



SABS
NEW ELECTRONICS LABORATORY

HVAC SERVICES
SPECIFICATION

DATE: 16 October 2024

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1.0 Detail Technical Specification for the Air Conditioning and Ventilation Installation

1.1 General

This Specification shall be read in conjunction with the drawings, Standard Specification and Conditions of Contract which form part of the tender and contract documentation. Any discrepancies between the documents and/or drawings shall be brought to the attention of the Engineer prior to submitting a tender.

1.2 Scope of Works

This specification covers the supply, delivery, erection, testing, commissioning, handing over in a complete working order and the subsequent maintenance and guarantee for a period of 12 months of the air-conditioning and ventilation installations including the following rooftop packaged unit:

- New Electronics Laboratories.

The New Electronics Laboratory are currently served by a mix of non functional and partially functional air handling units. The air handling units are connected to the central site wide chilled water system. The existing plant is located on the first and second floor plantrooms. The air handling units were originally designed to provide cooling via insulated ducting into the labs finally delivering air into the laboratories via ceiling mounted diffusers.

The existing air-conditioning installation shall be stripped out with the exception of the space between HM41 and HM50 on the southern side of the building. The stripped materials shall be carted away from the site under the direction of the onsite facilities management. During the stripping, the chilled water system shall be isolated to ensure that the remaining system is still able to function undisturbed.

Care must be taken to ensure that the ceiling diffusers selected do not dump supplied air to the operational level. A diffuser type with radial jets attached to the ceiling such as Trox ADLR or equal shall be preferred. In the Cooking Appliances Test Laboratory HG45, it is important that this stipulation is particularly adhered to safeguard the integrity of the appliance tests.

The new HVAC system shall in turn consist of a mixture of new packaged air conditioning units, a tempered fresh air delivery packaged air conditioning unit and a VRF system to deliver cooling to the remainder of the laboratories as detailed in the drawings. The new installation is designed to ensure that the building is no longer connected to the chilled water system.

The return air path shall be through return air grilles and ducted back to the packaged units in the plantroom. Door transfer grilles shall be provided in on the VRF fed laboratory doors to

ensure that excess air is delivered using the ceiling void as the return air plenum back to the air-conditioning unit through a return air duct.

The power supplies to the VRF internal units shall be provided in the ceiling voids within 1m of each unit in the ceiling void.

Condensate drains shall be supplied and installed by the air-conditioning contractor in PVC trunking against the outside walls to match the existing condensate drains.

The contractor shall also allow for the replacement of damaged ceiling tiles during the stripping out and installation of the new air conditioning ducting system.

An allowance shall be made to close all openings in the “Mentis” grating floor left behind by the stripping out of ductwork that is currently penetrating the plantroom floor.

Ventilation fans shall be provided in the plantroom to ensure adequate air movement in the plantroom to evacuate excess heat from the space.

A reverse osmosis plant shall be provided in the plantroom to provide treated water to the humidifiers. Water shall be piped from the reverse osmosis plant to the different packaged units.

A validation process which shall be a task of verification to confirm that the HVAC systems and associate axillaries are functional and operated at the required set parameters as per norms and standards within SANAS guidance. The verification will cause affirmation of the basic function of the installed air conditioner system and component whilst satisfying that the key parameters, being temperature and humidity, is met and the system will operate efficiently.

1.3 Design Data

Supply voltage	400/240 V, 50 Hz		
Altitude	1350 m		
Maximum ambient temperature	37 ⁰ C DB		
	20 ⁰ C WB		
Minimum ambient temperature	-3 ⁰ C		
Corrosive conditions	Normal		
Outside air design conditions	Summer:	32 ⁰ C	DB
		19 ⁰ C	WB
	Winter:	-3 ⁰ C	DB
		80 %	RH

1.4 Inside Design Conditions

Room No	Name	Temp Required	RH Required	Internal Load kW
HG41	Vacant	20 ± 3°C	N/A	3

HG42	Ventilator	20 ± 3°C	N/A	2
HG43	Fire-Proof	20 ± 5°C	N/A	2
HG44	Dishwashers	23 ± 2°C	55 ± 5%	6
HG45	Stoves	23 ± 2°C	N/A	8
HG46	Store	N/A	N/A	0
HG47	Geyser	20 ± 3°C	N/A	6
HG48	Vacant	20 ± 5°C	N/A	3
HG49	House Appliances	20 ± 5°C	<75%	3
HG50	Soiling	23 ± 2°C	55 ± 5%	8
HG51	Metering	23 ± 2°C	60 ± 15%	3
HG52	Refrigerators	20 ± 5°C	N/A	2
HG54	Laundry	23 ± 2°C	65 ± 5%	8
HG55	Office Equipment	20 ± 5°C	<75%	3
HG56	Endurance	20 ± 5°C	N/A	4
HG57	Audio Visual	20 ± 5°C	<75%	3
HG58	House Appliances	20 ± 5°C	<75%	3

1.5 Site and Site Conditions

The Contractor shall acquaint himself fully with the prevailing site, conditions, access to the site, storage and other facilities prior to submitting a tender since no claims in this regard will be considered.

The Contractor shall allow for the cost of hoisting heavy equipment and for all hoisting which may be out of sequence with the main Contractor's activities.

Apart from his function as project manager and Co-ordinator of activities on site, the principal Building Contractor will be responsible to provide the finished building structure.

It is the responsibility if the Contractor (Air-conditioning Contractor) to provide "Marked up" drawings timeously indicating all openings, frames, etc. as well as openings or walls to be left out temporarily for access of equipment.

The General Electrical Sub-contractor will be responsible to provide power supplies in the form of isolators at a distance of one meter from each air-conditioning condensing unit and each ventilation fan. The termination to the isolator will be done in this contract.

The power supplies to the split units will be on the roofs in the form of weatherproof isolators at the condensers.

Condensate drains shall be supplied and installed by the air-conditioning contractor in PVC trunking against the outside walls to match the existing condensate drains.

The sub-contractor shall complete a detail programme in conjunction with the Principal Contractor. The programme shall be submitted to the Engineer within two weeks from date of appointment.

1.6 Quality and Quality Assurance

The Sub-contractor is primarily responsible to ensure that the installation meets the requirements of the specification.

The air-conditioning contractor shall comply to the requirements of ISO 14001.

To assist the Sub-contractor in order that corrective action can be taken in good time, at least the following quality control programme will be implemented:

Description	Hold points required
Engineers approval of data sheets for all equipment prior to placing of orders	Yes
Sample ducting approved	Yes

1.7 Drawings

The Contractor shall provide all drawings necessary for the execution of the contract and shall submit general and detailed drawings of the plant and apparatus including in the “Extent of Contract” as the Engineer may reasonably require approving the construction of the plant.

Details and drawings of all major items of equipment made by the Contractor or his suppliers shall be submitted for approval without specific request from the Engineer.

These drawings shall be submitted to an agreed programme to suit the construction of the plant.

All drawings shall be clearly numbered and marked with the equipment item number as listed by the successful tenderer in his equipment schedule.

The Contractor shall submit for approval, in principle, copies of all drawings and all general arrangement drawings of equipment showing overall dimensions, full foundation requirements, building connections and the position of each item relative to the building and other adjacent equipment. The Engineer may require from the Contractor further detail drawings and/or calculations which clarify features not adequately shown on the layout drawings.

The Engineer will return to the Contractor within ten (10) working days of their receipt by him, one copy of each drawing marked “**APPROVED IN PRINCIPLE**” or marked with any changes which are necessary.

The Contractor shall immediately modify the details and drawings as required by the Engineer. The nature and date of each modification and a distinguishing symbol shall be added and the drawings submitted again for approval.

Two copies of each drawing shall be submitted for approval. Five copies of the final General Arrangement and detail drawings shall be issued to the Engineer by the Contractor within ten days of receipt by him for approval, in principle, by the Engineer.

Further copies shall be provided as may be required by the Engineer, either before or after the final approval.

The Contractor shall provide a complete and comprehensive drawing schedule, up-dated with each drawing issue, for the use of the Engineer.

The drawing schedule shall be issued every time drawings are issued.

The Contractor is to ensure that all plants offered can be accommodated in the positions shown on the drawings.

The approval in principle of drawings by the Engineer shall not relieve the Contractor of any responsibility in terms of the Contract.

The Contractor shall be responsible for any discrepancies, errors, or omissions in the drawings and other particulars supplied by him, whether such drawings and particulars have been approved by the Engineer or not, provided that such discrepancies, errors or omissions be not due to inaccurate information or particulars furnished in writing to the Contractor by the Employer or the Engineer.

All dimensions shall be in S.I. metric units.

The Contractor shall provide, at his own expense, all copies of drawings required by him in the execution of the work and shall also, at his own expense, supply to the Engineer such drawings and copies thereof as are provided for in the Specification.

The Sub-contractor will be required to keep a separate set of all approved drawings on site and to continually “mark-up” any alterations and additional information in order that he can produce “as installed” information.

On completion of the installation, but before the Plant is handed over to the client, the Contractor shall provide two negatives on SEPIA of each of the following drawings showing the services as fixed:

- Complete 1:50 scale layouts of pipe work inside the Plant Rooms.
- Large scale details of the Plant Rooms (at least 1:50 scale).
- Complete 1:50 layout drawings of the whole installation.
- Detailed drawings of all items of plant.
- Details of any other items requested by the Engineer.

The drawings shall be sufficient in detail to enable the Employer's staff to maintain, dismantle, reassemble and adjust all parts of the Works.

The layouts shall show the location of all manual and automatic valves, controls, control panels, sensors, thermostats etc.

The wiring diagrams shall indicate all motor kilowatt ratings and circuit breaker and contactor ratings and settings.

A copy of the wiring diagram shall be mounted in the Plant Room in a glass fronted frame. The diagrams shall be printed by a non-fading process.

1.7 Health and Safety File

A health and safety file shall be compiled to comply with the RSA OHS ACT - 1993.

1.8 Sound Attenuators

All attenuator sizes indicated on the drawings and schedule are estimated sizes. The actual attenuator sizes shall be calculated according to the noise levels of selected equipment.

Calculations of sound attenuation in octave bands from 63Hz to 4000Hz shall be submitted to the engineer for approval.

The sound attenuators shall be selected for the air quantities as indicated in the drawings

1.8 General AC Installation

The condensing units shall be installed on the roof plantroom of the building as shown on the drawings. The units shall be of the inverter type with environmentally refrigerant.

The refrigerant piping shall be installed in galvanised trunking where exposed the weather. Refrigeration piping in the rooms shall be installed in PVC trunking cut into the walls with the lids flush with the plaster. The condensate drain piping shall be hard drawn copper piping and recessed into the walls and shall connect to hand wash basins or wash-up troughs. The connection to the above drains shall be above the water traps. All condensate drain piping shall be cut into walls except the piping on the outside walls.

The air-conditioning contractor shall take cognisance of the fact that condensate drain piping shall be installed prior to installing the units. Such piping needs to be properly sealed until the units are installed.

Allowance shall be made for conduit and 100mmx50mm draw boxes to install the thermostats for units with hard wired thermostats. The thermostats shall be mounted at 1400mm AFFL or the same level as the light switches. Hard wired thermostats are preferred on all units.

SABS test certificates shall be provided with the tender confirming capacity and noise ratings. Vacuum shall be drawn on the installed split units prior to charging the unit with refrigerant. A sight glass and drier shall be installed on each split unit.

Power to the units will be supplied by others in the form of isolators. The isolators for the three phase and single phase units will be at the condensers. The wiring from the isolators to the units and between the condensers and evaporators shall form part of this contract.

1.10 Ducting

The ventilation ducting and fresh air ducting shall be galvanised steel ducting with sizes and positions as shown on the drawings. The air-conditioning supply air ducting shall be externally insulated with 25mm FRK insulation.

The flexible ducting and steel spigot shall be the same diameter as the diffuser neck size. The length of the flexible duct shall not exceed 1000mm without external insulation.

1.11 Fans

All fans shall be submitted for approval by the engineer where applicable. The axial flow and in-line duct fans shall be supplied with canvas collars between the sound attenuators and ducting and spring mounting hangers.

Each fan will be installed with a York box, with contactor and fan overload.

Sound attenuators shall be supplied on both sides of the fans and on the "room" side of the AHU systems to meet the specified sound ratings.

The propeller fans shall be supplied with a weather louvre externally and a wire guard on the inside.

The window/wall fans shall be supplied with a weather louvre and louvre shutter. The ceiling fans shall be supplied with a neat grille in the ceiling.

The fans shall supply the air quantities in the schedule against the system resistance.

All fresh air systems shall be supplied with a controller to switch the fan off in case of fire alarm, the fire alarm itself shall be supplied by others. The fresh air fans shall “auto restart” when the fire alarm signal is cancelled.

1.12 Weather Louvres

The weather louvers shall be powder-coated steel louvers. The colour of the weather louvers shall match the existing colour of the building.

1.13 Doors

All doors to laboratories shall be provided with 400 x 400 door grilles unless specified as indicated on the drawings.

1.14 Fire Dampers

All duct penetrations through fire walls including all ducting from plant room to laboratories to be fitted with fire damper.

The fire dampers shall have a fusible link.

The dampers shall be supplied with flanges to match the ducting. The dampers shall have a 2-hour fire rating.

A signal from the fire detection, by others, shall be provided to switch the plant off.

1.15 Painting

All external trunking and ducting shall be painted in a colour to be specified by the Architect.

1.16 Builders Work

The air-conditioning contractor shall take cognisance of the fact that allowance should be made to provide openings for pipes prior to the ceilings being installed. All piping penetrating walls shall be supplied with sleeves in the walls.

2.0 Standard General Technical Specification

2.1 General

This specification covers the general requirements regarding material, equipment, installation, testing, commissioning and maintenance of the Installation.

The complete installation shall comply with the requirements of this Specification. Should any discrepancies or contradictions exist between this specification and the Detail Technical Specification for the specific installation, then the latter shall take preference.

Should any discrepancies appear between written specifications and drawings, Tenderers shall ascertain the position before tender closing date, otherwise the worst case may be assumed correct by the Engineer.

All written parts together with drawings and other documents form part of the specification.

The Engineer will inspect the installation from time to time during the progress of the work. Discrepancies will be pointed out to the Contractor and these shall be remedied at the Contractor's expenses.

Under no circumstances shall these inspections relieve the Contractor of his obligations in terms of the Documents.

The Contractor should notify the Engineer timeously when the installation reaches important stages of completion (e.g. before closing cable trenches, before casting concrete, etc.) so that the Engineer may schedule his inspections in the best interest of all parties concerned.

The word "Contractor" shall also be read to mean "Sub-Contractor" in this specification.

2.2 Regulations

The installation shall be erected and tested in accordance with the following regulations:

- The Factories, Machinery and Building Work Act of 1941 as amended.
- The Regulations of the local Gas Board where applicable.
- The SABS Code of Practice for the Wiring of Premises SABS 0142- 1978.
- The local Municipal by-laws and Regulations as well as the regulations of the local Supply Authority
- The Standard Regulation of **any** Government Department or public service company where applicable.
- The local Fire Regulations
- The Mines and Works Regulations, Government Notice No R1609 of the 28th September 1962, as amended.

The Contractor shall issue all notices and pay all the required fees in respect of the installation to the authorities, and shall exempt the Owner from all losses, claims, costs or

expenditure which may arise as a result of the Contractor's negligence to comply with the requirement of the regulations enumerated in paragraph above or elsewhere.

It shall be assumed that the Contractor is conversant with the abovementioned requirements. Should any requirements, by-law or regulation, which contradicts the requirements of the Document, apply or become applicable during erection of the Installation, such requirement, by-law or regulation shall overrule this document and the Contractor shall immediately inform the Engineer of such a contradiction. Under no circumstances shall the Contractor carry out any variations to the installation in terms of such contradictions without obtaining the written permission to do so from the Engineer.

2.3 Materials and Workmanship

All materials shall be of adequate quality for the duty specified and the workmanship shall be in accordance with the best accepted modern practice. Unless otherwise stated, the Contractor shall be obliged to comply with the requirements of the latest edition (as amended) of the South African Bureau of Standards Specification where applicable.

Failing this the latest edition as amended of the relevant British Standard Specification shall provide the required standard. If the Contractor desires to use any other Standard Specification or Code of Practice it shall be referred to the Engineer for approval.

The Works shall be designed to provide ease of inspection, cleaning and maintenance, and shall conform with modern practice.

All artisans employed on site by the Contractor shall be competent in terms of the Regulations and Acts.

The Contract shall be executed with good workmanship in a workmanlike manner to the satisfaction of the Engineer or his representative. Should any material or workmanship not be to the satisfaction of the Engineer, it shall be rectified at the cost of the Contractor and all rejected materials shall be removed from site.

2.4 Arrangements with Supply Authority

It shall be the responsibility of the Contractor to make the necessary arrangements at his own cost with the local supply authority and to supply the labour, equipment and means to inspect, test and commission the installation to the requirements of the Local and Supply Authorities.

The Contractor shall supply and install all notices and warning signs that are required by the appropriate laws and regulations and/or the Documents.

2.5 Inspection and Testing

The equipment supplied under this Contract shall be subject to inspection by the Engineer or his Nominated Agent at all stages of manufacture.

The tests and commissioning procedure as laid down and such additional tests as the Engineer may reasonably require proving compliance with the Specification shall be carried out at the Contractor's Works and at Site.

The Contractor shall give reasonable notice of time and place in writing, to enable the Engineer to inspect and witness tests of materials and equipment. He shall provide the Engineer with facilities for witnessing same and for any additional tests or inspection of any portion of the works as required by the Engineer.

The Contractor shall, at his own cost, render all assistance and supply all labour, appliance and any other materials, as the Engineer may require to check the setting out, measure up and inspect any portions of the works at any stage during fabrications, construction, erection or painting. During such operations, the Contractor shall, if required, suspend any or all of the Works, without having claim for loss or damage as a result thereof.

The testing of the plant (or any part thereof) supplied under this contract shall be carried out through its full operating range (or part thereof) as required by the Engineer.

All such tests and inspections and the necessary inspection facilities shall be provided at the Contractor's expenses.

At the commencement of and during the whole of the commissioning and Testing Periods, the Contractor shall have available on site all essential spares and tools considered necessary to enable repair work of defective parts to be carried out immediately in the event of a breakdown.

The Contractor shall be responsible for the proper operation and maintenance of the plant throughout the period of the test and until the operator training period is complete.

Acceptance by the Engineer of any plant item, following such inspection or tests, shall not relieve the Contractor of any obligations under this Contract.

2.6 At Works

Materials and Components

All tests to comply with the relevant South African/British Standards.

Motors

All motors shall comply with the relevant South African/ British / I.C. Standards and test certificates in triplicate shall be supplied before despatch. Witnessed tests are not required.

Pumps

All pumps shall be lined up and tested as a complete set. Test certificates shall be supplied before despatch.

Fans

Balance tests to be carried out on all rotors.

2.7 Test Certificates

The Contractor shall provide three copies of test certificates in respect of all materials and equipment, further copies are to be bound into the operating and maintenance manuals.

Insulation Tests

All electrical wiring and equipment shall be subjected to insulation tests. All instruments and other equipment for the tests shall be provided by the Contractor.

Draining and Cleaning

On completion of the pressure test on a section of pipe work the water used for testing shall be drained away as quickly as possible to remove as much dirt and dross as possible. After completion of a pipe work circuit the circuit shall be flushed through to remove all pipe scale, dross and similar materials.

The Contractor shall provide all necessary connections, by-pass pipes temporary strainers, temporary make-up pieces, to enable the systems to be drained and cleaned.

Additionally, on boiler commissioning, steam lines are to be charged with steam to full operating pressure and allowed to cool. This procedure is to be carried out three times over a period of two days. Following the third cycle, the pipes are to be open ended and blown through. These procedures are to be supervised by the Engineer.

Plant Commissioning

The Contractor shall arrange, at his cost, for the manufacturer's representative to check over and fully commission items of equipment. This work is to be carried out by skilled engineers preferably employed by the manufacturers, who are completely familiar with

the equipment involved and shall be capable of training the operating and maintenance staff in the duties they are to perform.

On completion of the plant commissioning, the Contractor shall obtain written confirmation from the various manufacturers that they have completed all commissioning work and are satisfied that the items of plant, for which they are responsible, are functioning satisfactorily.

Copies of the manufacturer's written confirmation shall be sent to the Engineer.

2.8 Tests on Completion

On completion of the balancing and commissioning of equipment, the plant shall be put into normal operation and the final adjustments of the equipment shall be made.

Thereafter, the Tests on completion shall be carried out to ensure that the plant will fulfil the functions for which it has been supplied.

Such test shall include the following:

- Simulated tests for all alarm and safety cut-out of equipment to prove the operation of the equipment.
- Simulated tests on automatic controls to prove the ability of the controls to correct conditions which are outside the required design conditions. The tests shall be carried out manually, changing the desired values to produce an incorrect condition and then re-setting the controls to the design condition and then checking the operation of valves, etc. to restore the design conditions.
- Operational tests on the Plant to demonstrate that it is giving the rated output and efficiency.

The Contractor shall provide all necessary temporary measuring and recording equipment. The equipment shall be of a type generally used for this type of testing and shall be to the approval of the Engineer. All instruments shall be accurately calibrated before the tests begin.

On completion of the whole of the tests and when the Contractor is satisfied that the entire plant is operating satisfactory and will fulfil the function for which it has been supplied, he shall submit to the Engineer triplicate copies of all test records and charts together with reports on all the tests called for in this Specification.

The Engineer shall reserve the right to ask for any reasonable additional tests or for the repetition of previous tests in order to prove that the operation of the plant is satisfactory and in accordance with the Specification and Drawings.

2.9 Operator Training

On the completion of all tests to the Engineer's satisfaction, the Contractor shall continue to be responsible for the complete operation and maintenance of the plant for a further period of three weeks, during which time instruction shall be given to the Employer's staff on the proper operation and maintenance of the Plant.

The operation and maintenance of the plant for the duration of the instruction period shall not in any way relieve the Contractor of his responsibility under the terms of the Contract.

2.10 Tools and Equipment

The Contractor shall provide all tools and equipment necessary for the proper efficient execution of the work.

No extra payment will be made for the Contractor's plant, labour and equipment to complete the work specified.

Maintenance Tools

The Contractor shall provide one complete set of all special tools, gland keys, lock shield valve keys, air lock keys, stoking tools, etc. required for testing, dismantling or operating of all items of equipment.

Electrical Equipment

The Contractor shall provide all motors, limit switches, devices operated by pressure, flow, temperature or any other means, heaters, thermostat, solenoid valves, probes and all other sensing and control devices necessary for the operation of the plant or equipment.

All motor starters, distribution boards and cabling are to be supplied and installed by the Contractor.

All electrical sensing and control devices supplied under this Contract shall be submitted for approval within 60 days from the date of award of the Contract prior to ordering from equipment suppliers.

All motors shall be suitable for operation on 400 volt/ 230V, 50 Hz supply and all electrical control and sensing devices for operation on 400V, or 230V or 24V, 50Hz supply as required.

2.11 Electrical Data to Be Submitted By the Contractor

The Contractor shall, within 30 days after being awarded the Contract submit for approval, final motor power ratings, numbers and locations of motors on each item of machinery; motor characteristic curves' method of starting motors' wiring diagram of electrical appliances on each items of machinery (e.g. stop/start buttons, micro-switches, limit switches, probes etc.,) ; control circuit devices; **complete control** diagrams and all other relevant data of each system, plant or machinery depicting the full operation of the system.

Further, the following additional information shall be provided in respect if each motor:

Two sets of characteristic curves, test certificates, certified prints, shop drawings, wiring diagrams, operating data, instruction books, diagrams covering rigging, assembly, installation, operation and maintenance of motors as required by the Engineer.

2.12 Programme and Progress

The Contractor's programme shall list each scheduled item of equipment in the Contract and indicate periods for:

- Preparation, approval and finalisation of manufacturing drawings
- Ordering
- Manufacturing
- Inspection and testing during manufacture.
- Delivery
- Installation
- Tests on Completion
- Commissioning.

The Contractor shall allocate to a senior member of his staff the duties of studying and evaluating the progress of the works in relation to the approved programme, of devising methods of overcoming or preventing delays and of co-operation with the Engineer and other Contractors working on the Site. He shall report to the Engineer and draw his attention timeously to anything which may cause delay in the execution of the Works.

2.13 General Machinery Protection

Coupling and Shaft Guards

All high-speed couplings, projecting shaft ends and every dangerous moving part of machinery which are within normal reach of a person shall be protected by a guard manufactured from not less than 1 mm mild steel plate.

Belt Guards

All belt or rope drives with normal reach shall be adequately protected by a belt guard.

The guard shall be manufactured from wire mesh or open type expanded metal, securely braced and stiffened with light rolled steel section and bolted in position.

Chain Drives

All chain drives shall be fitted with sheet steel chain cases and lubrication facilities to chain manufacturers' recommendations. All joints shall be dust tight and arranged for convenient installation and dismantling.

Each chain case shall be fitted with a hinged inspection door, drain hole and plug.

Painting

All guards shall be finished in a light orange colour to B.S. 381 C.

2.14 Welding

All oxy-acetylene welding and testing shall be in accordance with B.S. 1821 or B.S. 2640, as applicable, for oxy-acetylene welds in mild steel pipelines up to 1670 kPa and/or temperatures up to 218 degrees Celsius.

Metal arc welding shall be in accordance with B.S. 1856 or B.S. 2633 as applicable.

Before any welding is undertaken, each welder to be used on the Contract Work shall make a sample weld in the Works or on Site of an average size pipe of the same physical and chemical analysis as the tube to be used in the Contract. These test welds shall be executed in the presence of a representative of the Engineer and when completed, the welds shall, after stress relieving or normalising, be cut up and specimens prepared for micro and macro examination and physical tests. After the welding samples have been approved, only the welders who have been responsible for these samples shall be employed on the Contract Works.

The Engineer shall reserve the right to ask for welded joints to be removed for detailed testing at the Contractor's expense.

On completion each weld shall be coated with one coat of red lead paint.

2.15 Operating and Maintenance Manuals

The Contractor shall submit, for approval, four weeks before completion of the installation, two copies of the maintenance and operating manuals for the plant and equipment supplied.

The Engineer will return it to the Contractor within ten working days of their receipt by him, one copy marked with any changes which are necessary.

The Contractor shall modify the manuals as required by the Engineer and submit to the Engineer, within ten working days, two revised copies of the manual. On completion of the installation, but before the plant is handed over to the Employer, the Contractor shall provide three copies of the final maintenance and operating manuals for the plant and equipment supplied. These manuals shall be sewn and bound in book form with hard plastic covers to withstand constant use. All manuals shall be properly indexed to facilitate easy reference.

2.15.1 Contents of Manuals

The manual shall include:

- A list of recommended servicing tools and specialist equipment.
- A list of spares to be supplied by the Contractor to cover the period of warranty.
- A price list of recommended spares necessary for a period of 2 years of operation.
- Exploded drawings or detailed spares list from which every item of every piece of equipment can be positively identified for ordering replacements.
- A list giving the name and address of the local agent for each item of equipment.
- A list giving the name and address of manufacturer of each item of equipment.
- A copy of all test certificates obtained with the plant.
- A list of recommended lubricants.
- A preventative maintenance programme of all equipment.
- Operating instruction for each item of equipment.
- Performance data and/or characteristic curves.

Note:

Drawings and any other information to be bound into the final manuals duly up- dated to indicate the supply “as fixed”.

SABS		
Practical Completion/Take-over Certificate		
Project:.....		
Installation:.....		
Portion:.....		
Contractor:.....		
Reference:.....		
Partial Completion of		
Partial Completion of		
Practical Completion		
It is hereby certified that the installation is practically completed on		
The following items are completed:		
Item	Description	Date completed
1	3 copies of O & M Manuals	
2	2 sets of "As Built Drawings"	
3	Employer Personnel Training	
Signed: Date:		

SABS	
Final Completion Certificate	
Project:	
It is hereby certified that the Contractor has satisfactorily completed all his contractual commitments in terms of the one year comprehensive maintenance contract.	
SIGNED:	
Employer:	Date:

3.0 Standard Specifications for Room Air Condition Units

Units shall be standard products of reputable manufacturers regularly engaged in the fabrication of the specific equipment

3.1 Capacity

Cooling

The units shall be able to deliver their stated capacities at an ambient temperature of 35 °C DB and a room temperature a stated in the attached room datasheets.

The units shall be able to deliver their stated capacities continuously.

The units shall be able to deliver their stated capacities with the units delivering their stated amount of fresh air to the conditioned space. The temperature of the uncooled fresh air shall be the same as the ambient temperature.

Heating

The units shall be able to deliver their stated capacities continuously.

3.2 Heat Exchange System

Compressor

- The compressor shall be a hermetically sealed unit.
- The compressor shall be mounted on springs with rubber seating.

Evaporator

- The evaporator shall be a multi pass copper coil with copper fins or aluminium fins.
- The fin spacing shall be adequate to ensure even with build-up of dirt on the fins the unit still meets its capacity as stated.

Condenser

- The condenser shall be a single or multi pass copper coil with mechanically bonded copper or aluminium fins.

Condenser fan

- The fan shall be rated for continuous duty.
- The fan shall be of the non-overloading type.
- The fan motor shall be rated for continuous duty with long life bearing.
- The fan motor shall be a totally enclosed motor.

3.3 Safety Controls

Heat exchange circuit

- The compressor shall be protected against over current and over temperature.

Heaters

- The heaters shall be fitted with safety thermostats to protect the heaters against over temperature.

3.4 Controls

- The units shall be fitted with a manually adjustable thermostat.
- The thermostat shall automatically select cooling, heating or re-circulation according to the return air temperature.
- The unit shall be fitted with an on-off switch

3.5 Building Monitoring System (BMS)

All new equipment controls to be installed in the laboratory and refurbished areas are to be Building Management System addressable. The SABs currently has a BMS system installed in its facilities which shall be connected to the new installation. The BMS system shall monitor and control the operation of mechanical systems in the building. All offered equipment must be compatible with the BACnet IP protocol.

3.6 Air Distribution

Fan

- The fan shall be a silent running fan.
- The fan shall be of the non-overloading type.
- The fan shall be selected to have a small variation in delivery, between the system resistance of a clean filter and a dirty filter.
- The fan shall be a low speed fan.
- All fans shall be EC (Electro Commutated) fans

Grilles

- The outlet grilles shall be adjustable.
- The grilles shall not rattle, hum or vibrate under any operational conditions.
- The grilles shall not melt with half the outlet grilles blocked and the heaters on at full capacity.

Filters

- The unit shall filter outside air as well as return air.
- The filter shall be of the washable type.
- The filter shall be easily accessible for cleaning purposes.
- The filter shall prevent the clogging of the evaporator coil.

3.7 Construction

Casing

- The casing shall be constructed from the heavy gauge steel.
- The casing shall be painted with stove enamel.
- The casing shall be acoustically and thermally insulated.
- The casing shall not drum vibrate or emit noises when the compressor comes in operation.
- The casing shall be treated for corrosion.
- The unit shall be acceptable to the Engineer.

Condensate

- The unit shall be constructed to collect the condensate from the evaporator coil.
- The fan shall not carry condensate over into the conditioned space.
- The collected condensate shall be piped to the outside of the casing with an adequately sized pipe.
- The condensate shall not collect in the casing.
- The thermal and acoustic insulation shall not be able to absorb condensate.

3.8 Noise and Vibration

- The noise and vibration of the compressor shall be kept as low as possible.
- The unit shall be acoustically tested by the SABS and a copy of the test shall be produced on request.
- The unit shall equal or surpass the noise criteria laid down in the Detailed Specification.
- The casing shall not drum, vibrate or emit noises.
- The grilles shall not drum, vibrate or rattle.

3.9 Electrical

- The unit shall be able to operate on 400/230V, 50Hz
- The unit shall not draw more than 15 Amps when operating on either heating or cooling mode.

3.10 Types

The above specification shall be applicable to a wall type, window type or split type room air conditioning unit.

4.0 Standard Specifications for Fans

4.1 General

Requirements under the above heading apply to fans which are not integral parts of condensing units, cooling towers, air handling units, or similar equipment designed and manufactured as complete units by the manufacturer unless referred to.

Fans shall be statically and dynamically balanced. In the case of direct driven fans, the balancing shall be done on the motor/impellor assembly.

Electrical protection gear characteristics shall be determined by the fan/motor assembly characteristics.

Fans handling air or gases with abnormal qualities shall be selected for the relevant application.

Extract fans shall have suitable access doors to allow for cleaning of the inside of the casing and the impellor.

No fan shall be operated for any purposes, such as temporary ventilation testing etc., until the connected ducts have been cleaned and the filters, if any, have been put in regular operation.

Fans shall be selected to operate in the stable region and as close as possible to the point of maximum efficiency.

Large fans shall be manufactured in easily assembled parts to facilitate installation. This shall not affect the static or dynamic balance of the fans.

All finished parts of fans, such as shafts and bearings, shall be properly protected from rust and foreign matter by means of suitable wrappings and protective grease coatings until commissioning of fans.

The design total fan resistance as indicated in Part 4 shall be finally checked when all the information on selected system elements is available.

Fans shall be of reputable manufacture and approved by the Engineer. Fans shall be selected for the correct air density and temperature.

All fan accessories shall be the product of the manufacturer of the specific fan it is used with. Flexible connections shall be fitted with flanges matching those of the fan.

4.2 Centrifugal Fans

Bearings shall be of the self-aligning ball or roller type and shall be selected for quiet operation as recommended by the bearing manufacturer. Bearings shall be selected for an average life of not less than 200000 hrs, allowance being made for the dead weight of wheel and maximum belt pull. Should the bearings prove to be noisy during the maintenance period, they shall be replaced by a more suitable type. Only bearings supplied by one manufacturer shall be used on one project of centrifugal fans.

Fans shall be driven by V-drives.

V-drives shall be matched sets of "Fenner" or equivalent.

V-drives shall be selected with a service factor and additional factors as recommended by the manufacturer. Operation of over 16 hours per day and 4 starts per hour shall be the

determining factors. Service factors shall be applied to motor power and not absorbed fan power.

V-drives shall be installed and operated according to the manufacturer's instructions.

V-belt tension shall be checked and set after two hours of continuous operation and thereafter daily for two weeks of operations.

The fan and motor shall be mounted on a common frame and means shall be provided to adjust the belt tension.

Adequately ventilated drive guards shall be provided. Care shall be taken that the motor cooling air is not blown onto or into the drive guards.

Drive guards shall be constructed to permit maintenance and the use of speed counters with the guards in position.

Fans shall be supplied with mating flanges.

Fans with impellor diameters above 750 mm shall be provided with access doors in the casing.

Fans shall be fitted with vortex dampers. The vortex dampers shall be manufactured by the fan manufacturer.

All connections to duct work, plenums, etc., shall be flexible. Flexible connections shall be a minimum of 100 mm long and attached to the fan, duct work, plenums etc., in such a way that it can be removed and replaced without disturbing any of the aforementioned equipment.

Flexible connections shall be air-tight. Vibrations isolators shall be installed.

A drainage plug shall be installed at the lowest point of fan casing.

4.3 AXIAL FLOW FANS

Multiply aerofoil blades shall be fitted. Blades shall have an adjustable pitch angle.

Access doors of ample size shall be provided in the casing of long casing fans.

A weatherproof external terminal box forming an integral part of the casing, shall be provided as standard for motor connections.

Fans shall be direct driven with the motor in the air stream.

Inlet cones manufactured by the fan manufacturer shall be fitted to fans of which the inlet is not connected to ducting with the same diameter.

Fan motors shall be flange mounted.

Fans extended for use within duct work shall be of the long casing type such that the casing completely shrouds the fan and motor assembly.

Fans having only one end attached to duct work, plenums, walls, etc., shall be the short casing type. The fan shall be so installed that the motor is accessible.

Anti-vibration mountings shall be utilized.

Fan selection shall be made, ensuring that a stall condition will not occur.

Vortex dampers shall match the fans and be manufactured by the fan manufacturer.

Controllable pitch fans shall have pneumatic or electric actuators. To ensure smooth operation throughout the range there shall be a balance between the control force and return force.

All connections to duct work, plenums, etc., shall be flexible. Flexible connections shall be a minimum of 100 mm long and it can be removed and replaced without disturbing any of the aforementioned equipment.

Flexible connections shall be air-tight.

4.4 Propeller Fans

Fans shall be resiliently mounted on rubber cushions or by other approved means. Fans shall be plate mounted.

Fans shall be direct driven with totally enclosed motors.

Mounting rings or plates shall be die cast or die formed to smooth curves where the air enters the wheels. Mounting plates shall be heavy enough to prevent distortion and shall be adequately braced to prevent vibration.

Fans shall be suitable for speed control.

Speed controllers shall control the speed in steps and be suitable to receive external signals. Speed controllers shall control the speed in steps and shall be hand operated.

4.5 Window/Wall Type Extract Fans

Fans shall be suitable for single phase operation.

Fans shall be reversible.

Fans shall be supplied complete with mounting accessories. Required air volumes shall in all instances be selected at low speed. Fans shall include electrical shutters.

The shutters shall be closed when the fan is not operational.

Fan controllers shall be included. The controller shall be capable of switching the fan on and off.

4.6 Roof Extract Fans

Roof extract fans shall be “Brooks”, “Woods” or equivalent factory assembled type. Impellers shall be of the vane-axial type.

Fans shall be selected for quiet operation and shall have ball or roller bearings with dust tight seals.

All metal exposed to weather shall be corrosion resistant or coated so as to prevent corrosion. Fans shall include automatic shutters.

Sound attenuating kerbs shall be provided.

5.0 Standard Specification for Air Filters

5.1 General

Only those filter units shall be acceptable which the tenderer can show as a whole, or the actual filtering elements, media curtains, cells, holding frames etc., incorporated in filter units assembled in his own workshop are the standard product of a reputable manufacturer, regularly engaged in the fabrication of the particular type of air filter. If an imported product, the sub-contractor shall be able to prove that such products are well represented in the Republic of South Africa.

Only filters tested by the South African Bureau of Standards to the ASHRAE standard 51-687 will be acceptable. Arrestance (gravimetric), efficiency (photometric), dust holding capacity and resistance against air velocity shall be documented according to the above test.

Frames and filters shall be constructed in such a manner that the passage of unfiltered air is prevented. Gaskets shall be provided between filters and frames and filter frame unit casings.

Each filter bank shall be supplied with an identification label stating the type of filters, quantity of filter elements, model numbers and all other information necessary for re-ordering filter material.

Filters shall be adequately protected against dirt during construction and shall not be operated until the system is thoroughly cleaned. Filters must be put in regular operating condition before the fans which they connect are operated for any purpose.

An inclined manometer shall be installed on each filter bank. The gauge shall be connected to static pressure taps of approved design so that it will indicate correctly the resistance to air-flow of the filter. Connections shall be made with copper tubing. The full scale reading of the inclined manometer shall be between 30 and 60 percent higher than the change-out pressure of the filters.

All filters, other than automatic types, shall be provided with pressure differential switches which shall operate when the pressure drop across the filter reaches a value recommended by the manufacturer. The switch shall energise a pilot light on the main control board.

Filter dimensions shall be selected to suit the configuration of the air handling unit.

All filter accessories including the filter holding frames and clips shall be standard products of the filter manufacturer.

All metal parts shall be sufficiently protected against corrosion. All metal parts shall be coated with baked enamel or equivalent.

5.2 Panel Filters

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

All filters cells on the same project shall have the same dimensions.

Filter cells shall be easily removable from the upstream or downstream side of the filter. The filter medium shall be pleated and bonded to the media holding frames.

5.3 Spare Media

One complete set of spare filter media shall be supplied for all filters in the entire project.

Spare filter media shall be suitably packed and protected for storage. The packing shall withstand the normal handling procedures without damage to the filters.

6.0 Standard Specification For Air Ducts

6.1 General

Ducting shall be manufactured according to SABS 1238-1979 as amended.

All duct dimensions, including dimensions for internally insulated ducts refer to the clean internal cross-section area.

Unless specified type 316 stainless steel shall be used for stainless steel ducting.

Opposed blade balancing dampers shall be installed on all branch ducts feeding more than one air outlet.

Dampers shall not be used to create artificial resistance in the system in order to reduce fan air flow capacity. Reduction of air flow shall be accomplished by reduced fan speed or by changing the fan blade angle.

All ducts passing through concrete or brick walls shall be isolated from the walls by means of high-density glass fibre collar of at least 20 mm thickness.

Galvanised steel shall be used for ducting for air conditioning and ventilation unless otherwise specified.

Black mild steel of minimum thickness 1.6 mm thickness shall be used for grease contaminated exhaust systems. All joints shall be welded.

6.1 Duct Hangers

Duct hangers shall be as follows:

Longest Duct Dimensions mm	Round Hangers	Galvanized Strap Hangers	Shelf Angle	Maximum Spacing
Up to 760	6	25x1,6	25x25x3	3,0
761 - 1000	10	38x38x3		3,0
1001 - 2100	10	50x50x3		2,4
2101 - 2400	10	50x50x6		2,4
2401 and over	12	50x50x6		2,4

Round hangers shall not protrude below the lowest part of the shelf angels.