening the doors. Access to equipment and wiring shall not be possible without switching off the main isolator.

The cable boxes to terminate the incoming cable will be mounted by others, but supports for this box are to be provided. Where PVC insulated cable is indicated, a gland plate only is require.

Busbars are to be located in a separate chamber. The busbars shall be of solid copper, rated at 155 amps per square centimetre, and shall be spaced and mounted to withstand the short circuit current, equal to the rating of the main isolator. All busbars and conductors shall be fully insulated in the respective phase colours. Each board is to be provided with neutral and bare earth busbar, with one way for each circuit and for each conductor.

Internal busbars, wiring, and terminals, shall be of suitable size and rating. Terminals shall be of brass and comply with sections 5.14.2 and 5.14.4 of SANS 152-1977. Wiring shall be neatly bunched and run in PVC wiring channels.

The electrical equipment to be provided on the switchboard shall comply with the detailed requirements.

Each control panel shall have red alarm pilot lights to indicate any malfunction or operation of any safety device. Normal running conditions of fans, pumps, etc., shall be indicated with green pilot lights. All pilot lights shall have a "lamp test" facility. This can be done either collectively or singly by means of a push button switch.

All exposed equipment and pilot lights are to be clearly labelled by means of plastic engraved labels, mounted on the fascia panels by means of screws or channelling. Each item of equipment in the board is to be labelled to correspond to its reference number on the wiring diagram. All wiring connections to equipment are to carry numbered ferrules corresponding to the connection number on the wiring diagram. All wiring to external equipment is to terminate in a numbered terminal block, to which the external wiring is to be connected. The terminals are to be of suitable rating for each circuit. No deviation from these requirements will be permitted.

The grouping of equipment on panels will be logical and neat and shall be done on the following basis:-

- i) main incoming breaker, main metering, and incoming cable access;
- ii) each motor circuit with sub-main breakers, starters, and Contactors;
- iii) plant room auxiliaries and general control circuits.

A detailed drawing of the control panels, as well as an electrical component and connection diagram shall be **submitted for approval before** manufacture commences. A wiring diagram of each control panel is to be mounted behind glass in a position adjacent to its respective panel.

32. AUTOMATIC CONTROL SYSTEMS AND INSTRUMENTATION

GENERAL

Except where otherwise specified in the detail specification the controls shall be of either the electrical or electronic type. All control devices shall be connected so as to perform the required function and operate in the required sequence. Electric control circuits shall not exceed 100 V.

The performance of controllers shall be stable under all conditions and the control quality criteria shall be such that the area under the recovery curve of the controlled variable following on a disturbance shall be a minimum.

The mode of control shall be as specified in the detail specification. Controllers shall generally be of the following type:

- a) Two position (on - off) controllers having adjustable differential gaps.
- b) Proportional position (modulation or throttling) controllers having adjustable proportionality (gain or sensitivity).
- c) Proportional plus reset (or simply reset) controllers having adjustable proportional band widths and reset rates.
- d) Proportional plus reset plus rate (three-term control) controllers having adjustable proportional bands, reset rates and rate times.

Non-adjustable controllers or controllers where the amount of adjustment is inadequate are not acceptable.

Controllers shall be designed for minimum time lags around the control loop.

Adjustments shall be made to the various control modes of each controller to obtain maximum regulation quality. Systematic trial methods or adjustment shall be avoided as far as possible. Recommendations of the controller manufacturer shall be carefully followed or alternatively adjustments shall be made based on the ultimate sensitivity calculated method.

The ultimate sensitivity calculated method permits calculating all three controller adjustments from data obtained in a simple quick test of control loop characteristics. With reset and rate adjustments at their lowest value, the proportional band is narrowed (gain or sensitivity increased) while creating small set point changes until the process just begins to cycle continuously. The period of cycling "T" in minutes of the oscillations at this ultimate proportional band "B" is noted. The controller adjustments that will produce approximately a 0,25 amplitude ratio are calculated as follows:

a) Proportional plus-reset-plus-rate mode controllers:

$$\begin{aligned} \text{Proportional band (\%)} &= 1,6 B \\ \text{Reset rate (T/min)} &= \frac{2}{T} \\ \text{Rate time (min)} &= \frac{T}{8} \end{aligned}$$

Provision shall be made to prevent noise signals in the control loop. Where noise cannot be eliminated completely by means of filtering or averaging noise out of the signal or by shielding control wires against stray voltages, etc., proportional plus reset controllers shall be used.

Controllers shall be electrically interlocked with the equipment they control and shall only be in operation when the plant is running.

Electric and electronic controllers shall be wired from the electrical switchboards, where such control equipment shall be housed in separate cubicles.

33. THERMOSTATS AND HYGROSTATS

Thermostats and hygrometers or alternatively temperature and humidity transmitters in occupied areas, shall be provided where indicated on the drawings and shall be installed against the wall at a height of approximately 1,5 meters from the floor. Thermostats mounted against outside walls, shall be provided with insulated bases.

Temperature sensing primary elements shall be either bi-metal strips, sealed bellows or resistance wires.

Humidity sensing primary elements shall be either human hair, leather, plastic or of the hygroscopic resistance type.

Duct, pipe and tank thermostats or thermostats controlling outside and return air temperatures, shall be of the remote bulb immersion type. Alternatively, thermostats controlling air temperatures may have fast response coiled sensing elements.

Sensing elements in piping and tanks shall be installed in oil filled separable immersion wells, screwed into the pipe or tank. Immersion wells shall be of copper or brass. Small diameter pipes shall be enlarged at points where sensing elements are installed. Sensing elements in ducts shall be located where they will respond to a representative temperature within the duct.

Thermostats and hygrometers mounted out of doors shall be provided with splash proof enclosures.

Capillary type thermostats shall be installed at a height of approximately 1,5 m above floor level in easily accessible positions for adjustment and maintenance purposes. Thermostats mounted against insulated ducts or pipes, shall be mounted on stand-off brackets. Capillary tubing shall be neatly installed and coiled where necessary and shall be protected against possible damage.

Fire protection thermostats shall be of the rigid stem insertion type.

Thermometers shall be provided in piping, ducts and tanks at the location of all control thermostats (not at limit or safety thermostats). Thermostats having built in thermometers, are also acceptable.

Thermostats and hygrometers shall not be installed in positions where they are subjected to direct sunlight. Thermostats near electric heater elements, shall be shielded against radiation.

Thermostats and hygrometers shall be protected against dust, dirt, corrosive fumes, chemicals and moisture.

Unless otherwise specified in the detail specification, all thermostats and hygrometers shall be of the relay-operated type.

34. **RELAYS**

Electric relays shall be mounted inside the electrical switchboards.

Electric relays shall generally comply with the standard specification for electrical equipment and installation for mechanical services.

Relays for low voltage controllers shall have integral transformers to provide 24 volt power for the control circuit. Relays shall be suitable for the supply voltage specified and shall have a contact rating well in excess of the load.

35. **MOTORS**

Motors shall comply with B.S. 2613 : 1957 and dimensioned to B.S.S. 2960 as amended and be suitable for 380/220 volt, 3 phase, 50 cycle A.C. supply, unless otherwise specified and shall be continuously rated for operation at the required attitude, and ambient conditions.

The motors shall be suitably insulated to a minimum of class E, the speed not to exceed 1 500 r.p.m. and should suit the speed of the plant offered.

The motors shall be of the approved squirrel cage type with a low starting current.

Frames shall generally be of the standard protected type, but in dirty and damp installations they shall be totally enclosed, fan cooled. Where operating in moist air conditions, motor windings shall be specially treated.

The motors shall be protected against overheating by three temperature sensing devices incorporated in the stator windings. The devices shall be connected and wired in such a manner that the power supply to the motor will be interrupted when the temperature in the windings exceeds the manufacturers rating.

Motors shall be able to start satisfactorily at a voltage of 10 % below nominal voltage, as measured immediately after the starter is switched on. Motors shall be run up to full speed in the time given in Appendix E of B.S.S. 587 : 1957 with the voltage reduced by 10 % as above. Acceleration shall be smooth throughout the starting period with no signs of hesitation or "crawling".

Motors shall have a rated brake horse power at least 15 per cent in excess of the maximum horse power required to drive the unit when working under normal maximum load.

The motors shall be provided with approved watertight cable glands to accommodate the cables to be supplied with the equipment.

On completion at the manufacturer's works all motors shall be subjected to routine and type tests in accordance with B.S. 2613 : 1957, and test certificates shall be submitted for approval before delivery to site is undertaken. After installation at the site the Contractor shall carry out, in the presence of the Engineer, the high voltage tests laid down in clause 33 of B.S. 2613 : 1957.

Tenderers shall supply wiring diagrams and efficiency, power factor and starting current curves of the motors at the time of tendering.

Where any motor is remote from, or obscured from view, from the panel, a separate isolator shall be provided for it. In the case of equipment, which is located out of doors, weatherproof lockable isolators are to be supplied. Alternatively lockable type isolators shall be provided at the control panel.

36. STARTERS

The starters or switches for starting the electric motors shall be so designed, to limit the amount of current when starting and accelerating, to the current values set out below:-

1,5 kW to 3,7 kW four times full load current

4,5 kW to 11,0 kW twice full load current

11,5 kW to 18,5 kW one and three quarters full load current

over 18,6 kW one and a half times full load current

Starters are to be of the same manufacture.

Starters are to be of the magnetically operated type, preferably with thermal overload protection in each phase. For motors above 37 kW thermal overloads are to be of the bi-metal indirectly heated type. Either type of starter is to be such that with correct overload settings, the starter will trip within 45 seconds when the motor is single phasing. Where this latter requirement cannot be met, separate single phasing preventers are to be fitted on all 3 phase motors.

On starters for motors above 75 kW, protective relays shall be installed for overload, under and over-voltage, negative phase current, phase imbalance etc.

After commissioning, the full load current of each circuit is to be measured and the overloads set to suit this loading.

All starters are to be suitable for a minimum of 15 operations per hour.

All starters are to incorporate at least two auxiliary contacts that can be arranged as either normally open or closed and shall be suitable for adding further contacts if required.

They shall be suitable for both local and automatic operation.

In the case of star delta or reversing starters, only units comprising both electrical and mechanical interlocks will be accepted.

Where starting resistors are used these shall be mounted above or remote from the control panel, or starter enclosure in the case of large drives, to allow for adequate heat dissipation. The resistance banks shall be protected against overheating by thermal sensors.

The starters shall be automatic and shall have "start" and "stop" push buttons and shall be provided with reset buttons for the overload and over temperature trips.

The starters shall be fitted with approved terminal boxes and glands of ample dimensions to suit the cables to be supplied with this equipment. Provisions shall be made for easy access by means of doors to the starters for maintenance purposes.

An approved earth terminal shall be provided on the frame of each starter housing gear and provision shall be made for earthing each starter in accordance with the requirements of local regulations.

On completion at the manufacturer's works, the starters shall be subjected to the routine and type tests in accordance with clause 83-93 of B.S. 587 : 1957 and test certificates should be submitted for approval before delivery to site is undertaken.

37. **CONTACTORS**

All contactors shall be of highest quality and shall have easily removable contact and coils, such as Sprecher Shuh, Cutler Hammer or equal and approved. All contactors shall have adequately rated contacts and continuously rated coils with a drop-off value of not more than 80 % of rated voltage.

38. **SWITCHGEAR**

All switchgear shall be rated for the anticipated load and the maximum rupturing capacity of the particular system.

i) **Main isolators**

All control panels shall be provided with a suitably rated Main Isolator, which is to be of the "on-load" type, and can be operated without opening the door. This isolator shall be mechanically interlocked so that no live components are exposed without the isolator being in the off position.

ii) **Miniature and moulded case circuit breakers**

Heinemann circuit breakers to SABS 155 shall be used with magnetic inverse time overcurrent tripping and in addition with magnetic instantaneous tripping on excessive overcurrents or short circuit, of 250 volt rating for single and double pole and 380 volt rating for three pole, and shall be of the ampere rating and class of breaking capacity specified or shown on drawings. Where not otherwise specified or shown on drawings the breaking capacity shall be class C.

iii) **Miniature isolators**

Miniature isolators shall be micro-gap type manually operated air break switches suitable for flush mounting and shall be to SABS 152. Where individually mounted they shall be in galvanised steel boxes with brass dished cover plates finished to match switch cover plates.

iv) **Fused switches**

The fuse-switch units shall be of the three phase and neutral arrangement having double break moving contacts supporting H.R.C. fuses, all housed in a robust metal toggle mechanism. Interlocks shall be provided to ensure that the cover cannot be opened when the switch is in the closed position.

The fuses shall be of the H.R.C. type and shall comply fully with B.S. 88/1947 category of duty A.C. 4.

Set of spare fuses of each rating used in the switchboards shall be supplied and handed to the representative at the site, who will issue a receipt.

39. **METERING AND INDICATION EQUIPMENT**

i) **kWh Meters**

The meters shall be individually tested and shall comply with SABS 01/1955.

The scale shall be of the cyclometer type and definition down on 1/10 th of a unit shall be provided for.

ii) **Maximum demand ammeters**

Moving iron ammeters suitable for 5 Amp. secondary current transformers shall be used.

Ammeters shall indicate the instantaneous current and have a separate indication for a 15 minute average value, preferably of bi-metal element type.

The scale shall be clearly calibrated in black on a white background and both instantaneous and maximum demand readings shall be on concentric scales by means of different coloured pointers.

Meters shall be over-scaled with a suppressed over range corresponding to the starting current and where current transformers are used, the ratio of such transformers shall preferably be indicated on the ammeter fascia.

iii) **Voltmeters**

The instrument shall be a moving iron type, suitable for horizontal as well as vertical flush mounting.

The scale shall be clearly calibrated in black on a white background.

Calibration shall be up to 120 % of rated voltage and a suppressed scale at the zero reading shall be preferable.

The instrument shall comply with B.S.S. 89 of 1964 and shall have an Industrial Grade accuracy.

iv) **Voltmeter switches**

Voltmeter switches shall have one "off" and six measuring positions and shall be suitable for panel mounting in such a way that only the handle and labelling plate extends to the front of the panel.

The fascia inscriptions on the labelling plate shall be clearly marked.

The switch terminals shall be suitable for lug connections and shall be clearly marked.

The contact movement shall have a rolling or wiping action.

The voltage rating shall be suited to the installation.

v) **Voltmeter fuses**

The fuse base shall have a voltage rating suited to the particular installation and shall be suitable for either flush or projection mounting.

Cartridge type fuses shall be used with a nominal rating of 2 amp at 380 Volts 50 Hz and a rupturing capacity of 20 000 amps.

vi) **Current transformers**

Current transformers shall be of the cooled type and shall have mounting facilities.

Split core current transformers shall not be acceptable.

Current transformers shall comply with BS 3938 and IEC 185 with an accuracy of 50 for indicating instruments, and for measuring instrument up to 200 amp 1.0, 250 - 600 amp 0,5 and 800 amp and above 0,2.

Transformation ratios, primary and secondary terminals and polarity of windings shall be clearly marked.

40. **CABLE**

Cables in the plant room shall be 600 volt grade polyvinyl chloride (PVC) insulated steel wire armoured to SANS 150 - 1957 general purpose grade.

All cables which might be submerged shall be of a similar standard to the 3 core V.I.R.T.R.S. 660 volt grade submersible pump cable.

Tenderers are required to state in the schedule of process the size of the cable between the various units to be supplied under this contract. The current ratings of PVC cables shall be in accordance with the standard wiring regulations.

The Contractor will be responsible for measuring on his final layout plan for the plant room, the lengths of the different cables required. The tender price must include for the supply and installations of all the necessary cables.

No cable joints will be permissible within the plant room.

41. **CABLE AND EARTH CONNECTIONS**

The Contractor is required to supply, fix in position and properly connect all the cables between the circuit breakers and starting equipment on the switchboard and motors, and automatic control equipment etc, as required.

Cables, where required, are to be fixed to walls by means of shapes galvanised saddles or hardwood cleats so that the cables are not damaged in any way.

Care must be taken during the laying and installation of cables that the outer covering is not damaged, and where and damage does occur, it shall be made good.

No cables shall be bent in laying to a radius less than 12 times its outside diameter.

All cable ends are to properly made by a workman skilled in this class of work.

The Contractor is required to lay and properly connect the earth conductors between the motors, starters, switchboards and the earth mat.

All wiring and earthing arrangements shall comply with the standard regulations of the South African Institute of Electrical Engineers and also with the requirements of Local Authority.

All cables crossing the floor shall be protected by a robust cable covering of approved design.

42. **EARTHING**

All motors, starters, switchboards and cable armouring are to be connected to earth by means of separate PVC covered stranded copper conductor the same size as the cable conductors, run alongside cables and strapped thereto. Earthing conductors shall be fitted with sweated lugs at ends and are to be solidly bonded to each other, to the electrical plant and equipment and to earth.

The Contractor shall provide and install a suitable earth mat which must be connected to the switchboard and shall be responsible for the supply of all material for earthing the electrical gear to be supplied and installed under this contract.

The starters shall be automatic and shall have "start" and "stop" push buttons and shall be provided with reset buttons for the overload and over temperature trips.

The starters shall be fitted with approved terminal boxes and glands of ample dimensions to suit the cables to be supplied with this equipment. Provisions shall be made for easy access by means of doors to the starters for maintenance purposes.

43. **RADIO AND TV INTERFERENCE**

An electrical installation shall comply with Government and Local Government Laws and Regulations in respect of radio and television interference suppression. Interference suppression components shall not be used in any part of the circuit in such a way that their failure might cause an unsafe condition.

44. **EARTH LEAKAGE PROTECTION**

All general purpose power outlets and switched socket outlets shall be protected by and earth leakage unit.

Earth leakage protection shall be of the current-balance type. A static tripping arrangement, either a magnetic or a solid-state amplifier of simple design, shall be used.

The relay shall have a sensitivity such that immediate tripping will result from a total leakage of between 15 m A and 20 m A.

The relay shall have an integral tripping facility and shall also be temperature-compensated.

The relay shall stand up to high values of earth-fault current without damage to the tripping arrangement.

The relay shall be of an approved type to SABS 767/1964 and shall bear the mark.

45. **ELECTRICAL SUPPLY**

The electricity supply shall be 400/231 50 hertz 3 phase plus neutral and all equipment shall be selected to operate at the appropriate 3 phase or single phase voltages.

The electricity supply shall be installed by others up to a point indicated on the project drawings and shall terminate in an open flush mounted draw box over which the Contractor shall mount the distribution board for the boiler room.

Sub-distribution boards, one for each boiler system, shall be fed from the main distribution board.

46. **TESTING**

The following tests will be carried out on the installation in the presence of the Engineer or his representative.

- i) insulation resistance test using 500 volt insulation tester (megohmmeter);
- ii) earth continuity test;
- iii) test for correct direction applied to every motor;
- iv) earth resistance test;
- v) prove the correct connection and rotation of any energy meters;
- vi) settings of all overload and other adjustable protective devices shall be set to the requirements of the equipment.

47. **DRAWINGS AND INSTRUCTION BOOKS**

Within 3 weeks after receiving written acceptance of the tender, the Contractor shall supply the following information in fourfold:

- i) plant room layout drawings showing the main items of equipment as well as all cable and wiring runs;
- ii) switchboard and control board outline and equipment layout drawings and details of manufacturing;
- iii) single line and wiring diagrams detailing all control, metering and indication circuits;
- iv) instruction and maintenance books for all major items or equipment.

48. DUCTWORK

All ducting shall comply to SANS 1238 as amended. Galvanised steel shall be used for ducting. Thickness of 0,6mm for ducts up to 600mm and 0,8mm thickness for duct from 600mm to 1000mm. Ductwork lengths shall be connected with mezz-flanges.

All Steel surfaces to be painted shall be prepared according to SANS 10064 (Code for the preparation of steel surfaces for painting). The surface can thereafter be painted with Zinc Chromate primer , one coat of universal undercoat, one final coat of high gloss enamel paint, the final colour of paint shall be approved by the Architect.

All duct dimensions on the drawings are clear inside dimensions with the ducts externally thermally insulated and complying to the following:

- (a) Air ducts shall be externally insulated with insulation of at least 25 mm thickness;
- (b) Insulation material shall be resin-bonded mineral or glass-fibre with a protective aluminium facing specifically designed for external duct insulation; Poly-urethane protection is required in outdoor exposed duct work.
- (c) Insulation shall be installed in a neat and workmanlike manner and be weather proof;
- (d) Insulation shall be adhered to the entire duct surface by means of "FOSTER SAFETEE DUCTFAS ADHESIVE 81-99" or approved;
- (e) The Contractor shall ensure a 100 % area-bonding between the duct and insulation.
- (f) The insulation on the sides and bottom of the duct shall be pinned with mechanical fasteners;
- (g) All joints shall be taped with an aluminium adhesive tape approved by the Engineer;
- (h) The continuity of the vapour barrier shall be insured.

49. ELECTRICAL INSTALLATION

All electrical work involved forms part of this contract and includes the controlling hardware, wiring between the power points and the units and wiring between the controlling hardware and the units.

The contractor shall ensure that the power supply voltages corresponds to that shown on equipment name plates. Allow for an isolator, at most, a meter away for each air-conditioning unit.

Supply and install Electrical Distributing Boards rated at capacities indicated on the drawings. The Distributing boards shall supply power to all the air-conditioning units shown and shall be as Specified by the Electrical Engineer.

All electrical connections shall be weatherproof to at least IP65 and shall be suitably encased, insulated, resistant to ingress of dust and guarded against hosing jets from all directions.

50. **FILTERS**

All fresh air supplied shall be filtered prior to being introduced into any indicated space. All filters shall be readily removable and shall be of the high-efficiency type

Unless specified all outdoor filters shall be of the pad type panel filters with 20 mm disposable media, mounted onto a galvanized mild steel screen, fixed to an outer frame.

The filter media shall extend over the full face of the frame and standard filter panels must be used. The frame shall slide into a channel onto which a galvanized mild steel screen is fixed on the downstream side.

The channel edges shall be fitted with a seal to prevent bypass of air past the filter and intermediate supports with seals must be provided. For ease of installation filters shall be mounted onto the outdoor air inlet wall grilles.

The initial synthetic dust arrestance shall be not less than 90 % and the dust holding capacity not less than 500 g per square meter. The initial dust spot efficiency shall be not less than 90 %. The final resistance shall not exceed 100 Pa.

51. **WALL LOUVRES AND DOOR GRILLES**

Wall louvers and door grilles shall be supplied and installed by the contractor in the positions indicated in the drawing. All grilles shall be of anodised aluminium and of colour approved by the Architect.

The size of the air louvers are indicated for tendering purposes. The final selection of these louvers is to be done by also taking into consideration the elimination of undesirable noise and vibration.

All door grilles are to be installed 150 mm from the door's bottom edge, and on the door's vertical centreline.

Where shown doors to be undercut 30mm in lieu of door grilles.

52. **BUILDER'S WORK**

Builders work shall be done by the contractor and calls for the following:

Drilling or making of openings into walls or slabs, cutting into ceiling for piping work, opening up ceiling, or any surface for the installation of all units.

Opening up ceiling and drilling into slab or brickwork for mounting of air-handling sections.

Making good and finally painting to match the existing surface, where surfaces were damaged due to penetration.

All carpentry works such as: cutting of doors for fitting louvers, undercutting of doors, cutting of ceiling for mounting diffusers, or any other.

Building of plinths or bases for mounting of mechanical equipment

53. **MAINTENANCE AND SERVICING**

The Contractor shall be responsible for all maintenance and servicing on all installations for a period of twelve months from the date of official first hand-over.

The Contractor shall visit the installation at least once every three (3) months during the guarantee period of 12 months. All these visits shall be recorded in the log books which shall be provided by the contractor for each unit.

The Contractor shall allow for the Minor Service and the Major Service, as detailed below, within his visits on all equipment or installations.

54. **MINOR SERVICE**

Installations shall be serviced once every three months in accordance with the Minor Service Schedules included in clause 50 and clause 52 of this Project Specification.

55. **MAJOR SERVICE**

This service shall be completed during the first week of the final month of the guarantee period.

All units shall be subject to a major service which shall include the following work, and as detailed in the Major Service Schedules included in clause 51 and clause 53 of this Project Specification:

The units shall be thoroughly cleaned and rust-treated,

Refrigerant charges shall be checked,

All equipment shall be checked for operation and replaced if not operating correctly,

All casings shall be cleaned and checked for rust, and rust-treated as necessary,

Coils shall be given particular attention when cleaning, and all bent fins shall be combed.

56. SCHEDULE FOR SPLIT AND PACKAGED UNITS – MINOR SERVICE

TYPE OF SERVICE : AIR CONDITIONING
 SCHEDULE FOR : SPLIT UNITS – MINOR SERVICE
 SCHEDULE FREQUENCY : 3 MONTHLY
 INSTALLATION NAME : NEWCASTLE SAPS VAN ECK BUILDING
 CONTRACTOR :

REF :
 CODE :
 REF :

P.M. SERVICE (FIRM PRICE WORK)		RUNNING REPAIRS APPLY FOR V.O. (Note separate V.O. for site stock)				OTHER REPAIRS REQUIRED SUBMIT QUOTATION					
ITEM	INSTRUCTION	IN ORDER	OTHER NON- SPECIFIED RUNNING REPAIRS DONE	TIME TAKEN	DESCRIPTION OF SPARES USED	QUANTITY		DESCRIPTION OF OTHER REPAIRS REQUIRED	EST. TIME REQ.	DESCRIPTION OF SPARES REQUIRED	QTY REQ.
						EX SITE STOCK	EX FIRMS STOCK				
1.	Check for undue noise or vibration										
2.	Check sight glasses for refrigerant condition and correct level										
3.	Check for oil/refrigerant leaks										
4.	Check suction line insulation										
5.	Check and clean filters and seals										
6.	Check belt tension and condition and adjust										
7.	Check that belt guard is secure and in place										
8.	Check that condensate flows through drain piping										
9.	Check and note outdoor db/wb temps										
10.	Check and note indoor db/wb temps										
11.	Check and note thermostat setting(s). Adjust if necessary										
12.	Check operation of heating coils as applicable										
13.	Check for loose components										
14.	Clean plant and plant room										
15.	Check and clean condenser coil										
16.	Check condenser fan/motor bearings for undue noise or end play										

P.M. SERVICE (FIRM PRICE WORK)		RUNNING REPAIRS APPLY FOR V.O. (Note separate V.O. for site stock)				OTHER REPAIRS REQUIRED SUBMIT QUOTATION				
ITEM	INSTRUCTION	IN ORDER	OTHER NON-SPECIFIED RUNNING REPAIRS DONE	TIME TAKEN	DESCRIPTION OF SPARES USED	QUANTITY		DESCRIPTION OF OTHER REPAIRS REQUIRED	EST. TIME REQ.	QTY REQ.
						EX SITE STOCK	EX FIRMS STOCK			
17.	Check compressor, condenser fan mountings									
18.	Check and clean cooling coil(s) and drain pan									
19.	Clean rust spots and touch up with paint									
20.	Clean out fan and coil compartments									
21.	Check for rust and corrosion									

NOTE THE FOLLOWING:

- a) Outdoor Db/wb temperatures
- b) Indoor Db/wb temperatures
- c) Thermostat setting(s)

I CERTIFY THAT THE SPECIFIED SERVICE WAS CARRIED OUT ON / / OFFICIAL STAMP:

BY: NAME IN BLOCK LETTERS :
 COMPANY :

TIME IN : TIME OUT: TOTAL HOURS:

SIGNATURE OF RESPONSIBLE OFFICER:

57. SCHEDULE FOR SPLIT AND PACKAGED UNITS – MAJOR SERVICE

TYPE OF SERVICE : AIR CONDITIONING
 SCHEDULE FOR : SPLIT UNITS – MAJOR SERVICE
 SCHEDULE FREQUENCY : END OF CONTRACT
 INSTALLATION NAME : NEWCASTLE SAPS VAN ECK BUILDING
 CONTRACTOR :

REF :
 CODE :
 REF :

ITEM	P.M. SERVICE (FIRM PRICE WORK) INSTRUCTION	IN ORDER	RUNNING REPAIRS APPLY FOR V.O. (Note separate V.O. for site stock)			QUANTITY		OTHER REPAIRS REQUIRED SUBMIT QUOTATION			QTY REQ.
			OTHER NON- SPECIFIED RUNNING REPAIRS DONE	TIME TAKEN	DESCRIPTION OF SPARES USED	EX SITE STOCK	EX FIRMS STOCK	DESCRIPTION OF OTHER REPAIRS REQUIRED	EST. TIME REQ.	DESCRIPTION OF SPARES REQUIRED	
1.	Check for undue noise or vibration.										
2.	Check sight glasses for refrigeration condition and correct level										
3.	Test for oil/refrigerant leaks										
4.	Check suction line insulation										
5.	Check and clean filters and seals										
6.	Replace drive belts										
7.	Check that belt guard is secure and in place										
8.	Check that condensate flows through drain piping										
9.	Check and note compressor suction/discharge pressures										
10.	Check and note compressor and fan motor amperages										
11.	Check and note outdoor db/wb temps										
12.	Check and note indoor db/wb temps										
13.	Check and note thermostat setting(s). Adjust if necessary										
14.	Check operation of heating coils as applicable										
15.	Check for loose components										
16.	Clean plant and plant room										

P.M. SERVICE (FIRM PRICE WORK)		RUNNING REPAIRS APPLY FOR V.O. (Note separate V.O. for site stock)				OTHER REPAIRS REQUIRED SUBMIT QUOTATION			
ITEM	INSTRUCTION	IN ORDER	TIME TAKEN	DESCRIPTION OF SPARES USED	QUANTITY		DESCRIPTION OF OTHER REPAIRS REQUIRED	EST. TIME REQ.	QTY REQ.
					EX SITE STOCK	EX FIRMS STOCK			
17.	Check and clean condenser coil								
18.	Check condenser fan/motor bearings for undue noise or end play								
19.	Check compressor, condenser fan mountings								
20.	Check and clean cooling coil(s) and drain pan								
21.	Lubricate supply fan bearings as required								
22.	Clean rust spots and touch up with paint								
23.	Tighten all electrical terminals and check all switchgear and interlocks								
24.	Clean out fan and coil compartments, fan scroll and impeller								
25.	Remove motor end covers and clean out air ways								
26.	Check drive motor bearings								
27.	Tighten impeller, fan and motor pulley grub screws								
28.	Check DX valve superheat setting. Adjust if required								
29.	Check for rust and corrosion. Treat as necessary								
30.	Clean and remove loose paint, scale and repaint as required								
31.	Check and note HP and LP cut-out settings. Adjust if necessary								
32.	Check control thermostat calibration. Adjust if necessary								

NOTE THE FOLLOWING:

- a) Compressor suction/discharge pressures
- b) Compressor motor amperages
- c) Supply fan motor amperages
- d) Outdoor Db/wb temperatures
- e) Indoor Db/wb temperatures
- f) Thermostat setting(s)
- g) DX valve superheat settings
- h) HP and LP cut-out settings

I CERTIFY THAT THE SPECIFIED SERVICE WAS CARRIED OUT ON

BY: NAME IN BLOCK LETTERS :

COMPANY

TIME IN : TIME OUT: TOTAL HOURS:

SIGNATURE OF RESPONSIBLE OFFICER:

OFFICIAL STAMP:

58. SCHEDULE FOR FAN FILTER UNITS – MINOR SERVICE

TYPE OF SERVICE : VENTILATION
 SCHEDULE FOR : FAN FILTER UNITS – MINOR SERVICE
 SCHEDULE FREQUENCY : 3 MONTHLY – With or without heaters
 INSTALLATION NAME : NEWCASTLE SAPS VAN ECK BUILDING
 CONTRACTOR :

REF :
 CODE :
 REF :

ITEM	P.M. SERVICE (FIRM PRICE WORK) INSTRUCTION	IN ORDER	RUNNING REPAIRS APPLY FOR V.O. (Note separate V.O. for site stock)			QUANTITY		OTHER REPAIRS REQUIRED SUBMIT QUOTATION	EST. TIME REQ.	DESCRIPTION OF SPARES REQUIRED	QTY REQ.
			OTHER NON-SPECIFIED RUNNING REPAIRS DONE	TIME TAKEN	DESCRIPTION OF SPARES USED	EX SITE STOCK	EX FIRMS STOCK				
1.	Check for undue noise or vibration										
2.	Check for loose components										
3.	Check for hot water or steam leaks										
4.	Check fan drive condition and belt tension. Adjust as required										
5.	Check that the belt guard is in place and secure. (Where applicable)										
6.	Check and clean primary filters										
7.	Check secondary and tertiary filters. Note manometer readings as applicable										
8.	Check all filter seals and repair as necessary										
9.	Check by touch that the motors are not overheating										
10.	Check and note speed controller settings										
11.	Check and note thermostat setting(s). Adjust if necessary										
12.	Check operation of sail/pressure switch										
13.	Clean plant and plant room										
14.	Check fan bearings										
15.	Check and clean heating coil(s)										

P.M. SERVICE (FIRM PRICE WORK)		RUNNING REPAIRS APPLY FOR V.O. (Note separate V.O. for site stock)				OTHER REPAIRS REQUIRED SUBMIT QUOTATION			
ITEM	INSTRUCTION	IN ORDER	TIME TAKEN	DESCRIPTION OF SPARES USED	QUANTITY		DESCRIPTION OF OTHER REPAIRS REQUIRED	EST. TIME REQ.	QTY REQ.
					EX SITE STOCK	EX FIRMS STOCK			
16.	Check and observe control damper operation, where applicable								
17.	Check operation of all operating controls, valves								
18.	Clean rust spots and touch up with paint								
19.	Clean out fan coil compartments								
20.	Check motor mountings and bearings								
21.	Check condition of insulation								

NOTE THE FOLLOWING:

- a) Filter manometer readings as applicable
- b) Outdoor Db/wb temperatures
- c) Indoor Db/wb temperatures
- d) Thermostat settings
- e) Fan speed controller

I CERTIFY THAT THE SPECIFIED SERVICE WAS CARRIED OUT ON / / OFFICIAL STAMP:

BY: NAME IN BLOCK LETTERS :
 COMPANY :

TIME IN : TIME OUT: TOTAL HOURS:

SIGNATURE OF RESPONSIBLE OFFICER:

59. SCHEDULE FOR FAN FILTER UNITS – MAJOR SERVICE

TYPE OF SERVICE : VENTILATION
 SCHEDULE FOR : FAN FILTER UNITS – MAJOR SERVICE
 SCHEDULE FREQUENCY : END OF CONTRACT – With or without heaters
 INSTALLATION NAME : NEWCASTLE SAPS VAN ECK BUILDING
 CONTRACTOR :

REF :
 CODE :
 REF :

ITEM	P.M. SERVICE (FIRM PRICE WORK) INSTRUCTION	IN ORDER	RUNNING REPAIRS APPLY FOR V.O. (Note separate V.O. for site stock)			QUANTITY		OTHER REPAIRS REQUIRED SUBMIT QUOTATION			QTY REQ.
			OTHER NON- SPECIFIED RUNNING REPAIRS DONE	TIME TAKEN	DESCRIPTION OF SPARES USED	EX SITE STOCK	EX FIRMS STOCK	DESCRIPTION OF OTHER REPAIRS REQUIRED	EST. TIME REQ.	DESCRIPTION OF SPARES REQUIRED	
1.	Check for undue noise or vibration										
2.	Check for loose components										
3.	Check for hot water or steam leaks										
4.	Replace fan drive belts										
5.	Check that the belt guard is in place and secure. (Where applicable)										
6.	Check and clean primary filters										
7.	Check secondary and tertiary filters. Note manometer readings as applicable										
8.	Check all filter seals										
9.	Check by touch that the motors are not overheating										
10.	Check and note speed controller setting(s)										
11.	Check and note thermostat setting(s) Adjust if necessary										
12.	Check and note heating coil amperages where applicable										
13.	Check and note fan motor amperages										
14.	Check operation of sail/pressure switch										
15.	Clean plant and plant room										

P.M. SERVICE (FIRM PRICE WORK)		RUNNING REPAIRS APPLY FOR V.O. (Note separate V.O. for site stock)				OTHER REPAIRS REQUIRED SUBMIT QUOTATION				
ITEM	INSTRUCTION	IN ORDER	OTHER NON-SPECIFIED RUNNING REPAIRS DONE	TIME TAKEN	DESCRIPTION OF SPARES USED	QUANTITY		DESCRIPTION OF OTHER REPAIRS REQUIRED	EST. TIME REQ.	QTY REQ.
						EX SITE STOCK	EX FIRMS STOCK			
16.	Check and lubricate fan bearings									
17.	Clean fan mountings and flexible connections									
18.	Check and clean heating coil(s)									
19.	Check and observe control damper operation, where applicable									
20.	Check operation of all operating controls, valves									
21.	Clean out fan and coil compartments, fan scroll and impeller									
22.	Remove motor end covers and clean out air ways									
23.	Check motor mountings and bearings. Lubricate as required									
24.	Check for rust and corrosion. Treat as necessary									
25.	Tighten impeller, fan and motor pulley grub screws									
26.	Tighten all electrical terminals. Check and adjust as necessary all switchgear									
27.	Lubricate all valve and damper spindles									
28.	Check condition of insulation. Repair and repaint as required									
29.	Clean and remove loose paint, scale and repaint as required. Adjust if necessary									

NOTE THE FOLLOWING:

- a) Filter manometer readings as applicable
- b) Outdoor Db/wb temperatures
- c) Indoor Db/wb temperatures
- d) Thermostat settings
- e) Fan speed controller
- f) Heating coil amperages (if applicable)
- g) Fan motor amperages

I CERTIFY THAT THE SPECIFIED SERVICE WAS CARRIED OUT ON / / **OFFICIAL STAMP:**

BY: **NAME IN BLOCK LETTERS :**

COMPANY :

TIME IN : **TIME OUT:** **TOTAL HOURS:**

SIGNATURE OF RESPONSIBLE OFFICER:

SECTION GCC

PAINTING AND COLOUR CODING

INDEX

1	General
2	Painting
3	surface Treatment prior to Painting
4	Painting on Galvanised Surfaces
5	Colour Coding
6	Paint Identification

1 GENERAL

No untreated metal surfaces shall be permitted on the project. Items which are not galvanised or similarly protected against rust and corrosion shall be painted.

All piping (with the exception of hot dipped galvanised, copper and plastic/PVC), brackets and fixings, canvas covered insulation (where not clad with aluminium or galvanised sheet metal), unclad asbestos cement compound finish over insulation material, and surface mounted black conduits exposed to view shall be painted as specified below. Conduits not exposed to view need not be painted.

Where walls or ceilings which require to be painted, are inaccessible after the erection of equipment, the Contractor is to ensure that these are painted prior to his fixings taking place.

The surfaces of articles to be painted which will be inaccessible after their erection shall receive the full specified coating procedure before installation. This applies particularly to fixing brackets bolted to the structure.

2 PAINTING

The minimum requirement for painting shall comprise the following consecutive processes:

- thoroughly clean, descale and degrease all surfaces
- apply one coat of the appropriate primer
- give one undercoat prior to erection
- touch up damaged undercoat after erection
- follow with two coats of enamel or suitable weather and/or heat resistant paint

3 SURFACE TREATMENT PRIOR TO PAINTING

Paint shall not be applied over any surface containing traces of grit, grease, oil, loose rust, loose millscale or corrosion products of any kind, nor to within 50 mm of areas which are to be welded.

Welds and adjacent parent material shall be abrasive blasted and/or ground and all contaminants such as flux and weld spatter shall be removed prior to painting. Rust spots shall be removed by means of a wire brush or emery paper. The surrounding paint which is still intact shall be feathered for a distance of 50 mm beyond the damaged area.

4 PAINTING ON GALVANISED SURFACES

Where further protection against corrosion is necessary, is specified, or is required for colour coding, the Contractor shall proceed as follows:

- a) Surface to be thoroughly cleaned with a detergent chemical solution in accordance with SANS 10064:2005 : Preparation of Steel Surfaces for Coating
- b) One coat of self-etching primer to SANS 723, (Wash Primer)(Metal Etch Primer).
- c) One coat of zinc chromate paint to SANS 679 (Zinc Chromate Primers for Steel) Type II, Grade I.
- d) One coat oleo-resinous micaceous iron oxide paint to approved colour.
- e) Two coats pure acrylic emulsion exterior paint to SANS 1586.

All paints used shall be by the same and approved manufacturer and the Contractor shall ensure that the paints are compatible one with the other.

Surfaces exposed on galvanised material through cutting, drilling and/or pipe grips shall be painted with Galvalloy or similar.

5 COLOUR CODING

5.1 General

All equipment shall be colour-coded in accordance with standards recognised, and where possible to comply with relevant SANS colour codes unless specified otherwise.

5.2 Colour Coding of Pipes

Identification of the contents of pipes shall either be by painting a 100 mm wide primary colour band or by using self-adhesive PVC coloured tape. The colour of the paint or tape shall comply with SANS 10140 Identification Colour Marking, Part III, Contents of Pipelines, as detailed below.

The colour names referred to in the tables are specified in SANS 1091.

Colour bands shall be at intervals not less than 6 m apart, but in any case shall be adjacent to each side of bands, valves, etc. Where the run of pipes is hidden, i.e. within ducts, false ceilings etc., colour coding bands shall be provided opposite each access panel or equal.

A descriptive code indicator shall be used to describe the contents of the pipe where necessary. This shall give the name in full, or an abbreviation of the name, or by chemical formula or symbol, and where relevant the pressure, temperature or flow direction. The characters are to be of a size suitable for legibility of the indicator. If the diameter of the pipe is too small to provide adequate legibility of a descriptive code indicator, the indicator is to be fixed to a plate, and the plate fixed firmly to the pipeline.

Arrows indicating the direction of flow of the contents of the pipe shall be applied as per colour coding bands.

TABLE OF COLOUR CODING FOR PIPELINES AS PER SANS 10140 : PART III - 1978

CONTENTS OF PIPE PRIMARY COLOUR BANDS

AIR

- Compressed Arctic Blue
- Instrument (pneumatics) Arctic Blue Salmon Pink
- Vacuum Arctic Blue Primrose
- Medical Arctic Blue Black - White - Black

NB : Distinguish between high and low pressure medical air by superimposing the letter L or H as relevant.

FIRE FIGHTING

- All Pipes Signal Red

WATER

- Cold Water (i.e. Drinkable) Brilliant Green
- Hot Water Brilliant Green Crimson - Cornflower
- Boiler Feed Water (Distilled) Brilliant Green Crimson - White - Crimson
- Boiler Feed Water (Demineralised) Brilliant Green White
- Industrial Brilliant Green Golden Yellow

STEAM

- Steam Mains and Condensate Lines Pastel Grey

OILS

- Diesel fuel Golden Brown White
- Hydraulic Power Golden Brown Salmon Pink

GASES

GCC.3

- Acetylene Light Stone Maroon
- Argon Light Stone Peacock Blue
- Butane/Propane Light Stone Crimson (and superimpose with the letters LPG/VPG)
- Carbon Dioxide Light Stone Light Brunswick Green
- Carbon Dioxide (Medical) Light Stone Light Brunswick Green
- Light Grey

GASES

- Chlorine Light Stone Canary Yellow
- Hydrogen Light Stone Poppy Red
- Nitrogen Light Stone Light Grey - Black
- Nitrous Oxide Light Stone Ultramarine
- Nitrous Oxide-and Oxygen Mixed Light Stone White - Ultramarine
- Oxygen Light Stone White

The following pipe contents which have not been covered by SANS 10140 Part III have been based, where possible, on the colour coding specified by BSS.

WATER

- Drains Black
- Chilled Water Brilliant Green Ultramarine
- Condenser Water Brilliant Green Arctic Blue
- Cooling Water Brilliant Green White Arctic Blue White
- High Temperature Hot Water Pastel Grey Brilliant Green

FIRE FIGHTING

NB: Where more than one piped service is installed in a complex the following pipe identification is to be employed.

- Sprinklers Signal Red
- Fire Hose Reels Signal Red Brilliant Green
- Hydrants Signal Red White - Brilliant Green
- CO₂ Signal Red Light Stone - Light Brunswick Green
- Halon Signal red Light stone - Golden Brown

6

PLANT IDENTIFICATION

Wherever equipment rooms contain and/or switchboards serve multiple items of similar plant (e.g. run and stand-by pumps) each item shall be clearly identified. Generally a single numeral not less than 100 mm in height will suffice for this purpose. Such numeral may be stencilled directly onto the item of equipment in a contrasting colour, or a purpose made plate may be affixed to the unit. Self adhesive numerals will not be accepted.

SECTION GR**GENERAL REQUIREMENTS FOR REFRIGERATION AND COLD ROOM INSTALLATIONS****INDEX**

1	General
2	Guaranteed Performance
3	Co-Ordination
4	Plant rooms and Equipment Areas
5	Employer Training
6	As-Built Drawings
7	Operating and Maintenance Manuals
8	Maintenance
9	Maintenance Contract
10	New Materials & Equipment
11	Extended Equipment Guarantees
12	Conflict between Specification and Drawings
13.	Definitions

1 GENERAL

The work shall be carried out strictly in accordance with:

- 1) Occupational Health and Safety Act 85/1993.
- 2) SANS 1530(1) Panels for Thermal Insulation for Cold Rooms.
- 3) All relevant Regulations and Bylaws of the Municipal Council and Fire Department concerned.
- 4) SANS Standards as applicable
- 5) SANS 9000 and SANS 9001 – Quality Management

The refrigeration contractor shall give any notice required and pay all fees, including fees for any temporary connections required.

All tests shall be to the satisfaction of the Consulting Engineer or his representative who shall have the right to inspect the installation at all reasonable hours during the progress of the works.

Unless stated otherwise, all the work specified herein shall be the responsibility of the Refrigeration Contractor (hereafter referred to as the Contractor). Without relinquishing that responsibility, he may employ the Main Contractor for certain operations (such as the casting of wearing slabs, protective kerbings and the like).

2 GUARANTEED PERFORMANCE AND PLANT CAPACITY**2.1 Plant Capacity**

The system and individual items of the system shall be guaranteed by the Contractor to operate efficiently at not less than the specified duties when installed.

It is the Contractor's responsibility to establish, to the Engineer's satisfaction, that the specified duty is being achieved.

If at any time during the tender period or course of the contract the Contractor has any doubts about the specified for the equipment to be installed he must check and if necessary contact the Engineers in order to satisfy himself as to their adequacy.

The Contractor shall ensure that all items of equipment are matched in performance and will operate with maximum efficiency when so matched.

All inter-connecting piping and other fittings shall be so arranged that neither the performance nor the safety of operation of any equipment is jeopardised.

Resistance to flow for all pipework must be checked by the Contractor from shop drawings prior to final equipment selection being made, and any variations to pipework during installation of the plant must be allowed for and the necessary compensations provided.

All equipment shall be capable of performing its specified duty at the altitude at which it is to be installed.

2.2 Limitation of Noise.

The noise emitted from the plant, equipment duct, air-outlets supplied and installed by the Contractor shall be kept to a minimum and shall not exceed Noise Criteria Number specified under Noise Control.

As an initial check of the noise levels of an installation, dB (A) measurements shall be taken (i.e. measurements based on the single figure rating to the broad band sound, as given by the A-Scale of a sound level meter). The readings so achieved shall not exceed the specified NC level number by more than 4 to 6 dB (A). Should the noise so measured be deemed to exceed the acceptable levels, or, should the Engineers dispute that the specified NC level is being achieved, the Contractor shall be responsible for obtaining Sound Pressure Levels across the full octave band mid-frequencies and thus determine the exact NC level resulting in the space.

In case the ambient noise level in any room without the plant operating is higher than the specified NC curve, the noise level in the room with the plant operating may be increased by 3 dB above the ambient level, or the specified NC curve, whichever is the higher.

3 CO-ORDINATION

The Contractor shall be responsible for the co-ordination of his own work, and is to be mindful of co-ordination with all other services as regards both physical clashes and installation programme.

4 PLANTROOMS AND EQUIPMENT AREAS

Tenderers are required to check whether the plant areas shown on the drawings are large enough to accommodate the equipment offered by them. It will not be possible to alter the plant area sizes and Tenderers must ensure that the equipment offered can fit into the areas shown, allowing for clearances, access, maintenance, etc.

Before ordering prefabricated cold room and freezer room panels, the Contractor shall measure on site the actual dimension between existing brick walls and concrete floors in order to allow for the correct clearances between the outer skin of the panels and the brickwork as required.

5 EMPLOYER TRAINING

A representative of the Contractor shall be available to instruct the client's maintenance staff (or his appointed representative) in the operation of his system, and to ensure that such persons are fully conversant with the control and operation of the system.

This instruction exercise is to take place prior to the system being left operational. The Engineers are to be informed in writing as to when this instruction period is scheduled to commence. On the completion of the exercise the Contractor is to obtain the client's representative's formal acceptance of the hand-over tuition, thus acknowledging his complete understanding of the operational procedures for this installation.

6 RECORD DRAWINGS

The contractor is responsible for the production of record drawings, and for the issue of one plastic copy of each drawing to the client's maintenance engineer. A further 3 paper print copies are required, these forming an integral part of his Maintenance Manuals.

These drawings are to illustrate any changes in the pipework and duct routes; position of isolating or balancing valves, and clearly identify each valve with its tagged description. The as-built drawings are to include for schematic layouts of the electrical switchboard, control diagrams and of the pipe layout.

On copy of each approved as-built electrical switchboard control diagram, piping schematic etc shall be fixed in a glass or Perspex fronted frame, and this shall be mounted in a prominent position in the appropriate plantroom.

Plastic sepia copies of the Consulting Engineer's original drawings may be obtained from the Engineers, and these modified by the sub-contractor such that they become the master record originals.

7 OPERATING AND MAINTENANCE MANUALS

The Contractor is required to furnish the Operating and Maintenance Manuals as detailed in Part 3 Section MM. These are to be produced before the sub-contract will be passed by the engineers as complete and recommended for acceptance.

One draft copy of the manual is to be submitted to the offices of the Consulting Engineer for checking and acceptance.

If for any reason it is not possible to produce the completed manual by such date, an abbreviated draft copy of the operating instructions is to be issued to the client/tenant for his reference until the final copies are available.

In addition to the manuals he shall also provide a very simple operating instruction, on A4 or A5 paper sheet size, framed and mounted adjacent to the switchboard or control console to which it pertains. This is to enable a non-technical person to operate the system. It shall give clear instructions of how to stop and start the plant, to operate any function overrides, etc.

8 MAINTENANCE

The Contractor shall be responsible for maintaining the installation during the initial 12 months of operating of the plant. Unless otherwise specified this shall require service visits not less than 1 month apart. The costs of this initial 12 months maintenance shall be built into the contract price, but will exclude the costs of expendables (i.e. filters, oils, water treatment, chemicals etc).

He shall service all the equipment supplied by him as normally required under a comprehensive maintenance contract as required by SARACCA.

The Contractor is to negotiate and formalise a Maintenance Contract Agreement prior to the expiry of the free maintenance period.

9 MAINTENANCE CONTRACT

A price, based on present-day rates, is to be inserted in the Priced Schedule page to indicate the charges of an annual maintenance agreement. This shall be the (present-day) charge for a service contract to commence on the completion of the 12 month guarantee (with free maintenance) period, and is required to give the client an indication of the anticipated charges involved. It is noted that this value will be escalated by a recognised formula.

This price will not form part of the tendered sum.

The details of the works to be carried out is to be based on the requirements as detailed under the Maintenance clause in Part 5 of this document.

Immediately following the service at the middle of the guarantee period, the Contractor is to submit a draft Maintenance Contract Agreement to the client, through the Engineers, in order that a maintenance contract (between Client and Contractor) can be formalised well in advance of the expiry date of the guarantee period.

10 NEW MATERIALS AND EQUIPMENT

All materials and equipment furnished by the Contractor shall be new. No second hand or reconditioned equipment may form part of the main offer.

11 EXTENDED EQUIPMENT GUARANTEES

It is specified that the Client is to receive a Manufacturer's guarantee of 12 months from either the date of beneficial use of the equipment or the date of acceptance of the installation.

It is the Contractor's responsibility to ensure that arrangements are made for any necessary extensions to the Manufacturer's standard guarantee period to cover the full 12 months guarantee of the installation as a whole.

All extra charges for such equipment guarantee extensions are to be included in the tendered price.

12 CONFLICT BETWEEN SPECIFICATIONS AND DRAWINGS

Should the Contractor note any inconsistency between the Specification and drawings he shall be responsible for notifying the Engineer and obtaining clarification or instructions prior to ordering or installing equipment.

13 DEFINITIONS

Supply	: To purchase or procure and deliver complete with all necessary and additional specified accessories
Erect	: To place or mount and fix in position.
Install	: To erect, connect up and commission, complete with related accessories.
Indicated, Shown, Noted	: As indicated or shown on drawings.
Or Equal Approved/	: Equal or better in efficiency of performance and compatibility with installation.
Or Other Approved	: Approved prior to tender closing date.

SECTION MM

OPERATING AND MAINTENANCE MANUALS

INDEX

- 1 General
- 2 Preparation of the Manual
- 3 Contents of the Operating and Maintenance Manual
- 4 Sepia Copies of Drawings

1 GENERAL

The Contractor is required to furnish 3 sets of Operating and Maintenance Manuals and supply these to the Consulting Engineers.

2 PREPARATION OF THE MANUAL

The manuals shall be prepared within the contract, and shall be particular to the project. All charges that may be required by manufacturers suppliers for the provision of information and literature shall be included in the contract price.

The manual shall be arranged with an index and referencing system. A matching flysheet will give the names and addresses of the principals involved on the project.

The covers shall be hard bound with a four post loose leaf system. The contract details shall be embossed on the front cover. Numbered card dividers shall be inserted between the sections.

The completed set of manuals shall be provided to the Engineers at practical completion. A draft text of the manual shall be issued for approval.

3 CONTENTS OF OPERATING AND MAINTENANCE MANUAL

The format of the manual shall be in accordance with the following sections, after a preface and index.

Section 1:

This shall comprise the introduction, abbreviations, and any warnings that may be required by the Machinery and Occupational Safety Act, Local Authorities and other such bodies.

Section 2:

A full description of each system, together with the main plant components and locations, plus the mode of operation of automatic control systems associated with such system shall be reflected in this section.

Section 3:

This shall comprise the complete plant technical data of each item of equipment (eg manufacturers name and address, type and size of unit, serial number, bearing pulley and belt details, motor details, unit performance and duty details). This information shall be derived from a site inspection of identification plates together with information obtained from manufacturers.

Section 4:

This section shall describe in detail the operating procedures necessary for starting up, running and shutting down each individual system. This shall include the control panel starter and selection facilities together with any alarm and safety interlocks as identified on the control panels.

Section 5:

This shall comprise the maintenance operations on a daily, weekly, monthly etc basis for each item of plant. The preparation of this section shall be carried out by obtaining from the manufacturer his advice and recommendations for lubrication, adjustment and routine maintenance.

Section 6:

This section shall comprise the emergency procedures to be adopted by personnel engaged on the operation and maintenance of the mechanical and electrical services, with respect to fire, first aid, general failures to water and electrical systems, gas lines, chiller refrigerant pipework, and call-out procedures for maintenance personnel in working hours and out of working hours.

Section 7:

A recommended action on plant malfunction shall be detailed in this section. This is to assist both the user and maintenance engineer in the event of a fault developing in a system by indicating the nature of the fault and the recommended action.

Section 8:

This shall comprise a list of recommended spares and lubricants. The preparation of this section shall be carried out by obtaining the manufacturers recommendations and also incorporate the Clients requirements regarding spares.

Section 9:

A schedule of the record, or as-built drawings together with reduced copies (A4 size) of the record drawings will be inserted in numerical order in this section.

Section 10:

This section shall comprise test certificates and commissioning reports. It shall also contain copies of fan and pump curves with the duty points clearly indicated.

Section 11:

This shall comprise the manufacturers literature, arranged in alphabetical order to match the manufacturers list. It shall also give the manufacturers (or their local representatives) names, addresses and telephone numbers.

4 SEPIA COPIES OF DRAWINGS

In addition to the as-built drawings required for the Manuals one sepia set of these drawings shall be provided within the contract.

The plastic sepia copies shall be of a quality equal to or better than the 0,05 grade.

SECTION PR

REFRIGERANT PIPING AND ACCESSORIES FOR COLD ROOMS AND FREEZER ROOMS

INDEX

1	General
2	Pressure Switches
3	Dehydrator
4	Sight Glass
5	Solenoid Valve
6	Shut-off Valve
7	Strainer
8	Thermostatic Expansion Valve
9	Drain Connection

1 GENERAL

The refrigerant tubing shall be sealed, deoxidized, dehydrated, halfhard seamless copper tubing, refrigeration quality as manufactured by MAKSAI or equal approved. Tubing shall be suitable for use with the maximum working pressures to be expected from this installation.

Piping shall be parallel and square to walls, beams etc., and shall be adequately saddled at intervals not exceeding 1000 mm and at T-pieces, bends, etc. by means of non-chafing copper saddles.

Pipework shall be given adequate grade to ensure proper oil return.

Joints in piping shall be by means of silver soldered standard malleable copper fittings or by means of standard SAE swaged malleable brass fittings where connected to apparatus. Cast fittings will not be allowed. The formation of scale shall be prevented during brazing, by passage of dry nitrogen to the pipework. Care shall be taken that all joints are thoroughly cleaned and that no dirt or filings are in the pipes. Piping to be neatly cut by means of pipe cutter and reamed.

Fittings for flare joints shall be manufactured by Imperial Manufacturing Company or equal and approved. Flare nuts shall be of the short frost proof type. An approved correctly sized refrigerant drier shall be installed on each system.

Piping shall be easily accessible and provided with sufficient valves and fittings for disconnecting equipment, controls, etc.

Pipe couplings at machines shall be sufficiently flexible to withstand the vibration of the compressor.

All piping through walls, etc. shall be provided with steel sleeves. Piping through insulated walls shall be properly vapour sealed and provided with plastic sleeves.

The run and arrangement of piping shall be approximately as indicated but shall be subject to modifications to suit conditions on site. All piping shall be run to avoid interference with the work of other traders and for convenient and accessible location of all parts of the piping system. In general;

Suction line pressure drop at design suction pressure shall not exceed 10kPa from compressor to any cooling unit outlet.

Liquid line pressure drop from receiver to expansion valve shall not exceed 30 kPa.

Refrigerant suction lines shall be insulated with 25 mm thick Armaflex or equal approved pre-formed flexible pipe insulation. Insulation to be self-extinguishing with regard to fire propagation.

Exposed insulation shall be suitably wrapped and painted to prevent deterioration due to sunlight and weathering.

2 PRESSURE SWITCHES

High and low pressure cutouts, shall be Penn or equal with adjustable settings and scale. Manual reset on H.P.

3 DEHYDRATOR

Liquid line type. Silica-gel renewable cartridge. Renewable in line. Complete with felt filter. To be fitted with valved bypass.

4 SIGHT GLASS

Double port type. Brass.

5 SOLENOID VALVE

Alco or equal brass body positive sealing continuous rated coil. Easily removable coil. For pump down control.

6 SHUT-OFF VALVE

Back seating.

7 STRAINER (If not part of expansion valve).

Brass body. Renewable element. Replaceable in line.

8 THERMOSTATIC EXPANSION VALVE

Sporlan or equal.

9 DRAIN CONNECTIONS

Supply and install a 20 mm diameter copper drain connection from the evaporator unit in the cold room to the nearest gully point. A water trap shall be provided to the drain line.

SECTION QR

GENERAL EQUIPMENT SPECIFICATIONS FOR REFRIGERATION AND COLD/FREEZER ROOM INSTALLATIONS.

INDEX

1	Air Cooled Condensing Units.
2	Blower Coil Units.
3	Prefabricated Cold Room Panels.
4	Roof Panels.
5	In situ Floors.
6	Doors
7	Instrumentation and Controls
8	Thermometers
9	Lighting

GENERAL

1 AIR COOLED CONDENSING UNITS.

Compressors shall be of the semi-hermetic or hermetic type. Prestcold, Copeland, Mannerop, Techumseh or equal.

Unless otherwise stated in the Detailed Technical Specification each condensing unit shall be of the air cooled type fin and tube construction, complete with steel base, liquid receiver, air cooled condenser, condenser fans, accessible semi-hermetic or hermetic compressor, pressure control, suction and discharge service valves, oil safety control, fan guard, etc. The refrigerant used shall be R22 or R404 (Freezer Rooms).

Pump down controls shall be provided and the liquid receiver capacity shall be sized liberally for pumping down the system.

Pressure controls shall be similar or equal to Ranco or Penn and shall be combination or separate high low pressure. The high pressure cut-out shall be of the manual reset type.

The compressor shall be provided with shut-off valves, high and low pressure cut-outs and two pressure gauges, each with shut-off valve. These shall be mounted remote from the compressor on hardboard against the wall. A suction strainer shall be provided.

Floor mounted units shall be installed on a concrete plinth. Building Contractor shall provide the above bases to the Contractor's detail.

Wall mounted units shall be installed on cantilever type wall brackets. The cantilever brackets shall be hot dipped galvanised after manufacture and painted as specified hereinafter. All fastening bolts and nuts shall be galvanised or cadmium plated.

The motor shall be a squirrel cage induction type, high torque screen protected, suitable for 3 phase supply at the declared voltage.

The design power of the motor shall be at least 1.25 x power absorbed by the compressor.

The tenderer must submit curves showing balance point between condensing unit and evaporator capacity.

Where applicable, provide a sheet metal duct between condenser inlet and outside air louvre. The duct to terminate approximately 50 mm away from the outside air louvre. The duct to be constructed of 0,91 mm galvanised sheet steel, adequately supported from the floor. Provide a flexible duct connection between duct and condenser.

Provide an aluminium plate approximately 150 x 100 mm mounted on the base of each unit which shall show the final

pressure settings thus: -

Low side : Cut in.....kPa
Cut out.....kPa

High side : Cut in.....kPa
Cut out.....kPa

Where specifically required in the Detailed Technical Specification, water cooled equipment shall be of serviceable shell and tube construction.

2 BLOWER COIL UNITS.

Each blower coil unit shall be of the forced draught, ceiling mounted type and shall be complete with evaporator coil, casing, fan(s), motor(s), drip tray, thermostatic expansion valve, solenoid valve and heat-exchanger.

The blower coil unit casing and drain pan assembly shall be fabricated from heavy gauge hammered finish aluminium sheet, properly finished in a suitable enamel paint finish.

The evaporator coils shall be constructed of seamless copper tubing, mechanically expanded into rippled aluminium fins. The drain pan shall be supplied with large drain connection, to permit rapid removal of condensate during defrost.

The evaporator shall have one or more propeller type fans and be either the blow or draw through type. The fan blades shall be of strengthened steel or aluminium construction with anti-corrosive treatment and fans and motors shall be balanced to avoid vibration.

The motor shall be single phase, totally enclosed suitable for 220 V 50 Hz supply. The motor shall comply with the requirements of SABS 1189, continuously rated.

The motors shall be provided with suitable anti-vibration devices to eliminate the transfer of vibration to the casing.

The casing of the unit shall be able to be removed without removing the unit from its mounting.

The evaporator shall be mounted 150 mm under the ceiling, in the position where indicated and hung from four brass or stainless steel 12 mm bolts protruding through the insulation. These bolts are to be built in by the Sub-contractor and shall not damage the vapour seal of the insulation.

Evaporators for use in rooms of below 2°C are to be fitted with an automatic de-icing system utilising electric or hot gas defrosting.

For rooms below 0°C insulating tape suitable insulation shall be provided to the drip tray of the evaporator unit as well as to all exposed parts of the drain line within the cold room. Tape shall be as per Bostick No Drip tape type S.P. 137 or equal and approved.

3 PREFABRICATED COLD ROOM PANELS.

The cold rooms and freezer rooms shall be built with factory prefabricated modular panels, securely fastened together with reinforced to prevent warping of the walls, ceiling and at the entrance doors.

The wall and ceiling panels shall be composed of high density expanded polystyrene or polyurethane foam, clad on both sides with a stressed metal skin. The core of the insulation shall be securely bonded to the metal cladding with a rigid thermosetting chemical.

Unless otherwise specified in the Detailed Technical Specification the cladding shall be Chromadek 0,5 mm thick consisting of G 275 galvanising with silicone modified polyester paint to an approved colour. All cold rooms shall be provided with ABS overlay internally only on all walls from skirting to underside of ceiling. There shall be no horizontal joints in wall panels and no timber shall be used in the construction of the panels.

Provision shall be made to reinforce the framework next to the door opening to prevent warping and distortion of the walls and door area.

The panels shall be insulated with high density polystyrene 28 kg/m density guaranteed against deterioration and sweating and having a minimum overall heat transfer co-efficient of 0,32 watt/m²/°C.

Unless otherwise specified:

Cold Rooms	100 mm thick
Freezer Rooms	150 mm thick

Tenderers may quote for alternative type of insulation e.g. foamed polyurethane of equivalent insulation qualities, and thickness to suit.

The panels shall be jointed together solidly and positively, properly sealed and the whole outer surface vapour proofed and free from condensation. All joints to be completely filled and no joints or parts of construction shall form thermal bridges. Sealants to be non hardening mastic type.

The tenderer shall offer his standard T and angle pieces for jointing providing they conform to the above.

Unless specified otherwise, finish to be as follows:

Vinyl base baked enamel.

Other finishes e.g. bare galvanised aluminium or stainless steel, to be provided if specified in Part 6.

Panels must be free of dents and must be protected by means of a removable plastic skin.

Standard panel widths shall be 1200 mm

Panel joints shall be spline groove with 6 mm thick tempered masonite 95 mm wide splines. Mastic sealer and Tee piece cover strips shall be applied as per the standard drawing.

Wall to wall panel joints shall be stepped, with mastic sealer, 38 x 38 aluminium internal vapour seal angle and external Tee piece cover strips as per the standard drawing.

Wall panel to roof panel joints shall be stepped, with mastic sealer and 38 x 38 aluminium vapour seal angles internal and external.

Infill Panels (where necessary)

Infill panels shall be fitted to all exposed sides as detailed on the layout drawings and shall extend to the underside of the slab above. Panel thickness shall be 50 mm. Infill panels shall have a neat and tidy junction along the exposed sides and shall match the room panels with all joints corresponding with joints in the assembly wall panels.

Columns

Where columns occur inside rooms, these shall be clad with panels of the same construction, material and thickness as the respective room.

Vapour Sealing

All joints shall be sealed by applying a non-hardening mastic to produce a vapour seal that is effective and stays so even during movement of room panels caused by temperature variation.

Room Dimensions

The dimensions shown in the schedules and on the drawings are for tender purposes only. Full dimensioned shop drawings shall be submitted for approval before fabrication commences.

4 ROOF PANELS

Roof panels shall be similar to wall panels. Roof panels shall be able to span the rooms without sagging. Any additional support members required to prevent sagging and to support the blower coil shall form part of this contract.

The roof of those cold rooms over which condensers are to be installed, shall be suitably braced to prevent damage and sagging as a result of maintenance activities being carried out on top of these rooms.

5 INSITU FLOORS

Floor insulation in all new freezer rooms and cold rooms on suspended slabs only shall be provided unless otherwise indicated.

The floor insulation shall be 75 mm thick Sagex Megaphen 60 Kg/m³ density.

The contract shall include supply and installation of an under floor vapour barrier comprising of 150 micron membrane, single layer of insulation with tightly butting joints and covered again with a 150 micron membrane. The contractor shall provide 75 mm thick mesh reinforced concrete wearing slab, with integral kerbs and finished off with a wooden float. Concrete toppings shall be provided and finished by the builder. Floor to be same level as adjoining room.

6 DOORS

Doors shall provide a clear opening of 800 mm x 1900 mm high and shall be of the "slam-on" type.

Cold room door shall be provided with insulation and finish equal to that of the panels. The doors shall not twist or distort. The door frame shall be rigid with hinges capable of supporting the doors in the open position without buckling.

The door shall be equipped with heavy industrial grade chromium plated Hinges Kason No. 1055 and Safeguard Latch No. 55 or equal.

The door latch shall be capable of incorporating a padlock on the outside, but shall be fitted with internal safety release capable of operating whether the door is locked or not

Sliding door track holders shall be formed aluminium channel with extruded aluminium sliding track fitted to the channel. Nylon rollers shall have sealed bearings and mounted with horizontal and vertical adjustment. The lower guide assembly shall be manufactured from heavy gauge aluminium extrusion with nylon guides. Sliding arrangements shall be so constructed to drop the door down and into the frame.

Hinged and sliding doors shall be fitted with double rubber balloon type gaskets secured by channel section, screwed to the door for easy cleaning and replacement. Lower door seal to be wiper seal.

For Freezer Rooms, doors shall be slam-on type, with electric heating, and special "slam-on" hardware.

7 INSTRUMENTATION AND CONTROLS

Unless specified otherwise temperature control of cold rooms shall be by means of pressure switch cut out, and of freezer rooms by means of thermostat with solenoid valve and pump-down.

Supply and install cold storage Thermometer, Honeywell W200 British Rototherm, or equal, above the door. The thermometer shall be outside the door and outside any refrigerated passage with the bulb in the room.

Gauge to be 100 mm diameter, with chromium plated bezel.

Suction and delivery pressure gauges with cocks, mounted remote from compressor.

Gauges to be glycerine damped.

Unless specified otherwise in Part 6, defrosting facilities for Freezer Rooms shall be electric.

Defrosting shall be by means of Paragon type time switch to control the heater/compressor and fan.

Ensure that heaters are easily removable and that heaters can not remain on after the defrost cycle.

For freezer rooms heaters must be provided for doors and drains permanently on.

8 THERMOMETERS.

Supply and install one thermometer above each cold room and incubator room door architrave. The thermometer shall be 100 mm round dial type with flush mounting chrome plated flange.

Each thermometer capillary tube shall pass through a 20 mm diameter sleeve in the prefabricated panels which shall be sealed with a plastic sealing compound. The temperature range shall be -30°C to 50°C.

The capillary tube shall be brought to the bulb position in such a manner that it will be out of the way and not liable to be damaged. Alternatively it must be protected. The thermometer bulb shall be mounted 25 mm away from the wall on an approved bracket, as high as possible or near the ceiling corner. A serviceman's type of thermometer will not be acceptable.

9 LIGHTING.

Each room shall be supplied complete with ceiling mounted, low temperature, vapour proof light fittings suitable for +3°C duty in cold rooms. Light fittings shall be LASCON Model C10 258 ES (2 lamp 58W 5ft) with polycarbonate bowl and base and stainless steel mounting brackets. The lighting installation shall achieve average Lux levels of 225. Wiring from light fittings through the cold room/freezer ceiling up to a wall box in the slab above shall be included in the scope of this contract.

Light switches shall be externally flush mounted 5 amp with natural anodised aluminium switch plate finish. The switch plate shall be complete with a red pilot light wired in circuit with the light fittings to indicate that the lights are switched on.

Conduit boxes shall be fixed adjacent to the fittings and connections to the fittings shall be by means of rubber insulated flex with approved hermetically sealed glands.

The Contractor shall supply and install all necessary light switches, galvanised conduiting between light fittings and light switches and electrical switchboards containing switchgear, etc. for the various cold room equipment.

The positions of light fittings are shown on the accompanying drawings. The fixing of the light fittings shall not break the vapour seal and in order to eliminate condensation; fittings shall be installed such that there is no passage of air between the interior of the fittings and the cold room atmosphere. With the exception of the cable entry, fittings shall be completely free of any holes or apertures once the diffuser is fixed. This shall be achieved by means of external lugs fixed to the fitting body so that mounting screws do not penetrate the interior of the fittings.

DETAILED TECHNICAL SPECIFICATION

4.1 SCOPE OF WORK

The Contract, as detailed in these specification documents and the accompanying drawings, comprises of the manufacture, supply, delivery, erection, testing, commissioning, setting into operation and guarantee for a period of twelve months of the complete cold and freezer room installations. The provision of a switchboard and all interconnecting wiring between the cold and freezer rooms to the refrigeration equipment shall form part of this work.

4.2 STANDARDS AND REGULATIONS

The work shall be in full conformity with:

- SANS 1530-1-1991 Panels for Thermal Insulation for Cold Rooms
- Occupational Health and Safety Act 85/1993.
- Department of Works Standard Specification M-RCFM Issue 1,1998.
- SANS 9000 and SANS 9001 Quality Management Systems.

4.3 DRAWINGS.

4.3.1 Tender Drawings

The drawings accompanying this Specification as numbered D088 CR.01 (bound into document) shall be deemed to indicate the general layout and requirements only and are not Shop Drawings.

The Engineer shall provide the Contractor, free of charge, with 3 sets of Specification Documents, including Tender Drawings.

4.3.2 Architectural and Structural Drawings.

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

4.3.3 Builders Work Drawings.

All Builders Work and work to be carried out "by others" in accordance with the Specification has been indicated on the Tender Drawings. The Contractor shall check, approve, add to or alter such drawings as may be necessary to suit the plant offered by him, and accepted by the Engineer, within two weeks from date of acceptance of his Tender and shall submit to the Engineer in duplicate the revision which has been made to such drawings.

Such Builders Work Drawings shall indicate the location and extent of all foundations, bases, openings, timber frames and all other Builders Work, and the capacities and/or dimensions of all electrical and water supply points, the method of terminating such supplies and the position of the connection points, the position and dimensions for all water drainage connections and any other work to be provided by others for the Works, as detailed in this Specification.

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

Within a reasonable period after receiving such Drawings, the Engineer shall signify his approval, or otherwise, and one signed copy of each approved Drawing shall be returned to the Contractor. When approved, the following number of copies of each such Drawing shall be issued to each of the following:

Client	1 copy
Architect	2 copies
Structural Engineer	1 copy
Electrical Engineer	1 copy
Quantity Surveyor	1 copy
Main Contractor	3 copies

4.3.4 Shop Drawings.

The Contractor shall submit to the Engineer for approval within three weeks from date of acceptance of his Tender, duplicate copies of all Shop Drawings as required for the manufacture and installation of the Works or as the Engineer may reasonably require.

All Shop Drawings for work outside of plantroom shall be drawn to a scale of not smaller than 1 : 50 and all Drawings of work within plantroom shall be drawn to a scale of not smaller than 1 : 25. All details shall be drawn to a scale to show the detail required.

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

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

The Contractor shall supply copies of all approved Drawings in accordance with the requirements of Section MM Part 3 (Operating and Maintenance Manuals) of the Specification.

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

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

4.4 WORK TO BE CARRIED OUT BY OTHERS

Builder's Work

The provision of opening's and sleeves where necessary through beams, slabs, walls etc., and the sealing of same to provide an air-tight and water proof seal. Full details are to be provided timeously by the cold room contractor.

Brick partition walls as indicated.

Electrical Work.

The supply and installation of a power cable to the cold room switchboard and termination on the main isolator.

Plumber

Suitable drainage points will be provided where indicated on the drawings.

4.5 SITE CONDITIONS AND DESIGN CRITERIA

Altitude	1185 Metres above Sea Level
Ambient Dry Bulb	35°C
Refrigerant	R507
Running Time	Not less than 16 hours/24 hours
Compressor Selections	Based on Techumseh
Blower coil selections	Based on Recam
Room Temperature Difference	

4.6 INSPECTION OF SITE

No formal site inspection meeting will be held.

The prospective Tenderers are advised to thoroughly acquaint themselves with the nature and extend of work to be done and make allowance for items obviously intended and necessary for the proper completion of the Works, although not specified. Claims due to lack of knowledge will not be entertained.

4.7 DESCRIPTION OF EQUIPMENT

4.7.1 Rooms shall include:

Prefabricated panels and joining systems
Insitu floor insulation's and vapour barriers (where specified)
Doors complete with fittings
Infill panels
Vapour sealing
Wall and door protection
Dial thermometers
Condensate drains
Lighting
Shelving as specified
Racking as specified

4.7.2 Refrigeration shall include;

Condensing units
Blower coils
Refrigeration piping
Electrical installation including switchboard

4.7.3 Schedule of Cold Rooms

COLD ROOM NO	APPROX. INTERNAL ROOM SIZE LxBxH	DESCRIPTION	ROOM TEMP °C	COND TEMP	EVAP TEMP
Kitchen Cold Room	4600x2020x2070H	Cold Room	+1°C	45°C	-5°C
Kitchen Freezer Room	2270x2020x2070H	Freezer Room	-20°C	45°C	-25°C

4.7.4 Compressors

Compressors shall be sealed units unless size indicates semi-hermetic. The following compressors shall be considered acceptable.

Manuerop
Techumseh (American)
Techumseh (French)

4.7.5 Blower Coils

The following blower coils shall be acceptable.

Recam
Recoil.

4.7.6 Schedule of Refrigeration Loads and Equipment Selections.

DESCRIPTION	ROOM LOAD KW	CONDENSING UNIT	BLOWER COIL
Kitchen Cold Room	2.75 kW	TBA	TBA
Kitchen Freezer Room	3.10kW ⁱ	TBA	TBA

4.8 COLD ROOM CONSTRUCTION

4.8.1 General

Refer to the General Technical Specification, Part 3.
Cold Rooms shall be of the prefabricated modular construction consisting of metal clad insulated panels, precision formed for quick, efficient and clean installation. The system shall be frame-less free standing, self supporting and completely flexible. Each room shall be erected in the factory before disassembly and despatch to site. Only the products of recognised manufacturers shall be acceptable.

4.8.2 Panel Construction

The insulated panels shall consist of sheetmetal skins permanently bonded to polystyrene core using thermosetting glue.

Panels shall consist of high grade, fire resistant polyurethane insulation bonded to outer skins as specified, to form a sandwich panel. Inner skins of panels shall be of minimum 0,5 mm thickness. The outer skins of panels, where visible, shall be of minimum 0,9 mm thickness. Where panels abut walls, and roof panels the outer skin shall be 0,6 mm galvanised steel. The panels shall be equal to 'Chromadek' pre-painted galvanised sheet steel, with inner surfaces (facing insulation) coated with epoxy or vinyl primer. Outer surfaces shall be coated with baked silicon polyester or vinyl in an off-white colour, complete with protective plastic coating to be removed after installation.

All vertical corner joints, wall/ceiling and wall/floor joints both internally and externally shall be covered by 38 x 38 x 4 mm aluminium angle riveted to panels at intervals not exceeding 500 mm.

A silicone type sealer shall be applied to prevent the ingress of moisture between the joints and between the angles and floors.

Where the panels meet the false ceiling, an aluminium trim shall be used to cover all irregularities.

4.8.3 Condensing Units.

Condensing units shall include the following features.

Common integrated electrical board incorporating separate sections to include:

- Main Isolator
- Compressor motor protection
- Condenser fan motor protection
- Multifunction electronic controller
- Indicator lights
- High pressure reset
- Low pressure control
- Oil separator
- Vibration eliminators in refrigerant lines
- Aluminium/copper condenser coils
- Refrigerant service valve
- Oil safety control
- Receiver tank
- Liquid service valve
- Sump heater
- Filter drier
- Liquid moisture indicator
- Suction accumulator

Compressors and condensing unit fans shall be 3-phase.

Refrigerant shall be R507.

Condensing units shall be located as shown on the drawings, using suitable anti-vibration mounts to prevent vibration being transmitted into the structure.

Air cooled condensers shall be selected for an ambient air temperature of 35°C. The refrigeration loads shall be based on a minimum of 16 hours compressor running time per 24 hours and do not include compressor heat.

4.8.4 Dial Thermometers

Each room shall be fitted with a 100 mm diameter on the outside of the room adjacent to the door to indicate room temperature.

4.8.5 Temperature Monitoring and Alarm

Electronic temperature monitoring and logging equipment shall be provide to monitor and record the internal temperature of the Cold Room. The unit shall be mounted external to the room and be complete with and audible alarm and warning light, to indicate when the temperature within the Cold Room exceeds the MAXIMUM and MINIMUM setpoints. The alarm shall operate together with a RED lamp, which the later shall only switch off if the temperature returns to within setpoints. The audible alarm shall have an ACCEPT button to silence.

4.9 DRAIN PIPING

Drain piping shall be suitably fixed and sloped toward the connection provided by the plumber, the first 5m shall be insulated.

Final connection to waste shall form part of this Contract.

Tenderers shall provide sufficient cleaning access points in line where required.

4.10 ELECTRICAL WORK

The general requirements of Part Three shall apply.

Provide control panels where indicated on the plans.

Electrical power will be supplied at the refrigeration switchboard only. Tenderers shall allow for all further wiring from this board, in PVC conduit.

The switchboard is to be surface mounted and all wiring, switchgear and controls form part of this Contract.

Provide and install watertight remote isolators at each blower coil.

Provide and install watertight light fittings in cold room and freezer room as indicated on the plans. Light fittings shall be bulkhead type, incandescent and shall be easily serviceable. Light switch to be adjacent to cold room.

Provide and install pilot lamps with red lenses at the light switch to indicate when light in cold room is on.

4.11 ELECTRICAL SWITCHBOARDS AND CONTROLS

Supply voltage - 400V/3/50/4 wire

Control voltage - 230 Volts line to neutral

The switchboard will be provided with normal and emergency electrical power supply by the Electrical Contractor who will also connect the above supply to the main isolator of each switchboard.

All controls for motors shall be so arranged, that if the main supply to a motor is disconnected, controls are de-energised.

All electrical work shall comply with the requirements of the local Municipal Authorities and the Code of Practice for the "Wiring of Premises" SANS 10142 as amended.

4.12 MAINTENANCE

The Contractor shall include in his tender price for the maintenance of the complete installation for a period of ONE YEAR after first delivery of the entire plant has been taken by the Secretary for Works or his representative.

The Contractor shall visit the installation at regular intervals on an acceptable and agreed day and perform full maintenance on the basis of a proper preventive maintenance programme approved by the Engineer.

The Contractor shall report to an official nominated by the Hospital Engineer on arriving and again at leaving the hospital premises on the occasion of each visit. Such person, who has been nominated by the Hospital engineer, shall sign a Service report giving details of any defects made good, temperature readings taken, etc. A copy of such Service Report is to be submitted to the Engineer and Hospital Engineer liaising with the Consultant Engineer in all cases.

At each service visit, the contractor shall, inter alia perform the following duties in addition to any other which may be necessary.

Check condensing units for correct functioning and refrigeration system for leaks, refrigerant dryness, sufficient oil level, sufficient refrigerant, and operation of all safety controls and settings etc.

Check blower coil units including defrost cycle and expansion valves, solenoids, etc.

Check all fans and drives, lubricate moving parts and check all lock-out stops.

Check and clean condensing unit coils.

Check all switchboards. Tighten connections, check contacts and switchgear for burnt contacts, check overload settings, phase failure relays etc. Replace defective volt metres, ammeters, transformers, pilot lights, etc.

Check all operating and safety devices such as high and low pressure switches, door switches, thermometers, alarm thermostats, etc.

Make good any defects as required in terms of the guarantee given for the plant in terms of the specification.

Attend to any complaints made with respect to the installed plant by the authorised person mentioned in the foregoing. No other person shall have any right to instruct the contractor or make any complaint.

The Contractor shall further instruct the Hospital maintenance personnel on the maintenance of any item requiring more frequent attention than during his service visits.

A major service shall be executed by the Contractor in the twelfth month of the contract maintenance period.

4.13 GUARANTEE

The Contractor shall guarantee the materials, apparatus and workmanship delivered by him for a period to twelve months. The guarantee must be valid for a period starting on the date when the Contract is accepted by the Secretary for Works or his representative as completed and in working condition. The complete installation must be guaranteed

against defects as a result of patent and latent defects of the apparatus as well as against faulty materials and workmanship. Fair wear and tear is excluded from the guarantee. The guarantee must provide for all parts, spares and appurtenances, which become defective during the guarantee period, to be replaced free of charge to the Administration or to the Engineer. All costs of labour, out of town allowances, materials and transportation required to replace such part of a defective installation shall be borne by the contractor and shall be included in his guarantee. The Contractor shall cede to the Administration the remainder of any equipment guarantee which he has received from his suppliers and which may extend beyond the period of twelve months mentioned herein.

4.14 OPERATING AND MAINTENANCE MANUALS.

Refer to Section MM, of Technical Specification.

PART 4

PROJECT SPECIFICATION – LAUNDRY EQUIPMENT

5.1 GENERAL REQUIREMENTS

Tenderers are to make special note of the following:

The whole installation shall be in accordance with the Occupational Health and Safety Act 85 of 1993 and all regulations framed therein and shall be carried out to the satisfaction of the Head Works Representative.

Tenderer's attention is drawn to the provision of the clause – "Substitution of Materials" in the Preliminaries.

All work shall be carried out by competent workmen skilled in their trade. Quality shall be of the best standard practice and all workmanship will be subject to approval of the Head Works Representative.

All apparatus, component parts, fittings and materials employed in the execution of the Contract shall be new and unused and shall be the latest type or pattern of the particular manufacture employed. SABS mark bearing items shall be used wherever possible.

Rates shall include for all necessary electrical wiring and equipment to complete the installation as specified.

The installation shall be maintained for a period of twelve months after acceptance in writing by the Head Works Representative.

All materials necessary for the servicing shall be supplied by the kitchen unit contractor during this period, including all consumable items.

The complete installation must be guaranteed against defective parts and workmanship for a period of twelve months after the date of issued of the Completion Certificate. This period shall run concurrently with the maintenance period.

Rates are to include for testing and commissioning of the complete installation and handing over in complete working order and ready for use.

Tenderers are advised to visit the site and acquaint themselves fully with the site conditions and nature and full extent of the work involved prior to submitting their tender. Claims on the grounds of insufficient information in such respects or otherwise will not be entertained by the Administration.

The Administration reserves the right to make emergency repairs to keep the equipment in operation without voiding the Contractor's guarantee, nor relieving the Contractor of his responsibility during the guarantee period when, after proper notice, the Contractor fails to attend to such emergency repairs. All costs incurred by the Administration under these circumstances will be for the account of the Contractor.

5.2 SCOPE OF WORK

This specification calls for the supply and delivery to site, installation, electrical wiring, testing, commissioning, handing over in complete working order, ready for use and subsequent maintenance and guarantee for a period of twelve months of all plant and equipment necessary for the Laundry installation as specified hereinafter and as detailed on the drawing.

5.3 INSTALLATION DETAILS

The installation shall comprise the following: -

- a) Supply and installation of complete laundry equipment as indicated on drawings,
- b) All electrical power wiring and controls as specified.
- c) All other work not specifically, but necessary for the successful operation of laundry.
- d) Testing and commissioning of the complete installation and staff training of equipment.
- e) Maintenance and guarantee of the installation for twelve months after issue of the Completion Certificate.

Tenderers are advised to visit the site and acquaint themselves fully with the site conditions and nature and full extent of the work involved prior to submitting their tender. Claims on the grounds of insufficient information in such respects or otherwise will not be entertained by the Administration.

5.4 5 TIER STAINLESS STEEL MODULAR STORAGE SHELVING

Supply and install two (2) washer extractors in the position indicated. The machine shall be of the electric heated type and shall have a dry mass washing capacity per load 19kg, as indicated on drawings.

The washer extractor shall be of the front loading, rear removal type with heavy-duty stainless steel door to suit the 667mm diameter drum with a vacuum tight seal and heat-treated, shatterproof circular door glass. The door shall be interlocked with the starting mechanism so that the machine cannot run with the door in the open position.

The outer cabinet shall be fitted with 304 stainless steel panels with a satin finish and shall have dimensions as indicated on drawings. The framework shall be constructed of heavy gauge mild steel hot dipped galvanised or protected against moisture with a porcelain finish. The top and front panels shall be easily removable for servicing.

The inner and outer drum shall be constructed of Grade 430 stainless steel with lifters pressed from solid sheet. The perforations of the inner drum shall be of the especially large type to allow for easy penetration and extraction of liquid during the rinsing and extract processes. The drive shaft shall be supported on two heavy-duty ball bearings sealed against penetration of moisture.

Heating shall be by means of electric heating.

A 19mm diameter cold water inlet and a 76mm diameter drain outlet shall be fitted. The water inlet shall be connected into the nearest cold water supply. The drain outlet shall be run to the nearest drain. All piping to be suitably sized copper tubing.

The washer shall have completely automatic wash cycles with built in programmes to control water level and temperature, duration of wash and spin, supply dosing control, wash action rotation, flush control, rinsing and high speed extraction. These shall include four (4) pre-set wash formulas for hot, warm, medium and cold water washed. Wash speed shall be 47 rpm and high extraction speed shall be not less than 470 rpm.

The washer shall incorporate a multi-compartment self-cleaning dispenser to automatically dispense detergent for pre-wash, detergent for main wash and fabric softener for final rinse.

The washer shall be suitable for a 400 volt, three phase, 50Hz AC power supply.

The washer shall be the Gribreau high spin unit or other approved.

5.5 TUMBLE DRYERS

Supply and install two (2) tumble dryers in the position indicated. The machine shall be of the electrical heated type and shall have a dry mass capacity per load, as indicated on drawings.

The tumble dryer shall be of the vertical freestanding front loading type with large loading door with heat-resistant glass. The door shall be interlocked with the starting mechanism so that the machine cannot run with the door in the open position.

The inner drum shall be manufactured in heavy gauge galvanised sheet metal with outwardly embossed perforations and lifter to ensure thorough tumbling of goods processed.

The outer cabinet shall be fitted with sheet steel panels finished in electrostatically applied baked enamel paint and shall have dimensions as indicated on drawings. The framework shall be constructed of heavy gauge mild steel hot dipped galvanised or protected against moisture with a porcelain finish. The top and front panels shall be easily removable for servicing.

The machine shall be fitted with self-cleaning fine mesh lint filters that automatically deposit lint into a large storage area for easy removal.

The tumbler shall be activated by a push-to-start button and stopped when the door is opened. An illuminated light shall inform the user of drying cycle status.

The machine shall be equipped with thermostat control panels to enable a choice of drying temperatures to be selected, and dial type timers shall be fitted.

Exhaust ductwork shall be installed from the tumbler to the outside of the building. Ductwork to be in galvanized steel, ϕ 250mm or sized to suit the tumbler's air outlet. Duct work to include for all running joints, bends, fittings, supports etc., terminated in a galvanised wire mesh grille.

The tumbler shall be suitable for a 400 volt, three phase, 50 Hz AC power supply.

5.6 STAINLESS STEEL TABLE

The top shall be constructed of 1.0mm, type 430 stainless steel with a backing sheet of 1.2mm thick mild steel finished in baked enamel and having a vermin proof sound deadening compound spread evenly between the surfaces. The front and sides of the top shall have a turn down of 63mm and a 12mm turn under. The top shall be fixed to a 38mm x 38mm x 3mm thick angle iron frame sufficiently braced, welded to the backing sheet and finished in baked enamel. The top shall be supported on 45mm diameter type 304 stainless steel tubular legs with stainless steel corner gussets for bolting to the support frame and fitted with zinc, die-cast adjustable feet. Complete with Solid galvanised shelves.

3 off 2300 mm x 650 mm x 910 mm high.

5.7 ELECTRICAL WIRING

All electrical wiring shall be carried out in a neat and tidy manner and the best quality materials must be used. The whole installation shall comply with: -

The Code of Practice for the Wiring of Premises as issued by South African Bureau of

Standards. (SANS 10142)

The Occupational Health and Safety Act, Act 85 of 1993.

The Municipal By-laws and any special requirements of the Supply Authority of the area of district concerned.

Local Fire Regulations.

5.8 OPERATING INSTRUCTIONS

The contractor shall, at his cost, prepare and supply three manuals for the successful operations and maintenance of the installation. The information shall be forwarded to the Head Works Representative before first delivery of the equipment is taken.

5.9 TESTS

On completion of the installation, the contractor shall carry out tests on the equipment to ascertain the correct operation of all component parts with emphasis directed towards the safety controls and operation.

The laundry equipment contractor shall provide all the necessary staff and properly calibrated instruments for the necessary test, which shall be executed in the presence of and to the satisfaction of the Head Works Representative.

5.10 BUILDERS WORK

Holes through the walls for the installation of water piping, drain piping and exhaust air ductwork shall form part of this specification and is to be allowed for by the laundry equipment contractor.

5.11 SERVICING AND MAINTENANCE DURING GUARANTEE PERIOD

Quotations for the following type of service must be provided in the Price Summary:

Maintenance services

Four services at 3-monthly intervals in accordance with the suppliers recommended maintenance schedules.

5.12 OPERATING AND MAINTENANCE MANUALS.

The Contractor shall furnish to the Engineer three bound copies of Operating and Maintenance Instructions prior to the final acceptance of the installation.

Index

Description of the System.

Operation of the System.

Plant and Equipment – including Model Numbers and Suppliers.

Test Report.

Maintenance Instructions.

Spare Parts List.

Descriptive Literature.

Record Drawings (both HARD COPY and ELECTRONIC FORMAT - drawing AutoCAD)

Service Records

5.13 OPERATING AND MAINTENANCE MANUALS

The Contractor shall provide substantive training to selected end user staff in the correct operation and operator maintenance procedures of each item of equipment supplied by himself and requiring such training.

He shall issue a "Certificate of Training" to each staff member for each item of equipment on which the staff member has been trained. These certificates of training are to be signed by the Air Conditioning Contractor and the staff member concerned. Copies of these certificates shall be submitted to the Engineer for inclusion in the Practical Completion \ First Delivery Certificates

PART 4

FIRE APPLIANCES

PROJECT SPECIFICATION

2.1 SCOPE OF WORK

The work covered by this Contract comprises the servicing of existing and the replacement and installation of new fire hydrants, fire hose reels and portable extinguishers;

2.2 PRINCIPAL ITEMS OF WORK

The principle items of work for which the Contractor must allow are briefly as follows.

- Ensure that all existing portable fire extinguishers have current maintenance certificates attached, and where applicable, service appliances in accordance with appropriate SANS codes.
- Where indicated replace missing and/or supply and install new portable fire extinguishers.
- Ensure that all existing fire hose reels, hydrants and booster connections have current maintenance certificates, and where applicable services appliances in accordance with appropriate SANS codes.
- Where indicated, replace missing and/or supply and install new fire hose reels and hydrant valves.

2.3 STANDARDS AND REGULATIONS

The work shall be in full conformity with:

SANS 1475-1:2005 – Reconditioning of portable and wheeled (mobile) rechargeable fire extinguishers.

SANS 1475-2:2003 – Reconditioning of fire hose reels, hydrants and booster connections.

SANS 1567:2003 – Portable rechargeable fire extinguishers – Co₂ type.

SANS 10105-1:2005 – Selection, installation and routine inspection of portable and wheeled (mobile) extinguishers.

SANS 10105-2 2005 – Installation and inspection of fire hose reels, hydrants and booster connections.

SANS 1910:2003 – Portable, refillable fire extinguishers.

The Occupational Health and Safety Act, 1993 (Act 85 of 1993), as amended, or any other substituting or augmenting legislation which may be enacted before tender closure.

The Local Government Ordinance 1030 (Ordinance 17 of 1939) as amended and the local Municipal By-laws and Regulations as well as the Regulations of the local Supply authority

and any special requirements of the local supply authority.

The Fire Brigade services Act 1993 Act 99 of 1987 as amended.

All other applicable standards and codes of practice and local regulations having jurisdiction.

FIRE DETECTION AND ALARM EVACUATION

PROJECT SPECIFICATION

1. SCOPE OF WORK

The work covered by this Specification comprises;

The supply, delivery, installation, testing, commissioning and 12 months guarantee of the New Fire Detection and Alarm Evacuation Systems within the main building at the SAPS Decentralised Training Facility, Newcastle.

2. PRINCIPAL ITEMS OF WORK

The principle items of work for which the Contractor must allow are briefly as follows.

- The **Analogue Addressable** Fire Detection and Alarm Evacuation Installation. The contractor shall ensure the correct sizing, spacing and location of all equipment necessary for compliance and approval as specified.
- Alarm devices such as detectors, break glass units, alarm panel, extended light indication, remote interface units and alarm sirens, shall be installed in positions as indicated on the drawings.
- The alarm devices shall be wired to the alarm panel located at the Duty Officers Room. The panel shall have at least four (4) loops, as stipulated in the Bill of Quantity, supporting a minimum of 508 devices. The panel shall be suitable for "peer to peer" networking.

3. OTHER WORK SPECIFICALLY INCLUDED

The following work is Specifically Part of this Contract.

- .1 All builders' work including the forming of holes in walls and making good thereafter.
- .2 The cutting of holes in suspended ceilings and ceiling tiles for the fixing of detector heads, siren and other devices.
- .3 The provision of all wire ways and conduits (with draw wires), draw boxes, draw trays, sleeves, trunking etc., where surface fixed, as specifically indicated on the drawings.

4. SITE CONDITIONS

4.1	Altitude	1185 Metres above Sea Level
	Ambient Dry Bulb	35°C

5. INSPECTION OF SITE

The prospective Tenderers are advised to thoroughly acquaint themselves with the nature and extent of work to be done and to make allowance for items obviously intended and necessary for the proper completion of the Works although not specified. Claims due to lack of knowledge will not be entertained.

6. STANDARDS AND REGULATIONS

The work shall be in full conformity with:

SANS 10139 (as amended) Fire detection and alarm systems for buildings – System design, installation and servicing.

BS 5839 – Fire detection and alarm systems for buildings.

NFPA Codes of Practice

The Occupational Health and Safety Act, 1993 (Act 85 of 1993), as amended, or any other substituting or augmenting legislation which may be enacted before tender closure.

The Local Government Ordinance 1030 (Ordinance 17 of 1939) as amended and the local Municipal By-laws and Regulations as well as the Regulations of the local Supply authority and any special requirements of the local supply authority.

The Fire Brigade services Act 1993 Act 99 of 1987 as amended.

The National Building Regulations and Building Standards Act, 1977 (Act 103 of 1977) as amended, as well as any incorporated Standards. SANS 10142.

All other applicable standards and codes of practice and local regulations having jurisdiction.

7. SYSTEM OPERATION

Fire Detection and Alarm Evacuation

The fire detection and alarm evacuation installation shall operate as follows:

In the event of a heat, smoke or combustion gas detector and/or break glass unit being activated as a result of a fire condition (i.e. not "fault"), within a monitored area of the building, the specified audible and visual alarms shall be activated on the fire control panel associated with the zone in which the fire has been detected.

The device address and location, as defined on the drawings, shall be indicated on the LCD display of the fire control panel.

The generation of a fire alarm shall immediately initiate the following, within the affected fire zone only.

- All sounders within the building shall operate. However, facility shall be incorporated at the Fire Control Panel to manually activate such sounders by zone.
- All interface signals to other services shall be initiated.
- In the event of an alarm occurrence, a common signal will be sent to the Fire Station.

8. EQUIPMENT DETAILS

8.1 Fire Control Panel

- 1.) The Fire Control Panel shall include the following:
 - a) Annunciators
 - b) Power Supply Modules
 - c) Automatic Fault Monitoring Modules
 - d) Module including all necessary relays for switching functions
 - e) Main and Standby Tone Generation Modules

- 2.) The panel shall be of modular construction using solid state components to operate the system. Alarm initiating circuits shall meet the approved requirements for limited energy application and function for the required period of time. The equipment shall function satisfactorily at the normal mains voltage $\pm 10\%$ and within the following parameters:
 - a) With the batteries disconnected.
 - b) With the batteries connected as for normal use.

With the batteries connected in the discharged condition.

- 3.) A fully discharged cell is defined in terms of final voltage. For the purpose of this specification a battery is considered fully discharged when it is unable to maintain output in excess of the final voltage, measured at one minute intervals, whilst it is subjected to the maximum design load of the system.

- 4.) The panel shall contain all necessary equipment including internal trouble signals with silencing switches.

- 5.) Trouble silencing switches shall be furnished each with its associated pilot lamp so that faults on the alarm initiating circuits and the alarm signal circuits can initiate trouble signals and be silenced independently of each other.

Alternatively this can be done electronically using one common silencing switch. However, using either method, the silencing of one signal shall not prevent further signals from sounding the trouble alarm.

- 6.) Any relays used for critical alarm functions shall have the necessary respective coils electrically supervised and shall alarm in the event of an open circuit.

8.2 Annunciator

- 1.) Annunciator modules shall indicate fire and fault conditions. The fire indication shall be red and the fault indication amber. Initiating devices shall be individually identified on the Annunciator Panel.

- 2.) Clearly identified zone indicators shall be provided for fire and fault conditions. It shall be necessary to restore the alarm initiating device to normal and manually reset the annunciator indication lights. The Control Panel test switch shall test all circuit components necessary to sound an alarm as well as all the alarm lamps.

Provision shall be made for more than one test switch where it is not practical to use one test switch. All field wires connected to alarm initiating devices necessary to actuate an annunciator shall be electrically supervised, and a single short circuit, open or ground fault shall not cause illumination of any fire alarm indicator. The removal of any detector shall cause the relevant zone fault to alarm.

- 3.) The type of zone indicator used for the fire alarm system, and the specified critical alarms shall be one of the following:
 - a) Two lamps connected in parallel associated with each indicator and arranged so that the failure either of the lamps is apparent during the course of a routine test
 - b) Two light emitting diodes (LED's) connected in parallel with each indicator and arranged so that failure of either of the lights is apparent during the course of a routine test. Proprietary LED holder complete with lenses shall be used and the direct soldering of wires to LED connection leads shall not be permitted.
 - c) One lamp associated with each indicator and the circuit arranged so as to give an audible fault warning immediately on the failure of any lamp at any time.
- 4.) For all other auxiliary alarm indicators it shall only be necessary to have one lamp or one light emitting diode.

8.3 Fault Warning

- 1.) An immediate fault warning or trouble signal shall be given by:
 - a) An audible warning from a sounder situated within the indicating equipment.
 - b) A visible indication on the indicating equipment.
- 2.) A fault warning shall be given in the event of any of the following occurring:
 - a) Failure or disconnection of the normal power supply.
 - b) Failure or disconnection of the standby power supply.
 - c) Failure or disconnection of the battery charging equipment.
 - d) Failure or disconnection of the leads to the alarm sounders (fault warning facility per zone).
 - e) Failure of any fuse or protective device.
 - f) Isolation of any of the fire signal circuits.

8.4 Interfacing

- 1.) The Central Control Unit shall interface with the following peripheral device/systems at the positions indicated on the drawings.
 - a) Access Control System (if installed).
 - b) Air Conditioning Installation.

c) Lift Installations (if installed).

8.5 Remote Signal

- 1.) Facilities shall be provided at each Control Panel, for signalling all fire and fault alarm indication to a remote station via volt free contacts.

8.6 Branch Circuits

- 1.) Outputs to any ancillary services powered from the control equipment power supply shall be fused or similarly protected to ensure the safety of the control equipment. In addition, isolation switches shall be provided for maintenance and testing of the following:
 - a) Each fire service signal facility.
 - b) Each remote signal facility.
- 2.) The operation of any of the isolation switches shall initiate the fault warning as described in Clause 8.3.

8.7 Battery and Charger (24V DC).

- 1.) The normal (main) supply shall be 230/240V AC and a standby supply of 24V DC shall take over immediately upon a failure of the main supply. The changeover shall be automatic and must not interrupt the operation of the fire alarm system.
- 2.) The standby batteries shall be heavy duty sealed lead acid with the required amount of cells necessary for the system voltage. They shall have sufficient capacity to supply the largest load placed on them under normal, fire and fault conditions. The batteries shall be rated for a period of 24 hours normal load and 30 minutes fault alarm load for the complete Detection Evacuation System.
- 3.) Battery charging equipment shall incorporate automatic control features with the output designed to charge and maintain the cells within the limits specified by the battery manufacturer. The charger shall be capable of recharging the batteries fully within 12 hours. Under normal charging service, the charger shall charge the batteries at a high rate and automatically switch to a low charge rate when the batteries are fully charged.
- 4.) The charger shall contain a voltmeter, an ammeter and an indicating lamp shall illuminate to indicate the 230/240V AC power source. The battery charger shall be current limited to prevent damage in the event of a short circuit in the battery leads or a reversal of polarity.
- 5.) Fault warnings shall be provided as detailed in Clause 8.3.
- 6.) The battery shall be housed in a suitable robust ventilated cabinet.

8.8 Detectors

- 1.) An indication light on each detector shall indicate when smoke or combustion gas is detected. Extended lights shall be installed where detectors are located above ceilings, or where they are concealed in any way.

- 2.) Infra red detectors shall not respond to constant infrared radiation or short flickering phenomenon.
- 3.) Heat sensitive detectors shall incorporate a rate of rise feature as well as a fixed temperature alarm.
- 4.) All the above mentioned detectors shall utilize a common standard base mounting to ensure uniformity and flexibility with the installation.

8.9 Sirens

- 1.) The siren lines shall be electronically supervised for short and open circuits.

8.10 Strobe Alarm Lights

- 1.) Strobe alarm light lines shall be electronically supervised for short and open circuits.
- 2.) Strobe alarm lights shall be type Zenon Beacon (or similar approved), with red lens suitable for 24V electrical supply and have a flashing energy of 0.5 joule.

8.11 Relays

- 3.) All necessary relays shall be provided for operating air conditioning/ventilation plants, operating alarms and indicating on panels as specified.
- 4.) The relays shall each be provided with a minimum of one normally open and one normally closed contact rated at 5 amps.
- 5.) The relays shall be mounted in a separate compartment in the control unit and wired to terminals and wiring from the outgoing terminals of the Control Unit to the terminals of the appropriate air conditioning switchboard shall be executed by the Fire Services Sub-Contractor.

8.12 Terminals

Terminals shall be provided for each input and output and shall be suitable for DIN rail mounting and each terminal shall be provided with proprietary identification markers. Where a terminal has insufficient capacity for the number of connections, proprietary insulated insertion bridges shall be used. Allowance shall be made for 10% spare capacity with minimum of 10 terminals.

8.13 Electronic Door Holders (where specified)

- 1.) Electronic Door Holders shall be suitable for operation with 24V DC power supply.
- 2.) The unit shall be suitable for either wall or floor mounting as applicable.
- 3.) Units shall be suitable for surface fixing with rear (concealed) cable entry.

8.14 Labels

- 1) Engraving, silk-screening or etching on indication lights or adjacent to the lights must be clear and easy to understand. Approval of the method used must be obtained from the Engineer before manufacture commences.

8.15 Break glass Units

- 1.) Surface mounted break glass manual alarm units shall be provided where indicated on the drawings. The unit shall be of the normally open type with contacts rated at 5 amperes. The resettable front element shall only require firm thumb pressure to activate. A test probe shall be provided with each unit to enable the unit to be tested on site. The front of the unit shall be fitted with a hinged plastic cover to prevent accidental operation and shall be clearly marked "FIRE/BRAND".

8.16 Electrical Wiring.

- 1.) Refer to Standard Technical Specifications.

All electrical wiring shall be carried out in accordance with local regulations in fire retardant cables complying with SANS 10139 Classification PH30, encased in conduit and trunking as specified, to the satisfaction of the Engineers.

8.17 Conduit

All conduit and trunking shall be supplied and installed as part of this Contract and comply with the Standard Technical Specifications.

9. COMMISSIONING AND TESTING

- 1.) The installation shall be commissioned and tested to the satisfaction of the Engineer with the following minimum requirements.
- 2.) Each and every trigger device shall be tested.
- 3.) The supervision of each applicable circuit shall be tested.
- 4.) All the functions of the control unit shall be tested.
- 5.) All time delays shall be checked for accuracy and that the timers will complete their cycles even though wiring between them and their detector circuits are interrupted.
- 6.) The power supply, battery and automatic changeover shall be tested.
- 7.) All audible and visual alarms shall be tested.
- 8.) All air conditioning plant signals shall be tested in the presence of the respective Sub-Contractor's representative.

10. OPERATING AND MAINTENANCE MANUALS

- 1.) Refer to part Technical Specification.

Suitable framed operating instructions shall be mounted in a position to be determined by the Engineer. These instructions must be in English and must state clearly the procedure to be followed in the event of a fire or fault condition.

Three additional copies of the operating instructions and zone plans and one electronic copy and record drawings shall be bound with maintenance instructions and spare parts listed in stiff cover binders and handed to the Engineer on completion of the installation. Record Drawings shall also be provided in electronic (ACAD 2004) format on CD.

11. MAINTENANCE AND SERVICE

The Contractor shall guarantee all plant and equipment, and shall maintain and service the entire plant for a period of 12 months from the date of the Practical Completion Certificate. During the Maintenance Period, the plant shall be serviced at Bi-Annual Intervals, when it shall be necessary for a responsible person nominated by the Owner, to sign a service report, a copy of which shall be sent to the Engineer.

12. TRAINING

The Contractor shall provide substantive training to selected staff in the correct operation and operator maintenance procedures of each item of equipment supplied by himself and requiring such training.

He shall issue a "Certificate of Training" to each staff member for each item of equipment on which the staff member has been trained. These certificates of training are to be signed by the Fire Detection & Alarm Evacuation Contractor, the End User Staff Member concerned. Copies of these certificates shall be submitted to the Engineer for inclusion in the Practical Completion \ First Delivery Certificates

PART 4

PROJECT SPECIFICATION – KITCHEN EQUIPMENT

5.1 GENERAL REQUIREMENTS

Tenderers are to make special note of the following:

The whole installation shall be in accordance with the Occupational Health and Safety Act 85 of 1993 and all regulations framed therein and shall be carried out to the satisfaction of the Head Works Representative.

Tenderer's attention is drawn to the provision of the clause – "Substitution of Materials" in the Preliminaries.

All work shall be carried out by competent workmen skilled in their trade. Quality shall be of the best standard practice and all workmanship will be subject to approval of the Head Works Representative.

All apparatus, component parts, fittings and materials employed in the execution of the Contract shall be new and unused and shall be the latest type or pattern of the particular manufacture employed. SABS mark bearing items shall be used wherever possible.

Rates shall include for all necessary electrical wiring and equipment to complete the installation as specified.

The installation shall be maintained for a period of twelve months after acceptance in writing by the Head Works Representative.

All materials necessary for the servicing shall be supplied by the kitchen unit contractor during this period, including all consumable items.

The complete installation must be guaranteed against defective parts and workmanship for a period of twelve months after the date of issued of the Completion Certificate. This period shall run concurrently with the maintenance period.

Rates are to include for testing and commissioning of the complete installation and handing over in complete working order and ready for use.

Tenderers are advised to visit the site and acquaint themselves fully with the site conditions and nature and full extent of the work involved prior to submitting their tender. Claims on the grounds of insufficient information in such respects or otherwise will not be entertained by the Administration.

The Administration reserves the right to make emergency repairs to keep the equipment in operation without voiding the Contractor's guarantee, nor relieving the Contractor of his responsibility during the guarantee period when, after proper notice, the Contractor fails to attend to such emergency repairs. All costs incurred by the Administration under these circumstances will be for the account of the Contractor.

5.2 SCOPE OF WORK

This specification calls for the supply and delivery to site, installation, electrical wiring, testing, commissioning, handing over in complete working order, ready for use and subsequent maintenance and guarantee for a period of twelve months of all plant and equipment necessary for the kitchen installation as specified hereinafter and as detailed on the drawing.

5.3 INSTALLATION DETAILS

The installation shall comprise the following: -

- a) Supply and installation of complete kitchen equipment as indicated on drawings,
- b) Supply and installation of kitchen extract canopy, ducting and fan.
- c) All electrical power wiring and controls as specified.
- d) All other work not specifically, but necessary for the successful operation of kitchen.
- e) Testing and commissioning of the complete installation and staff training of equipment.
- f) Maintenance and guarantee of the installation for twelve months after issue of the Completion Certificate.

Tenderers are advised to visit the site and acquaint themselves fully with the site conditions and nature and full extent of the work involved prior to submitting their tender. Claims on the grounds of insufficient information in such respects or otherwise will not be entertained by the Administration.

5.4 5 TIER STAINLESS STEEL MODULAR STORAGE SHELVING

Comprising of:

6 off 820 x 380mm Shelves

11 off 1120 x 380mm Shelves

The shelves shall be manufactured from 1,2mm type 304 solid stainless steel. The shelves shall have a turn down of 35mm and a return of 12mm on all four sides. The end frames shall be manufactured from 2,5mm type 304 stainless steel formed into a 20 x 30 x 20mm channel. The foot plate shall be stainless steel flat bar measuring 510 x 40 x 5mm. A tie bar of 40 x 5mm type 304 stainless steel flat bar shall join the two uprights at each end frame.

The uprights shall have pre-drilled holes to enable the height of the shelves to be adjusted.

Shelf fixings shall be cadmium M10 x 50 Hex Screws, M10 nuts, washers, spring washers and 30 x 30mm spacers.

5.5 4 TIER CAMSHELVING MODULAR STORAGE SHELVING

Comprising of:

9 off 1220 x 460 x 1860mm high Shelves

1 off 1070 x 460 x 1860mm high Shelves

The shelves shall be manufactured from composite material with easily removable shelf plates

Units to be Cambro or other approved.

5.6 STAINLESS STEEL TABLE WITH SPLASHBACK

The top shall be constructed of 1.0mm, type 430 stainless steel with a backing sheet of 1.2mm thick mild steel finished in baked enamel and having a vermin proof sound deadening compound spread evenly between the surfaces. The front and sides of the top shall have a turn down of 63mm and a 12mm turn under. The top shall be fixed to a 38mm x 38mm x 3mm

thick angle iron frame sufficiently braced, welded to the backing sheet and finished in baked enamel. The top shall be supported on 45mm diameter type 304 stainless steel tubular legs with stainless steel corner gussets for bolting to the support frame and fitted with zinc, die-cast adjustable feet. Complete with Solid galvanised shelves.

10 off 1650 mm x 650 mm x 910 mm high.

1 off 2300 mm x 650 mm x 910 mm high.

5.7 STAINLESS STEEL PREPARATION SINKS

Comprising of:

2 off 1850 x 650 x 1060 mm high double bowl sinks

The top shall be constructed of 1.2 mm type 304 stainless steel and shall have a 20 mm drip fillet to the front and sides and has a 150 mm high integral splashback at rear. The drainers shall be fluted and drain towards the centrally situated integrally welded bowls.

The front and sides shall have a 63 mm turn down with 2 mm turn under. The drainer sections shall be fitted with a 1.6 mm mild steel backing sheet under, finished in baked enamel and having a vermin proof, sound deadening compound spread evenly between the surfaces.

The bowl size shall measure 506 mm long x 506 mm wide x 250 mm deep and shall be constructed of 1.2 mm, type 304 stainless steel and shall be complete with a 40 mm diameter waste outlet hole. The top shall be fixed to a 38 mm x 38 mm x 3 mm thick angled iron frame, sufficiently braced, welded to the backing sheet and finished in baked enamel.

The top shall be supported on 45 mm diameter, type 304 stainless steel tubular legs with stainless steel corner gussets for bolting to the support frame. The unit shall be fitted with zinc, die-cast adjustable feet.

5.8 DOUBLE BOWL POT SINK

Comprising of:

1 off 1850 x 650 x 1060 mm high sinks.

The top shall be constructed of 1.2 mm type 304 stainless steel and shall have a 20 mm drip fillet to the front and sides and has a 150 mm high integral splashback at rear. The drainers shall be fluted and drain towards the centrally situated integrally welded bowls.

The front and sides shall have a 63 mm turn down with 2 mm turn under. The drainer sections shall be fitted with a 1.6 mm mild steel backing sheet under, finished in baked enamel and having a vermin proof, sound deadening compound spread evenly between the surfaces.

The bowl size shall measure 506 mm long x 606 mm wide x 300 mm deep and shall be constructed of 1.2 mm, type 304 stainless steel and shall be complete with a 40 mm diameter waste outlet hole. The top shall be fixed to a 38 mm x 38 mm x 3 mm thick angled iron frame, sufficiently braced, welded to the backing sheet and finished in baked enamel.

The top shall be supported on 45 mm diameter, type 304 stainless steel tubular legs with stainless steel corner gussets for bolting to the support frame. The unit shall be fitted with zinc, die-cast adjustable feet.

5.9 HAND BASIN

Supply and install four (4) off stainless steel hand basins.

VULCAN stainless steel Wash Hand Basin measuring 520 x 432mm complete with gallow type wall mounting brackets. Unit to be supplied with waste outlet, plug and plug chain and 15 mm Cobra Pillar taps

5.10 POT RACK

Supply and install one (1) off wall mounted tubular pot rack

The unit shall measure 2600 x 400mm and consist of one tier. The storage platform shall be constructed from 20mm diameter stainless steel piping, with centres measuring 75mm apart. 2(two) base plates are to be welded at the end to be bolted to the wall. 2 (two) m16 rawl bolts on each base plate to be used to bolt the rack to the wall.

5.11 STAINLESS STEEL MODULAR SHELVING

The shelves shall be constructed of 1,2mm thick stainless steel. Supplied in modular size of 850mm long x 500mm wide, complete with a turn down of 35mm and a turn under of 12mm on all four sides. The shelves shall be supported on Type 304, 2,5mm thick x 1442mm or 1982mm high x 500mm wide stainless steel, channel section end frames, cross braced and provided with Type 304, 40mm wide x 4,5mm thick foot plates. The frames shall be pre-drilled to enable the height of the shelves to be adjusted. Adjustable to number of tiers required.

"Vulcan" SS 8 or other approved.

5.12 UNHEATED COUNTER

The unit shall measure 1880mm long x 750mm wide x 910mm high. The top shall be constructed from type 430 1,6mm thick stainless steel braced with a 1,6mm thick aluminised mild steel channel. The top shall over hang the base cabinet by 15mm at the sides and 20mm at the front and back. The top shall have a turn down of 45mm all round.

The counter shall be of a monocoque construction with outer panels of type 430 0,9mm stainless steel and inner panels of 1,6mm aluminised steel. The centre and lower shelves shall be constructed from type 430 1,6mm stainless steel.

The unit shall be mounted on 150mm high, 45mm diameter type 304 stainless steel tubular legs fitted with zinc die-cast adjustable feet

Unit shall be by VULCAN model C-1880 or other approved.

5.13 ELECTRIC RANGE

Supply and install one (1) 3 plate electric range and oven as indicated on drawing.

The unit shall be a solid top heavy duty industrial type electric oven range, with overall dimensions of approximately 1000 x 850 x 1115mm high including a back guard of approximately 215mm. The unit must be mounted on tubular stainless steel legs, with a clear space of approximately 150mm below the unit. The legs must be of a sanitary design and must be adjustable.

The external finish shall be stainless steel front, door and side panels with aluminised steel

back panel. The range shall be fitted with a stainless steel curb and back guard.

The hob shall consist of three 640 x 330 x 16mm hot plates each with 4kW individually controlled.

Each plate to have a 3 heat switch and the oven is to be thermostatically controlled from 50°C to 300°C.

The internal dimensions of the oven are to be approximately 610 x 700 x 340mm and have an aluminised steel interior. Two grid shelves and three or more position runners are to be fitted. The oven door shall be of stainless steel, drop type with dead weight counter.

Electric requirements 220/380V, 3 phase, loading 19kW.

The Oven Range is to be VULCAN RE-3 or other approved.

5.14 ELECTRIC RIBBED GRILLER

Supply and install one (1) solid ribbed electric griller as indicated on drawing.

The unit shall be a solid top heavy duty industrial type electric ribbed griller, with overall dimensions of approximately 915 x 735 x 910mm high including a back guard of approximately 50mm. The unit must be mounted on tubular stainless steel legs, with a clear space of approximately 150mm below the unit. The legs must be of a sanitary design and must be adjustable.

The external finish shall be stainless steel front and side panels with aluminised steel back panel. The range shall be fitted with a stainless steel curb and back guard.

The griller shall consist of one 910 x 590 x 16mm hot plates with 10kW individually controlled.

The griddle to have a 3 heat switch to be thermostatically controlled from 50°C to 250°C.

Electric requirements 400V, 3 phase, loading 10kW.

The Griller is to be VULCAN FTG-10 Ribbed or other approved

5.15 TILTING FRYING PAN

Supply and install one (1) electric tilting frying pans, as indicated on drawing.

The unit shall consist of a rectangular shaped cast-iron pan placed in between a heavy duty U-shaped square-tube pedestal which is self-supporting. The pedestal is to be entirely enclosed by easily removable stainless steel cladding to prevent dirt from entering.

The pan is to be swivel-mounted to provide a smooth tilting action from horizontal through 90° tilt, which shall discharge the entire contents of the pan, through a pouring lip integrated in the front of it. The pan is to be provided with anti-splash and anti-drip moulding and is to be made from close-grained cast iron 10mm thick, suitably treated to give a non-porous surface, ideal for preventing the sticking of food products under temperature. It is to be heated by means of thermostatically controlled flat heating elements insulated with fibre cement, which shall cover not less than 65% of the area underneath the pan, providing uniform heat.

The tilting mechanism shall consist of a screwed spindle and bush, which shall be self-locking when the hand wheel is released. All bearings are grease lubricated.

The lid shall be constructed of stainless steel Grade 304, 1.2mm thick, braced and strengthened and is to be provided with an internal drip flange, so that condensate forming in the lid pours back into the pan. The lid shall be counter balanced by a high quality spring

mechanism which shall hold it in any position desired. It is to be fitted with a side mounted handle to avoid operator scalds.

The control panel shall consist of:

Pilot and heating lamp

Combination On/Off and thermostatic control knob

Power connection to be 380V, 3 phase, 15 kW.

The tilting frying pan shall have overall dimensions of approximately 1310 x 785 x 1030 mm high, shall have an effective roasting area of 765 x 590 mm with a depth of pan of 200mm, thus approximately 80 litre capacity.

Unit shall be by VULCAN series TS40 or other approved.

5.16 5 DIVISION BAIN MARIE HOT CUPBOARD

Supply and install two (2) bain maries in positions as indicated on drawings.

The unit shall measure 1800mm long x 750mm wide x 910mm high with provision for (5) five 1/1 Gastro norm pans. The Bain Marie well and top shall be constructed from type 304 1,6mm thick stainless steel. The Bain Marie shall be fitted with a stainless steel immersion element with a loading of 2, 5 kW controlled by means of a variable thermostat with a range of 0°C to 95°C. The top of the Bain Marie shall overhang the hot cupboard by 15mm at the sides and by 20mm at the front and rear. The top shall have a turndown of 45mm all round.

The hot cupboard shall be of monocoque construction with the outer panels manufactured from type 430 0,9mm thick stainless steel and the inner panels of 1,6mm thick aluminised steel. The body of the hot cup board to be insulated 30mm thick mineral wool insulation.

A drain valve shall be fitted under the well for drainage purposes.

The doors shall have outer panels manufactured from type 430 0,9mm thick stainless steel and the inner panels of 1,2mm thick aluminised steel and 15mm thick mineral wool insulation between the surfaces. The lower door runner shall be manufactured from type 430 1,6mm thick stainless steel and shall form a level hygienic continuation of the lower shelf. The upper door guides shall consist of 1,6mm aluminised steel channel. The doors shall be fitted with Nylatron door guides.

The upper and lower shelves shall be manufactured from Type 430 1,6mm thick stainless steel. The lower shelf shall have a 1,2mm aluminised steel baffle plate fitted to the underside.

The heating of the hot cup board shall be by means of incaloy elements with a loading of 4kW and wired up to a pre-set thermostat set at 70°C and activated by an On/Off control switch. The control panel shall be manufactured from type 430 0,9mm thick stainless steel; this shall house the pre-set thermostat, On/Off switch and circuit breakers, and shall run the full length of the unit above the doors.

The unit shall be mounted on 150mm high, 45mm diameter type 304 stainless steel tubular legs fitted with zinc die-cast adjustable feet.

Electric requirements 380/V, 3 phase N+E AC, loading 6, 5 kW.

The unit shall be supplied complete with:

- (2) Two off 1/1 x 150mm deep stainless steel GN inserts and lids.
- (6) Six off 1/2 x 150mm deep stainless steel GN inserts and lids.

Unit shall be by VULCAN model BMHC-1800E or other approved.

5.17 EXTRACT CANOPY

A 4900 x 2600 x 600mm high stainless steel extract canopy complete with filters, fire damper, silencers, ducting, fans and wired up light fittings is required for this installation. The canopy shall be designed, constructed and installed generally as specified and shown on drawings.

The panels of the canopy must be of class 304 stainless steel having a minimum thickness of 1,2mm. The panels must be fixed to a tubular or hollow section stainless steel frame in such a way that the panels are maintained flat and vertical with no sharp edges or unsightly welds. Welding beads must be ground down in order to leave the surfaces and edges of the canopy smooth and free of blemishes.

The canopy must be braced against the roof trusses and walls for stability. The Building Contractor will be required to finish off the ceiling against the perimeter of the extract canopy.

The canopy must be neatly finished with no exposed rough or sharp edges or crevices in which insects can be harboured. Where canopy modules are joined the joints must be completely and neatly sealed with a silicon type non hardening sealant. A perimeter condensate drain is required 50mm wide x 25mm high around the bottom lip of the canopy sloped to a final drain point with a 25mm diameter drain.

The canopies shall have flush fitting vapour sealed fluorescent lights 1200mm long.

There shall be an exhaust fire damper manufactured from 1.6mm grade 304 stainless steel. Dampers shall be activated by a minimum of three (3) fusible links per spigot rated at 140°C. Dampers must be accessible through the exhaust plenum therefore eliminating the need for access doors in the ducting.

The filters must be of the impingement type, approximately 500 x 500mm in size and made of 0.70mm grade 430 stainless steel. They must be completely washable and easy to remove and replace.

One axial flow extract fan is required with a minimum extract capacity as of 6.36m³/s @ system resistance. The fan head must be compatible with the resistance imposed by the canopy filters, ducting and sound attenuators etc.

It is required that the fan runs at the lowest speed compatible with the above in order that noise levels be kept as low as possible. The noise level in the kitchen shall not exceed NC 45. If sound attenuators are required to achieve this with the fans offered, such attenuators must be incorporated in the inlet ducting to the fans and outlet ducting from the fan and must be of a type that will not readily absorb fats and grease from humid extract air thus becoming a fire hazard.

The ducting must be manufactured a minimum of 1,0mm thick galvanised steel according to acceptable standards and neatly finished and installed.

The fans must be supplied complete with ducting and a discharge cowl. Tenders must allow for flashing and waterproofing in their tender prices.

Fan motors must be rated for operation in very humid areas and be suitable for use at site voltages.

Note that all dimensions, particularly the exact positioning of existing roof beams MUST be verified on site prior to cutting in or air extract spigots and installation of the canopy and fans.

(The Kitchen Sub-Contractor shall inform the main contractor of any structural roof requirements for the mounting of the canopy fan).

A weather proof local isolator must be supplied and installed at the fan motor in the roof void. The electrical supply to these isolators will be provided by others. The Sub-Contractor will be required to connect this electrical supply provided by others to the local isolators and make the

necessary connections from the isolators to the fan. In addition, a local STOP/START station for the fan and lights is to be allowed for and located in the Kitchen on a wall adjacent canopy in a position to be determined on site. Switch to include run/trip indication lights.

The canopy is to be a minimum 300mm wider and longer as the cooking equipment as indicated on the drawing. The equipment is to place 100mm from one another and from the wall.

The canopy to be by Alex Murray Metal Systems Cyclovent or other approved.

5.18 DISHWASHER

Supply and install one (1) dishwasher in position as indicated on drawings.

The unit shall measure 624 mm wide x 740 mm deep x 1460 mm high. The dishwasher shall be of the fully automatic lift up hood type capable of washing all types of tableware. The unit shall be constructed of type 304 stainless steel having a set of upper and lower swivelling wash arms provided with plastic jets, which are detergent and heat resistant. Removable plastic scrap trays shall be fitted to facilitate access to the 48 litre tank and easy cleaning. The unit output shall be 65 racks per hour.

All heater elements shall be controlled by contactors and protected by circuit breakers. The machine frame shall be constructed of type 304, 2.5 mm thick stainless steel. The machine body shall be constructed of type 304, 1.0 mm thick stainless steel. The unit shall be supported on 150 mm high stainless steel legs with adjustable feet.

The unit shall have an electrical loading of 10.5kW, 230 V, AC.

5.19 WATER BOILERS

Supply and install two (2) off 25 litre wall mounted hot water boilers.

Unit to be of stainless steel construction and have a capacity of 25 Litres and have two (2) outlet taps with a capacity of 120 to 150 cups at a time and an approximate recovery rate of 3 cups per minute.

Units to be wall mounted above the sink and be piped to the domestic cold water supply by copper piping and to have an inline strainer/filter and shut off valve.

Unit size 510 x 290 x 630mm

The unit shall have an electrical loading of 230V 3.0kW

5.20 DELUXE TOASTER

Supply and install one (1) off Deluxe four slice toaster.

Toaster to be table mounted and have non-stick surface and adjustable handle for different thickness sandwiches.

Unit size to be 355 x 466 x 327mm with a cooking surface of 330 x 355mm

The unit shall have an electrical loading of 230V 1.97kW

5.21 CONVEYOR TOASTER

Supply and install one (1) off conveyor type toaster.

Unit to be heavy duty brushed stainless steel construction with power on and toaster ready indicator lights, with cool touch side panels.

Toaster to have a 450 slices per hour capacity with less than 5 minute heat up time. Unit to have speed control and energy saving standby options.

Unit dimensions 461 x 394 x 343mm high

The unit shall have an electrical loading of 230 V 1800 watts

5.22 OIL JACKETED BOILING PAN

Supply and install one (1) 135 litre boiling pans in positions as indicated on drawing.

The outside diameter of the pot shall be 947 mm. The unit shall comprise an inner pan and curb of type 304 stainless steel, a 2 mm mild steel jacket with fibreglass blanket insulation and an outer skirt of type 304 stainless steel. The spring assisted spun lid shall be of type 304 stainless steel. The pan shall be mounted on type 304 stainless steel tubular legs fitted with zinc, die-cast adjustable feet. Heating shall be by means of stainless steel immersion elements controlled by a manually operated variable thermostatic switch with a range of 50 - 160°C. The unit shall be provided with a safety override thermostat preset at 180 °C, to prevent overheating. In addition, an overriding thermostat shall be situated behind the control panel set at 180 °C as additional safety measure.

Electric requirements 380V, 3 phase N+E AC, loading 9.0 kW.

5.23 ELECTRIC MIXER

The unit is robustly constructed table standing heavy duty food mixer with a bowl capacity of 60 litres. It shall be finished in an acrylic epoxide paint. The mixing action shall be planetary.

The mixer to incorporate a manual bowl lift, power assisted variable speed control. Built-in no volt release emergency stop button, and a 10 minute timer. Unit to be supplied with a 60 litre stainless steel bowl beater, whisk and dough hook.

Electric requirements 380V, 3 phase N+E AC, loading 9.0 kW.

5.24 MICROWAVE OVEN

Supply and install an industrial type microwave oven.

Unit shall be of a stainless steel construction interior and exterior with a 30 Litre capacity 1000W output.

Unit shall have a digital display with 20 programs and five power levels.

Unit to be mounted on a wall mounted 1.6mm thick 430 stainless steel shelf 600mm long x 500mm deep, shelf to be one single bent sheet with canterlever sides for support.

Internal unit size 350 x 230 x 357mm High

Unit external size 542 x 329 x 461mm High

Electrical requirements 230V 1600W

5.25 GAS BOILING TABLE WITHOUT OVEN

The Boiling Table shall be of modular design with six (6) open burners without oven. The body shall be manufactured of grade 430 stainless steel.

The range shall be mounted on four (4) ± 150 mm high stainless steel legs with adjustable

feet.

OPEN BURNER TOP:

Six heavy duty cast iron aerated burners 22 000 kJ/hr each; lift off cup; individually controlled off/high/low safety gas taps; pilot ignition; heavy duty cast iron grids; removable drip tray below burners; stainless steel back guard.

External Dimensions: Approximately 1200 mm x 850 mm x 900 mm high.

5.26 ELECTRIC FOUR PAN DEEP FRYER

The unit shall measure 1015mm long x 600mm deep x 1040mm high to the top of the 125mm high backguard. The unit shall be mounted on 150mm high stainless steel legs, fitted with zinc, die-cast adjustable feet. The external finish shall be a stainless steel front, door and side panel. The back panel shall be of aluminised steel. The two pans and surrounds shall be manufactured from 1.6mm, type 304 stainless steel. Each pan shall have a 20-litre capacity and the correct oil level shall be clearly marked. Each pan shall be fitted with a stainless steel tubular sheathed element with an electrical loading of 15kW. The elements shall be protected by a perforated, stainless steel fishplate. Each element shall be individually controlled by a variable thermostatic switch with a range of 100°C - 185°C and shall have a safety-overriding thermostat preset at 220°C. The control panel shall house the thermostat control and amber pilot light to indicate that the control thermostat has failed and that the overriding thermostat cut the elements out. A reset button shall be provided for each pan, to reset the safety-overriding thermostat. Each pan shall be fitted with a drain cock so that the oil can be drained directly into the stainless steel oil receiver provided in the base cabinet. The oil receiver shall be provided with a pouring lip and handle. The circuit breakers and overriding thermostat-reset button shall be mounted in the base of the cabinet. Overall capacity to be 2 x 10 l overall.

Electrical load is 30 kW, 400 V, 3 N.

"Vulcan" DPF 2/20 or other approved

5.27 OPERATING AND MAINTENANCE MANUALS.

The Contractor shall furnish to the Engineer three bound copies of Operating and Maintenance Instructions prior to the final acceptance of the installation.

Index

Description of the System.

Operation of the System.

Plant and Equipment – including Model Numbers and Suppliers.

Test Report.

Maintenance Instructions.

Spare Parts List.

Descriptive Literature.

Record Drawings (both HARD COPY and ELECTRONIC FORMAT - drawing AutoCAD)

Service Records

5.28 OPERATING AND MAINTENANCE MANUALS

The Contractor shall provide substantive training to selected end user staff in the correct operation and operator maintenance procedures of each item of equipment supplied by himself and requiring such training.

He shall issue a "Certificate of Training" to each staff member for each item of equipment on which the staff member has been trained. These certificates of training are to be signed by the Air Conditioning Contractor and the staff member concerned. Copies of these certificates shall be submitted to the Engineer for inclusion in the Practical Completion \ First Delivery Certificates

PART 4

PROJECT SPECIFICATION

1. SCOPE OF WORK

The work covered by this Specification comprises the repairs, renovations and replacement of equipment and pipe reticulation associated with the existing hot and cold water system and equipment at the SAPS Decentralised Training Facility, Newcastle.

2. STANDARDS AND REGULATIONS

The work shall be in full conformity with:

SANS 10400 – 1990
NOSA. General Safety Standards
Occupational Health and Safety Act 85 of 1993 as amended

All other applicable standards and codes of practice and local authority regulations having jurisdiction.

3. PRINCIPAL ITEMS OF WORK

The principle items of work for which the DHCW Contractor must allow are briefly as follows:

- Supply and install new domestic hot water and heating hot water storage vessels.
- Supply, install and commission three (3) new air to water hot water heat pumps.
- Supply, install and commission circulating and booster pumps for both systems.
- Supply, install and commission Hot water heating radiators complete with control valves.
- Supply and install new domestic hot water and heating hot water piping valves and insulation.
- Supply, install and commission electrical panel and all associated wiring for hot water systems.

4. WORK TO BE CARRIED OUT BY OTHERS

The following work is excluded from this specification and will be carried out by others.

- .1 All builders' work including the forming of holes in walls and making good thereafter.
- .2 The provision of a 230V 1 ph 50 Hz essential and non essential electrical supply comprising local isolators to equipment.

5. SITE CONDITIONS AND DESIGN CRITERIA

Altitude 1185 Metres above Sea Level
External Design Ambient (Summer) 35°C db

6. INSPECTION OF SITE

The prospective Tenderers are advised to thoroughly acquaint themselves with the nature and extent of work to be done and make allowance for items obviously intended and necessary for the proper completion of the Works, although not specified. Claims due to lack of knowledge will not be entertained.

7. MAINTENANCE

The Contractor shall include in his tender price for the maintenance of the complete installation for a period of ONE YEAR after first delivery of the entire plant has been taken.

The Contractor shall visit the installation at regular intervals on an acceptable and agreed day and perform full maintenance on the basis of a proper preventive maintenance programme approved by the Engineer.

The Contractor shall report to an official nominated by the End User on arriving and again at leaving the facility on the occasion of each visit. Such person, who has been nominated, shall sign a Service Report giving details of any defects made good, temperature readings taken, etc. A copy of such Service Report is to be submitted to the Engineer and End User liaising with the Consultant Engineer in all cases.

A major service shall be executed by the Contractor in the twelfth month of the contract maintenance period.

8. GUARANTEE

The Contractor shall guarantee the materials, apparatus and workmanship delivered by him for a period to twelve months. The guarantee must be valid for a period starting on the date when the Contract is accepted as completed and in working condition. The complete installation must be guaranteed against defects as a result of patent and latent defects of the apparatus as well as against faulty materials and workmanship. Fair wear and tear is excluded from the guarantee. The guarantee must provide for all parts, spares and appurtenances, which become defective during the guarantee period, to be replaced free of charge. All costs of labour, out of town allowances, materials and transportation required to replace such part of a defective installation shall be borne by the contractor and shall be included in his guarantee. The Contractor shall cede the remainder of any equipment guarantee which he has received from his suppliers and which may extend beyond the period of twelve months mentioned herein.

9. **OPERATING AND MAINTENANCE MANUALS.**

The Contractor shall furnish to the Engineer three (3) bound and two (2) electronic copies of Operating and Maintenance Instructions prior to the final acceptance of the installation.

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10. **TRAINING**

The Contractor shall provide substantive training to selected end user staff in the correct operation and operator maintenance procedures of each item of equipment supplied by himself and requiring such training.

He shall issue a "Certificate of Training" to each staff member for each item of equipment on which the staff member has been trained. These certificates of training are to be signed by the Air Conditioning Contractor and the staff member concerned. Copies of these certificates shall be submitted to the Engineer for inclusion in the Practical Completion \ First Delivery Certificates