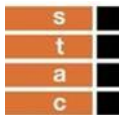


SUTHERLAND OBSERVATORY - PRIME BUILDING: HVAC TECHNICAL SPECIFICATION

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**SECTION 1: GENERAL****1. GENERAL**

This technical specification shall be read in conjunction with the project drawings.

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

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

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

2. THE SITE

The site is situated in Sutherland, South Africa.

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

3. COMPLETION DATE

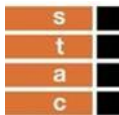
The Contractor will be required to keep up with the main contract in accordance with the main Contractor's program and to complete the mechanical installation concurrently with the main contract.

4. PROGRAM

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

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

- Working drawings
- Approval of working drawings
- Equipment detail submission for approval
- Ordering of material
- Ducting installation
- Piping installation
- Approval of first fix
- Plant equipment installation
- Second fix
- Electrical installation



- Commissioning and testing
- Inspection for practical completion
- Remedial work
- As built information; operating and maintenance manuals

A copy of the program shall be submitted to the Engineer well within time. The program shall be regularly updated and circulated to all affected parties.

5. FINISHING AND TIDYING

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

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

6. SCAFFOLDING, LIFTING AND PLANT EQUIPMENT

All scaffolding, lifting and plant equipment required for the execution of the contract shall be supplied by the Contractor under this contract.

7. SUPERVISORY STAFF

At all times while on the premises, all artisan and labourer members of the mechanical Contractor's and Subcontractor's staff shall wear clothing adequately marked with the relevant Contractor's name.

The work shall be done by, or at all times be under the personal supervision of a qualified artisan (or qualified technician) in the respective trade.

8. QUALITY OF MATERIALS AND WORKMANSHIP

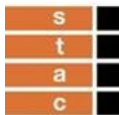
All materials shall be new, undamaged and free from rust or other defects. Only material of the best quality, which has been approved by the Engineer, shall be used.

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

Where applicable, all material shall be in accordance with the relevant standard specifications of the South African Bureau of Standards and /or other standards as specified in the technical specifications.

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

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



9. RATING OF EQUIPMENT

The Contractor shall supply the sizes and rating of all the equipment to be installed under this contract to the Engineer for approval prior to purchasing or ordering such equipment.

All equipment offered shall operate well within the manufacturer's ratings. Where applicable, the Contractor shall de-rate all equipment for site specific conditions.

10. SPACE REQUIREMENTS AND ACCESS

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

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

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

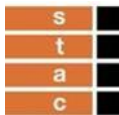
11. REGULATIONS AND STANDARDS

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

- a) The Occupational Health and Safety Act, Act No. 85 of 1993.
- b) Local Municipal Regulations, by-laws and Ordinances.
- c) Local Electrical supply authority regulations.
- d) Fire Department Regulations.
- e) Code of Practice for the Wiring of Premises, SANS 10142 as amended.
- f) The Application of the National Building Regulations, SANS 10400.
- g) Standard Specification for Air-Conditioning Ductwork, SANS 1238.
- h) Code of Practice for Refrigeration systems including plants associated with air-conditioning systems, SANS 10147 as amended.
- i) The Installation, Testing and Balancing of Air-conditioning duct work, SANS 10173.
- j) BS EN 12101

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

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



12.DRAWINGS

The dimensions and positions of equipment shown on the Engineer's drawings are schematic and for tender purposes only. The drawings are not suitable for manufacturing purposes. The responsibility for dimensional and layout accuracy remains with the Contractor. The following drawings shall be submitted by the Contractor to the Consulting Engineer for approval, within 3 weeks of acceptance of the tender:

1. Builder's work drawings

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

2. Mechanical layout drawings

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

3. Electrical drawings

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

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

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

The mechanical and electrical drawings shall be updated during the contract period and shall be included in the operating manuals at the end of the contract period as "As Built drawings".

13.OPERATION MANUALS AND MAINTENANCE INSTRUCTIONS

The Contractor shall submit three copies of operating and maintenance manuals to the Engineer. Manuals shall consist of:

- a) Comprehensive literature of the different components of the installation.
- b) Paper prints of all approved drawings and diagrams where applicable.
- c) Start-up and shutdown procedures.
- d) Commissioning data of all equipment in tabulated form.
- e) Prescriptions for routine tests, which shall be performed by the user together with the time when such tests shall be performed.
- f) Schedule of apparatus and equipment complete with model numbers, optional extras, modifications, electrical requirements, etc.
- g) Detailed monthly, quarterly, bi-annual or annual preventative maintenance procedures where applicable.
- h) Manufacturer's catalogues.
- i) List of spares for all equipment.



- j) Suppliers telephone numbers and addresses.
- k) Wiring diagrams.
- l) Test certificates.

The operating manuals shall be bound in strong hard cover format. Material in the manual shall be clear, legible and well-arranged and provided with an index.

Manuals shall be available three weeks before practical completion of the installation and no handover shall be considered without these manuals.

14. MAINTENANCE AND GUARANTEE

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

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

The Contractor shall visit the installation on a monthly basis and do the scheduled maintenance as prescribed in the operating instructions. On completion of the monthly visit a full report shall be prepared and submitted to the Engineer within 5 days from the visit.

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

15. PAYMENT CLAIMS

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

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

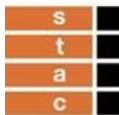
16. PAINTING

Where painting is specified, the following shall apply:

Steel surfaces shall be properly cleaned by removing all dirt, oil, scale and rust by brushing and sanding until a clean shiny surface is obtained. Hereafter a metal primer shall be applied.

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

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



The primer coat shall be followed by a matt undercoat and a final topcoat of high gloss enamel of an approved colour. Each layer of paint shall be clearly distinguishable from each other by means of different colours and each layer shall be properly sanded before the following coat is applied.

All paint shall at least be of SABS quality for industrial use and shall be approved by the Engineer. Equipment shall be painted according to the National colour standards for paint, SANS 1091.

17.PROTECTION OF WORKS

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

The Contractor shall be held responsible for any damage of equipment during transport and installation as well as any damage to the building and shall repair any such damage at his own expense. Where equipment cannot be repaired to an “as-new” condition, it will be completely replaced at the expense of the Contractor.

Equipment delivered to site shall be stored in a well-protected area where it cannot be damaged.

18.BUILDING WORK AND REMOVAL OF EQUIPMENT

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

- a) Drilling and cutting of necessary holes in the concrete, brickwork, ceilings and wooden doors, including making good to match original finish.
- b) Removal and re-installation of suspended or plastered ceilings.
- c) Cutting of ceiling or floor panels for installation of air terminals.
- d) Concrete plinths for installation of equipment.
- e) Waterproofing of roof penetrations and plinths.
- f) Water supply points and drain points for a/c equipment.

Existing HVAC equipment, which has been removed from an existing building, shall be handed over to the Client. Removal and disposal of replaced equipment shall be coordinated by the Consulting Engineer.

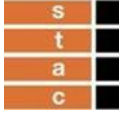
19.TESTING

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

20.COMMISSIONING

The installation shall be commissioned in accordance with the following codes or any other recognised commissioning procedure or code approved by the Consulting Engineer:

- a) Air distribution systems - SANS 10173: Code of Practice for Installation, Testing and Balancing of Air Conditioning Ductwork.
- b) Refrigeration systems - CIBSE Commissioning Code: Code R: Refrigeration systems.
- c) Control systems - CIBSE Commissioning Code: Series C: Automatic Controls.



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

The results of all checks and measurements shall be recorded in writing during the commissioning period. Commissioning records shall be handed over to the Consulting Engineer prior to the first acceptance of the plant. The commissioning records shall also be included in the operating manuals.

21.TRAINING

The Contractor shall train the Client's site staff after commissioning has been completed. The site staff shall receive enough instructions to ensure that they are fully conversant with the equipment concerned. The operating manuals shall be used during training.



SECTION 2: VENTILATION SYSTEMS**1. SCOPE**

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

- Fresh air supply systems: FAF-01
- Extract air systems: EAF-01

2. DESIGN CRITERIA

DESIGN DATA	
Outdoor summer temperatures	41°C Db/ 34°C Wb
Outdoor winter temperatures	-2°C Db/ -5°C Wb
Altitude above sea level	1460 m

3. GENERAL

The combination of fan and attenuators shall be such as to satisfy the specified noise levels.

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

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

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

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

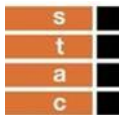
Indicating arrows for both directions of rotation and direction of airflow shall be provided on fan casings.

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

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

Bearings shall be of the ball or roller type and shall be quiet in operation.

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



4. SUPPLY & EXTRACT AIR SYSTEMS

4.1 FANS

The duties of the fans shall be as indicated on the drawings.

The fans shall be of the AMS type or equally approved, non-overloading, and directly driven by totally enclosed motors to IP55 or as specified.

Flow and rotation direction arrows on fan casings shall be easily visible from the access positions to the fans.

Motors shall be fitted with thermal overload protection, and have sealed ball or roller bearings, lubricated for life.

Fans shall be installed with suitable sound attenuators to ensure noise levels as specified.

4.2 SHEETMETAL DUCTWORK

Sheet metal ductwork shall be manufactured in accordance with SANS 1238, and installed, balanced and tested as set out in SANS 10173.

Low velocity, low pressure and medium pressure ductwork shall be manufactured from galvanized sheet metal and shall be rectangular in cross-section, except where otherwise specified.

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

All final dimensions shall be checked on site or verified by means of architect's working drawings and structural drawings, before the fabrication of the ducting. Air velocities in ducts shall be such as to ensure quiet operation.

Where beams, stanchions or other obstructions interfere with the straight running of ducts, suitable offsets shall be provided or changes in the section of the duct made. Aspect ratios in excess of 3:1 in rectangular ductwork shall be avoided.

Ducting shall be airtight and mechanically strong and sturdy. Long radius elbows shall generally be used, and the inner surfaces of ducting shall be smooth.

Adjustable opposed blade dampers, sound attenuators, duct splitters and turning vanes shall be provided where shown on the drawings.

Flexible connections shall be provided between all fans, sound attenuators and ducting. Flexible connections exposed to weather shall be provided with protecting galvanized sheet steel cover strips. Flexible connections shall be made of fireproof fabric, reinforced, air-tight material attached both sides with approved galvanized steel collars or frames.

As an alternative to transverse joints specified in SANS 1238, other flanged joints such as MEZ-flanges will also be considered provided that they meet the SANS requirements. MEZ-flanges or equivalent products shall be manufactured from cold rolled steel and hot-dip galvanized after manufacture.

An approved sealant shall be applied to longitudinal and transverse joints prior to assembly of such joints.

Galvanized ducting shall not be erected using components made of copper or copper alloys, unless the contact surfaces are isolated so that electrolysis cannot occur. Ducting shall always be installed in such a way, that, especially in plant rooms, maximum height between the floor and the underside of ducting is achieved.

The thickness of sheet metal to be used for drive-in slip joints shall be the same as that used for the ducting itself. All sides of ducting shall be cross broken for stability. All joints, seams, and duct stiffeners shall be supplied and installed according to SANS 1238.

Radiused bends shall be manufactured with a throat radius of equal to or greater than 0,75 times the width of the duct. Where space limitations exist, a minimum radius of 100 mm will be allowed, provided splitters according to SANS 1238 are installed.

Access doors in ducting shall be large enough to allow for the removal of the necessary equipment during maintenance. Access doors shall be hinged with at least two hinges, two latches and one handle.

Overhead hangers for horizontal rectangular ducts shall be of the steel strap (up to 450 mm only) or trapeze type with steel rod supports. Hanger sizes and spacing for horizontal rectangular ductwork shall be as follows:

	Wider side of duct in mm	Hanger steel rod, Ø mm	Steel strap dimension mm	Angle dimension mm	Maximum spacing m
For low pressure ductwork	Up to 450	10	25x2,0	25x25x3	3
	451-800	10	-	25x25x3	3
	801-1600	10	-	40x40x3	2,5
	1601-2000	10	-	50x50x3	2,5
For medium and high pressure ductwork	Up to 450	10	-	40x40x3	3
	451-800	10	-	40x40x4	2,5
	801-1600	10	-	50x50x5	2,5
	1601-2000	10	-	50x50x6	2

Overhead hangers for horizontal circular ducts shall be of the steel strap or band type. Hanger sizes and spacing for horizontal circular ductwork shall be as follows:

Diameter, mm	Hanger steel rod, Ø mm	Steel strap/ band dimensions mm	Maximum spacing			
			Low pressure ductwork		Med. & high pressure ductwork	
			Straight seamed ducts, m	Spiral seamed ducts, m	Straight seamed ducts, m	Spiral seamed ducts, m
Up to 200	10	25x3	2,0	3,0	1,8	3,0
201-450	10	25x3	2,5	3,5	2,5	3,5
451-800	10	25x3	2,5	3,5	2,5	3,5
801-1200	10	25x3	2,5	3,5	2,5	3,5

All hangers shall be treated against rust and painted.

Contractors shall make use of clamped joints where branch ducts, collars or spigots are attached to main ducts.

As an alternative, branches, collars and spigots may be attached to main ducts by means of return flanges with 1,6 mm galvanized sheet metal flanges which have been sealed and clamped by means of pop rivets spaced 150 mm apart. No other method shall be allowed unless approved by the Consulting Engineer.

Un-exposed ducting shall be left unpainted. It shall be ensured that the galvanized surface of the ducting is not damaged or marked in any way. The internal surface of plenums and ducting shall be painted black where necessary, to prevent visibility of the inside surface of the duct or plenum.

4.3 FLEXIBLE DUCTING

Flexible ducting between air terminals, diffusers, etc. and sheet metal ducting shall be made from polyester/aluminium laminate with a heavy-duty steel helix core, similar to the Europair Euroflex or equally approved.

Each flexible duct shall be connected to the air terminal and sheet metal duct spigot by means of an airtight connection. Metal clamps shall be used for this purpose.

Flexible ducting connected to diffusers or terminals shall not exceed 1 m in length nor have more than the equivalent of one 90° bend. Bends shall be of the maximum possible radius without flattening distorting the flexible ducting. Flexible ducting shall be supported with sufficient and correct brackets that will ensure maintenance of shape.

Flexible ducting shall comply with SANS fire resistance requirements.

4.4 TESTING OF DUCTWORK

The total ductwork installation shall be tested for leakage as per SANS 10173.

Leakage rates in excess of 5% of the required air flow rate in any section of ductwork or in excess of the SANS permissible leakage, whichever is the smaller, will not be accepted.

4.5 GRILLES

Supply air grilles shall be complete with opposed blade damper, plenum box and/or flexible connection as required.

Grilles shall be selected in accordance with the manufacturer's recommendations to be capable of passing the specified air quantity without creating excessive resistance, noise or local draughts.

Egg crate grilles shall be complete with opposed blade damper, manufactured from natural anodized.

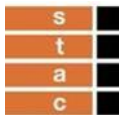
During commissioning of the system, each grille shall be set to deliver the specified air quantity.

It is the Contractor's responsibility to check regenerated noise levels of grilles offered against the overall acoustic performance of the system required. Noisy grilles shall be replaced at the Contractor's account with more suitable types.

Door grilles shall be of the inverted V-blade type, manufactured from natural anodized aluminium and flanged on both sides of the door.

4.6 WEATHER LOUVRES

Weather louvres shall be manufactured of extruded aluminium sections and finished in a colour as approved by the Engineer. Louvres shall be of the Trox AWG type or other approved. Weather louvres shall be complete with plenum box mounted in a hardwood timber frame.



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

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

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

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

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

FIXING OF WALL MOUNTED GRILLES AND LOUVRES

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

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

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

4.7 MOTORISED DAMPER FOR TEMPERATURE EQUALISATION INSTALLATION

Temperature equalisation louvres shall be installed on the observation and telescope levels where indicated on the drawings.

The weather louvres shall be of the Trox AWG type, natural anodised aluminium as specified in the technical data sheets. Motorised dampers shall be of the Trox multileaf, galvanised steel parallel blade damper or other approved.

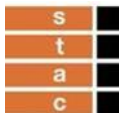
The dampers shall be driven open/closed by 24V motors mounted on the dampers. The control to open and close the dampers shall be installed in the control room on ground floor. Each set of vertical dampers (3 off) shall be actuated by one open / close selector switch mounted in a control panel. All selector switches and dampers shall be clearly labelled. Wiring from the building Distribution board to the control panel shall be neatly mounted in a cable tray and shall be included under this contract. The step-down transformer (220V to 24V) shall be mounted at the main electrical DB. The wiring between the Control Panel and the dampers shall be mounted in a cable tray included under this contract.

4.8 VOLUME CONTROL DAMPERS

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

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

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



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

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

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

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

4.9 AIR FILTERS

4.9.1 GENERAL

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

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

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

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

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

Proper sealed access doors with closed cell rubber gaskets shall be fitted to filter service areas.

4.9.2 FILTER HOLDING FRAMES AND BOXES

Filter holding frames shall be the manufacturer's standard product installed and used in accordance with his recommendations. Frames shall be manufactured from at least 16 gauge galvanised or epoxy powder coated steel.

Holding frames may be bolted or riveted together and shall be suitably reinforced in larger arrangements to withstand all possible operating conditions.

Fasteners shall be of the positive sealing type that clips in, with a minimum of four fasteners per filter. Fasteners shall match the particular filter, filter arrangement and frame.

Filter boxes shall be constructed and installed to ensure no un-filtered air by-pass the filter. Boxes shall be sealed with silicone sealer.

4.10 FIRE DAMPERS

Fire dampers shall be of the Electrovent type or other approved and shall be installed where indicated on the drawings.

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

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

Fire damper markings shall be as follows:

- a) Manufacturer's name or trade name or trade mark.
- b) Fire resistance rating, in hours.
- c) Vital instructions regarding installation, direction of airflow, mounting position.

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

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

Fire dampers shall be fitted with an actuator and be triggered by the fire detection system to provide normal closure in the event of a fire being detected. Fire dampers shall also have a backup fusible link and shall be incorporated into the assembly to provide normal closure in the event of increasing temperature within the duct.

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

Fire dampers shall be installed according to the manufacturer's and SANS requirements and recommendations. Fire dampers shall be installed as to form part of a continuous barrier to passage of fire when in a closed position. Where a fire damper cannot be fitted immediately adjacent to the fire wall, the section of ducting between the damper and the wall shall be of at least the same metal thickness and fire rating as the damper casing.

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

Sheet metal sleeves shall be provided for housing the fire dampers where fire dampers are mounted in walls. These sleeves shall be built into the walls by the Building Contractor. Retaining angles shall be installed on the four sides of the fire damper sleeve on both sides of the wall. The angles shall be fastened to the sleeves only, and not to the wall. The retaining angles shall lap the masonry by a minimum of 25 mm around the entire opening. Recommended minimum angle sizes are:

Largest Dimension of Fire Damper	Angles
Up to 1200 mm	38 x 38 x 3,2 mm
1200 mm to 1800 mm	44 x 44 x 3,2 mm
Over 1800 mm	51 x 51 x 4,8 mm

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

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

4.11 SOUND ATTENUATORS

This part of the specification shall be read together with section 4: sound control.



All sound attenuators shall be off the Donkin type or equally approved. If sizes are not specified, sound attenuators shall be selected to comply with the noise levels as specified in Section 4: Sound Control.

4.12 ELECTRICAL

The electrical contractor shall provide isolators within 1m from the fans. The mechanical contractor shall do the electrical installation from the isolators to the fans.

Where applicable, Section 5: Electrical of this technical specification shall also apply to this section of the specification.

4.13 CONTROLS

4.13.1 FAF-01

The fans shall be switched on and off by means of timers situated in the electrical switchboard feeding the fans. The timers shall be of the circuit breaker size type to be mounted next to the circuit breakers feeding the fans. The timers shall be of the electronic 7-day type and shall be fully programmable. The timers shall be supplied and installed under this contract.

On receiving of a fire signal, the fans shall switch off. The fire signal shall be provided by the fire detection system installed by others.

4.13.2 EAF-01

The fans shall be switched on and off by means of timers situated in the electrical switchboard feeding the fans. The timers shall be of the circuit breaker size type to be mounted next to the circuit breakers feeding the fans. The timers shall be of the electronic 7-day type and shall be fully programmable. The timers shall be supplied and installed under this contract.

On receiving of a fire signal the fans shall switch off. The fire signal shall be provided by the fire detection system installed by others.

SECTION 3: AIR-CONDITIONING UNITS

1. SCOPE

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

- DX high-wall split units AC-01/02/03
- Condensing unit CU-01/02/03

2. DESIGN CRITERIA

DESIGN DATA	
Outdoor summer temperatures	41°C Db/ 34°C Wb
Outdoor winter temperatures	-2°C Db/ -5°C Wb
Indoor conditions	22C° Db / 50%RH
Altitude above sea level	1460 m

3. APPLICABLE STANDARDS

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

- SANS 1125: Room air conditioners and heat pumps
- SABS 0147: Refrigerating systems including plants associated with air-conditioning systems
- SANS 60335-2-40: Household and similar electrical appliances – Safety. Part 2 – 40: Particular requirements for electrical heat pumps, air conditioners and dehumidifiers
- SANS 10142-1-2003: The wiring of premises Part 1: Low-voltage installations
- SABS 1453: Copper tubes for medical gas and vacuum services

4. AIR-CONDITIONING UNITS

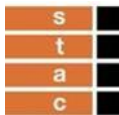
4.1 GENERAL

The split units shall be individual self-contained units. Units shall be of the heat pump type with inverter driven compressors. Units shall be of the manufacturer's energy efficient range.

4.2 HIGH WALL SPLIT UNITS

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

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



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

4.3 CONDENSING UNITS

Condensing units shall be of the heat pump inverter type. The unit framework and casing shall be of galvanised steel construction finished in good quality enamel or lacquer in the standard colour of the manufacturer.

Compressors shall have low oil pressure protection and shall contain crankcase oil heaters to ensure boil-off of dissolved refrigerant from lubricating oil when the compressors are stationary.

Condenser coils shall consist of copper tubes with mechanically bonded aluminium plate fins, all housed in a robust galvanised steel frame and protected with a suitable galvanised wire mesh screen. Suitable space shall be provided at the coil ends in order that tube bends are easily accessible in the event of possible refrigerant leaks.

Condenser fans shall be of the slow-running propeller type, direct driven by squirrel cage electric motors. The units shall be provided with a minimum of two propeller fans, which shall be arranged, preferably for vertical discharge through suitable weatherproofed protective wise guards. The fan and motor bearings shall be of the permanently lubricated sealed type, and the motor shall be resiliently mounted so as not to transmit vibration to the unit casing.

Condenser air intake and discharge arrangements shall be such that no short-circuited discharge air can be drawn back into the air intake.

Refrigeration pipework shall be carried out in seamless, refrigeration quality copper tubing, and suitable provision being made to ensure that the piping is not subjected to any stresses from vibration of the compressors. The refrigeration system shall be split into at least two stages on the liquid side for adequate capacity control. Refrigerant circuits shall incorporate replaceable core type filter-driers, sight glasses, thermostatic expansion valves and vapour proof insulation on the suction lines.

Automatic safety controls within the unit shall include a dual pressure switch with manual reset on the high-pressure side, and an oil pressure switch with manual reset. Provision shall be made for pressure relief of the high side refrigerant piping in accordance with government regulations. Provision shall also be made for cycling the condenser fans.

The units shall be thoroughly tested for all operating conditions. Spares shall be freely available in South Africa. All equipment stored or installed on site shall be adequately protected always, until the final overall acceptance of the entire installation by the engineer.

4.4 PERFORMANCE SPECIFICATIONS

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

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

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

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



4.5 ELECTRICAL

The power to condensing units shall be provided by the electrical contractor by means of an isolator. Wall mounted isolators shall be installed at the indoor units by the electrical contractor.

All electrical and control cables shall be neatly mounted in galvanised cable trays.

The entire electrical installation shall comply with:

- SANS 10142-1-2003: The wiring of premises Part 1: Low-voltage installations

On completion, the Contractor shall issue a compliance certificate for the entire electrical installation forming part of this contract.

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

4.6 CONTROLS

Controls to high wall split units shall be of the infrared, remote controlled type. Outlet boxes and conduits shall be chased into walls by the electrical contractor. Controls shall be of the same manufacture as the air-conditioner.

Controls shall have the following minimum functionality:

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

4.7 REFRIGERANT CIRCUITS

Refrigerant piping shall be in accordance with the following standards:

- SABS 1453: Copper tubes for medical gas and vacuum services
- SABS 0147: Refrigerating systems including plants associated with air-conditioning systems

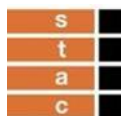
Fittings shall be copper based capillary solder fittings in accordance with SABS 1067. All soldered joints on proprietary manufactured units shall be carefully checked and remade if found damaged in transit.

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

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

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

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



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

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

Refrigerants shall be of the Zero Ozone Depletion (ODP) with low Global Warming Potential (GWP) type. Refrigerants shall be readily available in South Africa.

4.10 INSTALLATION REQUIREMENTS

The following standard drawings shall apply and shall be read in conjunction with this specification:

DRAWING DESCRIPTION	DRAWING NUMBER
N/a	

4.10.1 INSTALLATION OF INDOOR AND OUTDOOR UNITS

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

Outdoor condensing units shall be installed on anti-vibration mounts.

4.10.2 INSTALLATION OF CONDENSATE DRAIN PIPES

Condensate drain pipes shall be installed on cable trays as far as the installation permits and shall be installed at a slope to ensure positive draining of condensate. Drain piping shall be of uPVC type installed with saddle type brackets at regular intervals to prevent sagging.

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

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

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

4.10.3 INSTALLATION OF REFRIGERANT PIPING

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

Refrigerant piping shall be installed in galvanised steel Cabstrut light duty cable trays. Pipes shall be strapped over insulation to cable trays at 500 mm intervals with suitably sized cable ties.

Any insulation material exposed to the elements shall be neatly strapped with cable ties to minimise the possibility of dirt and water entering between the insulation and refrigeration pipes.

SECTION 4: SOUND CONTROL

1. SCOPE

The general sound control for the air conditioning and ventilation installations are specified under this section of the technical specification.

2. GENERAL

The installation shall operate without causing undue noise and vibration. The Contractor shall take the necessary precautions to ensure that noise levels in occupied areas do not exceed the levels as specified below.

Environment	NC level
General offices	35
Private offices, libraries and lecture rooms	30
Cafeterias	40
Equipment rooms	45

Noise generating equipment such as fans, compressors, pumps, motors, etc. shall be selected to operate as close to the point of maximum efficiency as possible.

Where piping and ducting pass through plant room walls or slabs, the opening around the pipe, duct or sound attenuator shall be sealed with high density foam and galvanised flashing on both sides of the wall or slab. Shafts directly connected to plant rooms shall be considered as part of the plant room.

Equipment shall be provided with sound attenuators, enclosures, or sound attenuating cowls in order to meet the minimum sound levels specified below.

Noise levels on the outside of buildings due to air-conditioning and ventilation equipment shall not exceed the following values when measured at a distance of 10 m directly in front of the noise source (cooling tower outside air grille, etc.):

Environment	NC Value
Buildings in residential areas with 24 hour plant operation	25
Buildings in residential areas with 12 hour plant operation	30
Buildings in city centres adjacent to or across roads to flats, hostels, hotels, etc. with 24 hour plant operation	25
Building in city centres adjacent to or across roads to flats, hostels, hotels, etc. with 12 hour plant operation	30
Building in industrial areas with 24 or 12 hour plant operation	35



3. SOUND ATTENUATORS

Sound attenuators shall be provided and installed in positions as indicated on the relevant drawings.

The Contractor shall submit noise-estimating sheets for all systems as well as the insertion loss ratings of sound attenuators for approval before ordering.

Rectangular sound attenuators shall be of the splitter type, like Howden Donkin Series RAS or other approved.

Cylindrical sound attenuators shall be of the acoustic pod type, with length of 1.5 x diameter, Howden Donkin Series Silax or other approved.

Sound attenuation shall be of the proprietary manufactured type. The sound attenuators shall be manufactured of pre-galvanised mild steel sheet. The acoustic infill material shall be moisture repellent, shall not support combustion and shall be guaranteed against surface erosion up to air velocities of 20 m/s.

Where sound attenuators are larger than the ducts, the joining duct sections shall be enlarged to the size of the attenuator. All sound attenuators shall be provided with flanged connections.

Sound attenuators in plant rooms shall be installed in or as close to the plant room wall as possible to prevent break-in of plant room noise into the duct after the sound attenuator. Where this is not feasible due to space limitations, the duct section between the sound attenuator and plant room wall shall be externally insulated and plastered with a suitable hard setting plaster at least 10 mm thick on all four sides. Where ducting passes through an external noisy area it shall be treated to prevent any noise transmission into the duct.

SECTION 5: ELECTRICAL INSTALLATIONS

1. SCOPE

The general electrical installations shall be specified under this section of the project specification.

2. GENERAL

The services of a qualified electrical contractor shall be employed by the mechanical contractor, who shall be responsible for the design engineering, documentation, supply, and installation and commissioning of the electrical installation for the hvac installation. The electrical system shall be designed, installed and tested in accordance with the criteria laid down in the Standard Regulations for the wiring of Premises, SANS 0142-1 latest Edition. An electrical certificate of compliance shall be issued under this contract and after completion of the installation.

The mechanical contractor shall supply and install all cables from isolators to all the equipment.

An electrical point in the form of a surface mounted isolator shall be supplied at each of the pieces of equipment by the electrical contractor. The feed from the isolators to the units shall run in galvanised conduits, installed by the mechanical contractor, and shall be neatly connected to the units.

3. DISTRIBUTION BOARDS AND CONTROL PANELS

Isolators will be provided by the electrical contractor. Power from the isolators to the equipment shall be installed by the mechanical contractor under this contract. Electrical cables shall be installed on cable trays.

4. MOTORS

Motors shall comply with BS.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 2 880 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.

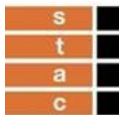
Frames shall generally be of the standard protected type, but in dirty and damp installations they shall be totally enclosed, fan cooled. Where operating in moist air conditions, motor windings shall be specially treated.

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.

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 DB, 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 DB.

5. STARTERS

n/a

6. CONTACTORS

n/a

7. SWITCHGEAR

n/a

8. METERING AND INDICATION EQUIPMENT

n/a

9. CABLE

Electrical cables shall be polyvinyl chloride (PVC) insulated steel wire armoured to SABS 150 - 1957.

Cables shall be continuous and not joined between the DB's and equipment isolators.

10. 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.

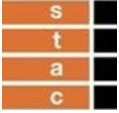
The Contractor shall provide and install a suitable earth mat which must be connected to the switchboard and shall be responsible for the supply of all material for earthing the electrical gear to be supplied and installed under this contract.

11. RADIO AND TV INTERFERENCE

The 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.

12. EARTH LEAKAGE PROTECTION

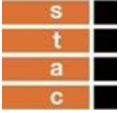
Earth leakage protection shall be provided and shall comply with the relevant SANS specifications.



13.DRAWINGS AND INSTRUCTION BOOKS

The Contractor shall supply the following information:

- i) switchboard and control board outline and equipment layout drawings and details of manufacturing;
- ii) single line and wiring diagrams detailing all control, metering and indication circuits;
- iii) instruction and maintenance books for all major items or equipment



ANNEXURE A: TECHNICAL DATA SHEETS

403-SCH-HVAC-00-R0

SECTION	DESCRIPTION	PAGE
WL-01,02,03,04	Weather Louvres	1
AC-01,02,03	High-wall Split Units	2
DG-01	Door Grills	3
Filter-01	Filters	4
SAG-01	Supply Air Grills	5
EAG-01	Extract Air Grills	6
FAF-01	Fresh Air Fans	7
EAF-01	Extract Air Fans	8
MD-01	Motorised Damper	9

Project no.	403-0619	Project Description	Sutherland Prime Building
Equipment no.	Various	Equipment Description	Weather Louvre

EQUIPMENT DATA

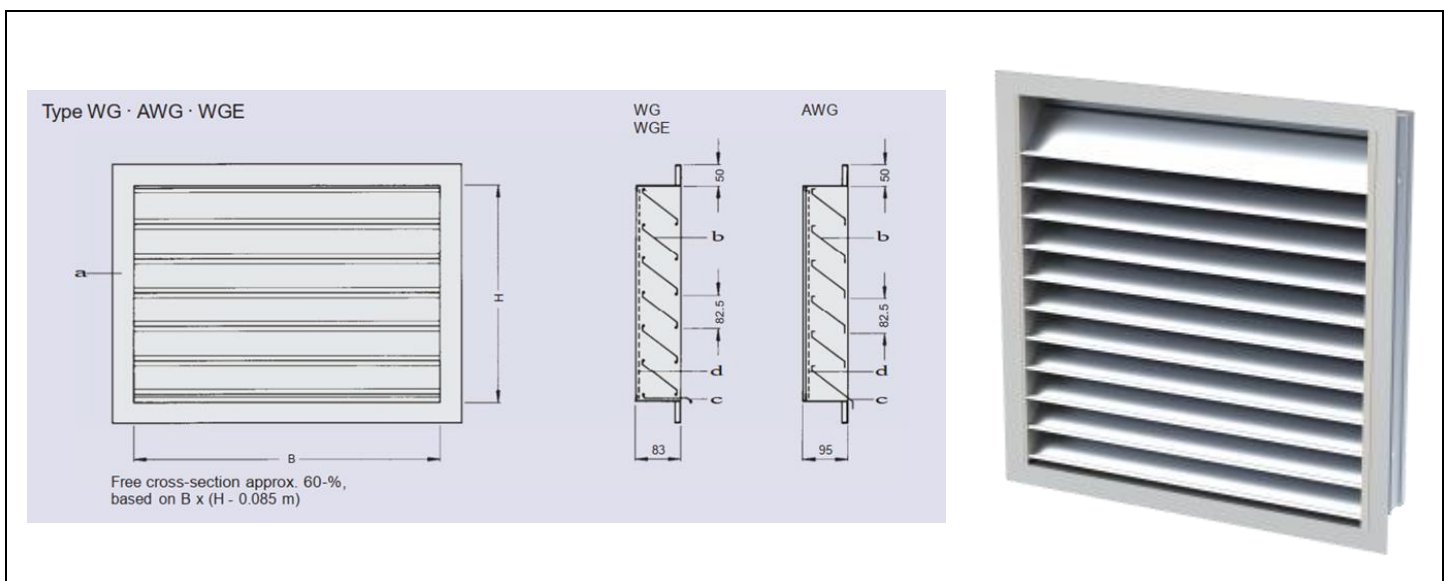
Manufacture:	Type:	Model Number:	Flow:	Velocity:	Plenum Box:
Trox	WL/AWG		60 l/s	2.5 m/s	No
Options:					
1.	2.	3.	4.	5.	6.

NOISE DATA

NC Level:	25-35 dB
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PHYSICAL DATA

Equipment no.	Type:	Size:	Finish:	Frame Type:	Accessories:	Pressure Loss:
WL-01	WL	300x300 mm	NA	50 mm	-	30 Pa
WL-02	WL	200x150 mm	NA	50 mm	-	30 Pa
WL-03	AWG	900x600 mm	Natural Anodised	95mm deep; 50mm flange	Wire mesh screen	30 Pa
WL-04	AWG	600x600 mm	Natural Anodised	95mm deep; 50mm flange	Wire mesh screen	30 Pa

DIAGRAMATIC


Project no.	403-0619	Project Description	Sutherland Prime Building
Equipment no.	Various	Equipment Description	High-Wall Split Unit

EQUIPMENT DATA

Equipment no.	Manufacture:	Model - Indoor:	Model - Outdoor:	Supply Air:	Total Cooling:	Total Heating:
AC-01				234 l/s	2.4 kW	1.6 kW
AC-02				191 l/s	2.4 kW	2.65 kW
AC-03				191 kW	2.4 kW	2.65 kW
	Control:	Options:				
		1.	2.	3.	4.	5.

ELECTRICAL DATA

Power:	Volts:	Amps:	Phase:

PHYSICAL DATA

DIAGRAMATIC


Project no.	403-0619	Project Description	Sutherland Prime Building
Equipment no.	DG-01	Equipment Description	Door Grilles

EQUIPMENT DATA

Manufacture:	Type:	Model Number:	Flow:	Velocity:
Europair	DG		60 l/s	2 m/s

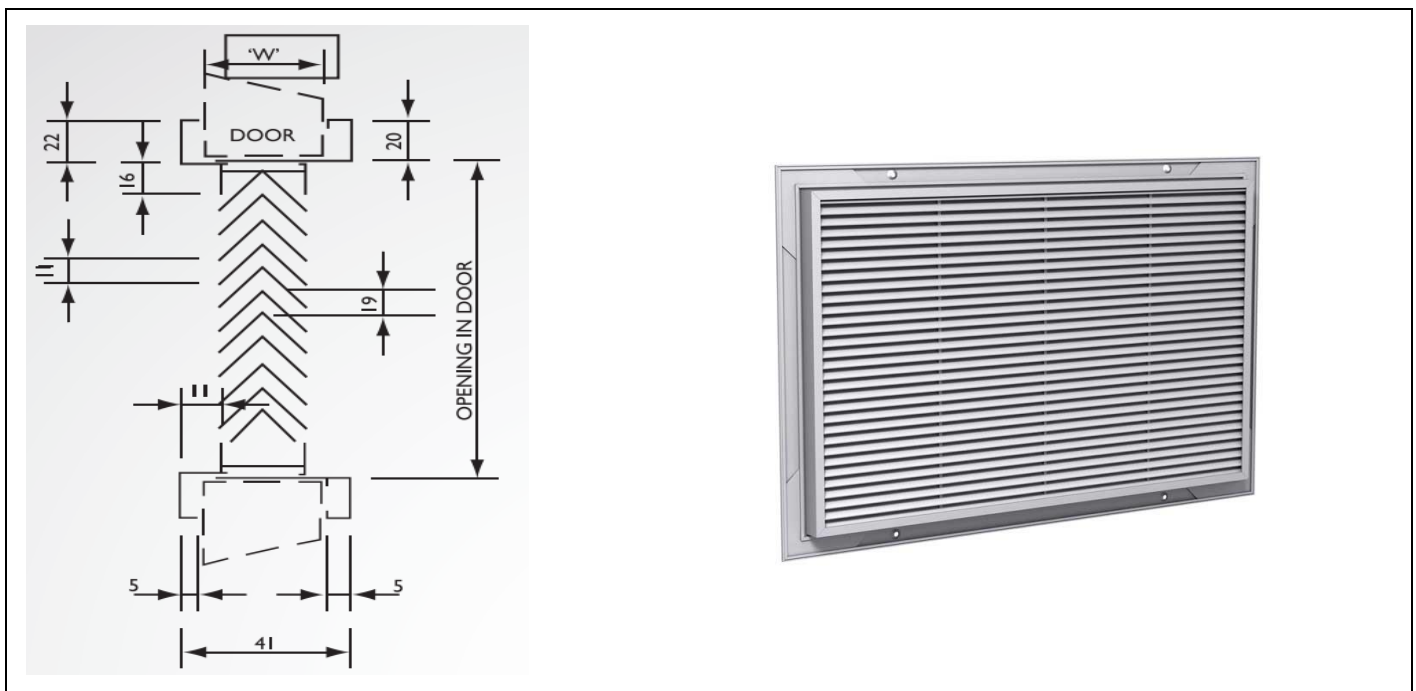
NOISE DATA01

NC Level:	-
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PHYSICAL DATA

Equipment no.	Type:	Size:	Finish:	Frame Type:	Accessories:	Pressure Loss:
DG-01	DG	310x150 mm	NA	20 mm	-	20 Pa

DIAGRAMATIC



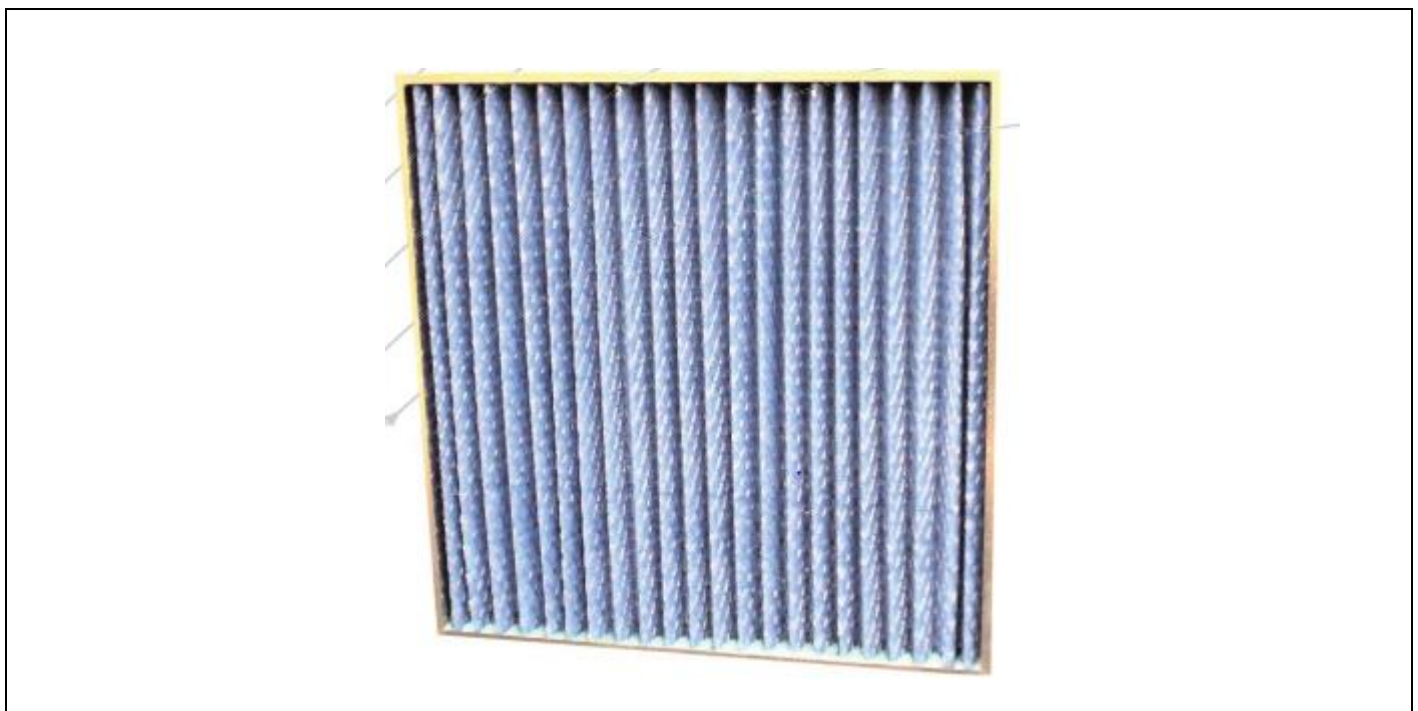
Project no.	403-0619	Project Description	Sutherland Prime Building
Equipment no.	Filter-01	Equipment Description	Filter

EQUIPMENT DATA

Manufacture:	Type:	Model Number:	Pressure (Initial):	Pressure (Final):	Flow:
TROX	Washable	WP77	60 Pa	250 Pa	60 l/s
Plenum Box:	Face Velocity:	Options:			
yes	2.5 m/s	1.	2.	3.	4.

PHYSICAL DATA

Equipment no.	Filter Thickness:	Size:
Filter-01	50 mm	295x295 mm

DIAGRAMATIC


Project no.	403-0619	Project Description	Sutherland Prime Building
Equipment no.	SAG-01	Equipment Description	Supply Air Grilles

EQUIPMENT DATA

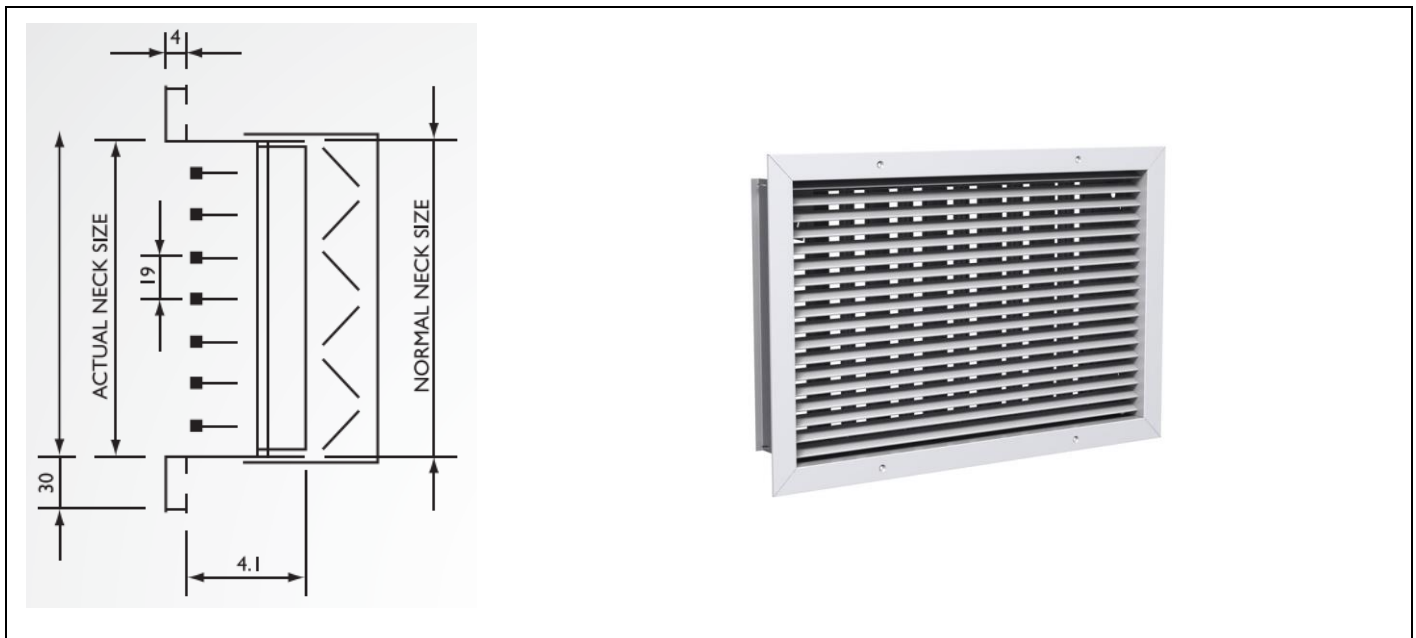
Manufacture:	Type:	Model Number:	Flow:	Velocity:	Plenum Box:
Europair	D/D		20 l/s	2.18 m/s	Yes
Options:					
1.	2.	3.	4.	5.	6.

NOISE DATA

NC Level:	-
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PHYSICAL DATA

Equipment no.	Type:	Size:	Finish:	Frame Type:	Accessories:	Pressure Loss:
SAG-01	DD	200x100	NA	30 mm	OBD	2.12 Pa

DIAGRAMATIC


Project no.	403-0619	Project Description	Sutherland Prime Building
Equipment no.	RAG-01	Equipment Description	Return Air Grilles

EQUIPMENT DATA

Manufacture:	Type:	Model Number:	Flow:	Velocity:	Plenum Box:
Europair	RA		60 l/s	2 m/s	No
Options:					
1.	2.	3.	4.	5.	6.

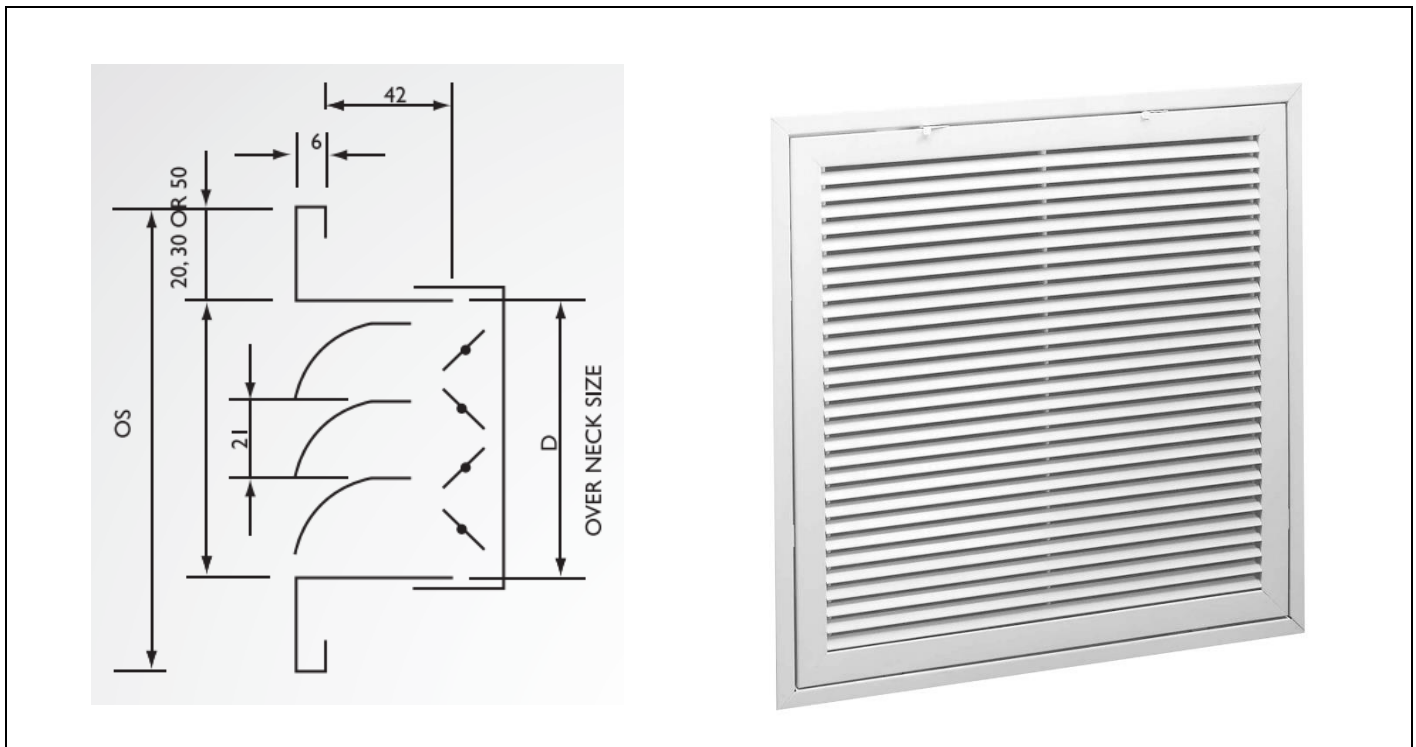
NOISE DATA

NC Level:	
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PHYSICAL DATA

Type:	Size:	Finish:	Frame Type:	Accessories:	Pressure Loss:
RA	310x150	NA	30 mm	OBD	20 Pa

DIAGRAMATIC



Project no.	403-0619	Project Description	Sutherland Prime Building
Equipment no.	FAF-01	Equipment Description	Fan and Attenuator

FAN DATA

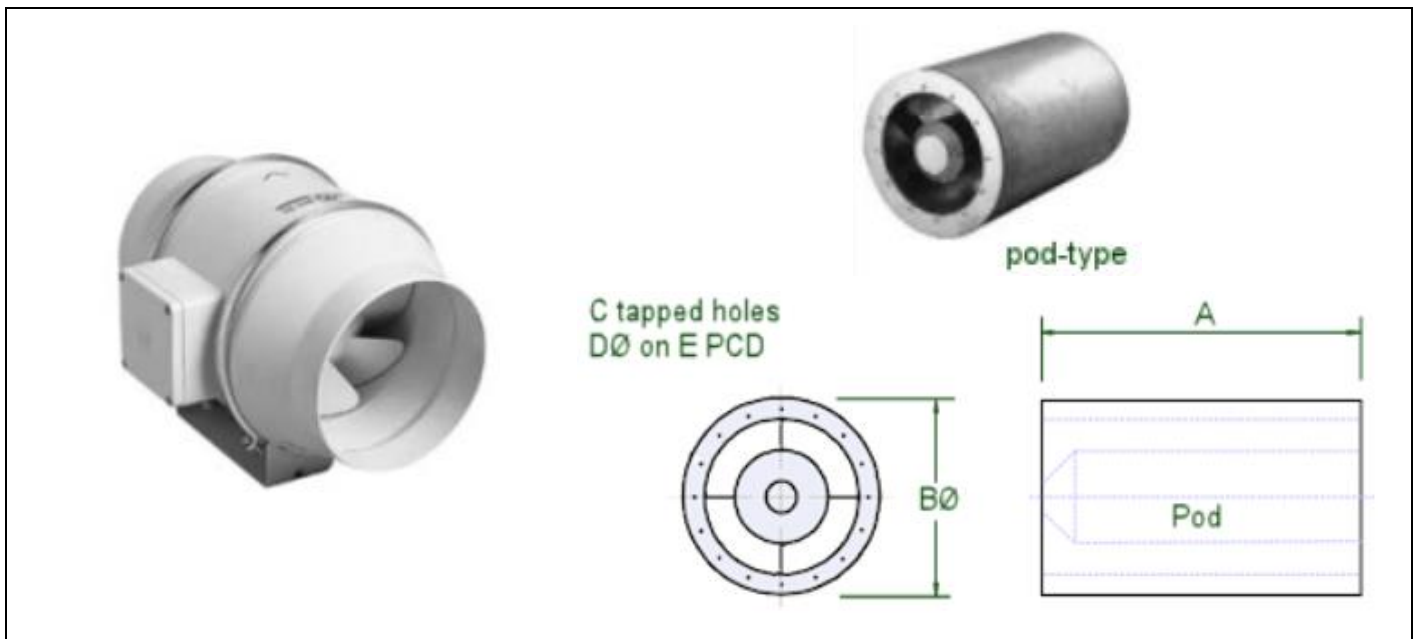
Manufacture:	Fan Type:	Model Number:	Pressure:	Air Quantity:	Maximum Speed:
A.M.S.	Mixed flow fan	TD 2000/315	355 Pa	60 l/s	46 rpm
Control:	Options:				
	1.	2.	3.	4.	5.

ATTENUATOR DATA

Model Number:	Dimensions:	Attenuation Required:
C2P-031	Ø315x600 mm	0, 0, 8, 17, 23, 23, 19, 11

ELECTRICAL DATA

Motor size:	Volts:	Isolator:	Phase:
0.26 kW	220 V	1.0 amps	1-phase

DIAGRAMATIC


Project no.	403-0619	Project Description	Sutherland Prime Building
Equipment no.	EAF-01	Equipment Description	Fan and Attenuator

FAN DATA

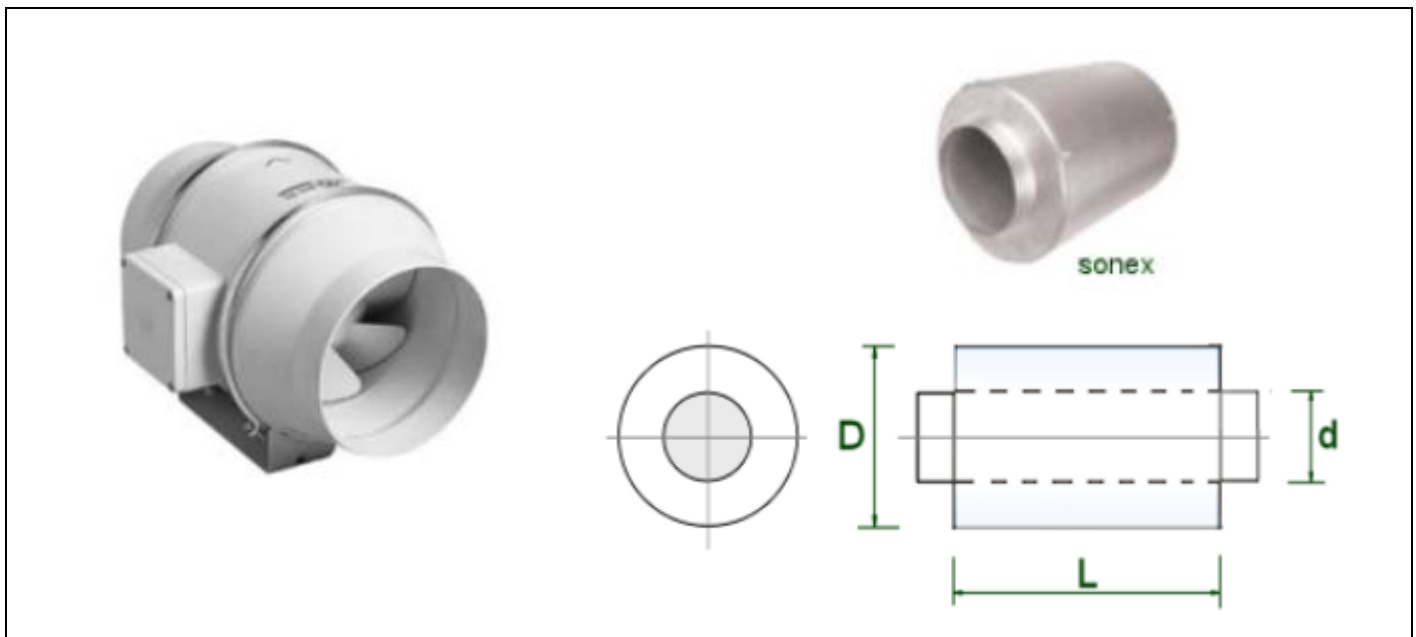
Manufacture:	Fan Type:	Model Number:	Pressure:	Air Quantity:	Maximum Speed:
A.M.S.	Mixed flow fan	TD 500/150	174 Pa	60 l/s	42 rpm
Control:	Options:				
	1.	2.	3.	4.	5.

ATTENUATOR DATA

Model Number:	Dimensions:	Attenuation Required:
SN-015-060	Ø150x600 mm	0, 0, 12, 19, 20, 22, 15, 10

ELECTRICAL DATA

Motor size:	Volts:	Isolator:	Phase:
0.1 kW	220 V	0.27 amps	1-phase

DIAGRAMATIC


Project no.	403-0619	Project Description	Sutherland Prime Building
Equipment no.	MD-01	Equipment Description	Motorised Damper

EQUIPMENT DATA

Manufacture:	Type:	Actuator
TROX	JZ-P (Motorised Damper)	Open/close

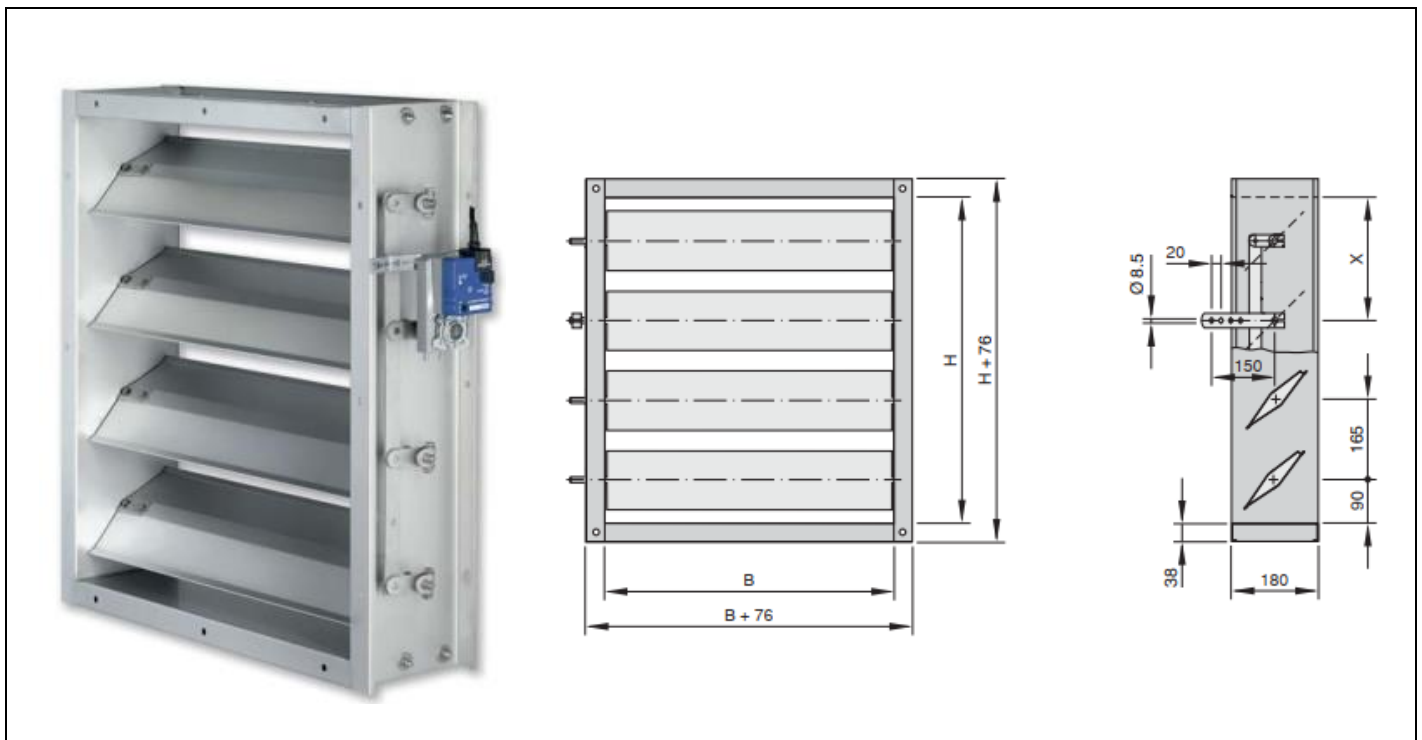
ELECTRICAL DATA

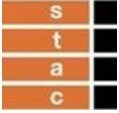
Actuator	24V	Actuator Type	Motor
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PHYSICAL DATA

Equipment no.	Type:	Size (B X H):	Insulated	Horizontal / Vertical	Material / Finish
MD-01	JZ-P	900x600	No	Horizontal	Galv.
MD-02	JZ-P	600x600	No	Horizontal	Galv.

DIAGRAMATIC

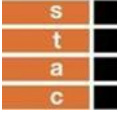




ANNEXURE B: LIST OF DRAWINGS

403-DWG-HVAC-01-R1

403-DWG-HVAC-02-R1



ANNEXURE C: BOQ

403-BOQ-HVAC-00-R0

PREAMBLE TO THE BILL OF QUANTITIES

1. All prices shall be quoted in the currency of the Republic of South Africa and will be held to be firm unless otherwise stated, in which case sufficient information must be afforded at the time of tendering to indicate the basis on which payment shall be adjusted.
2. The Tenderer shall enter a price against each item in the schedule of prices.
3. The prices quoted against each item in the schedule of prices shall cover the full inclusive cost of everything required for the execution of the work under the item plus an apportionment of any cost involved in meeting the obligations and liabilities imposed by the conditions of contract and in complying with the specifications.
4. The prices quoted shall include for all handling, loading, transporting and of-loading required for the delivery of the plant and equipment to the site, including in the case of off-site storage for double handling at the store.
5. The prices quoted shall include for all erection, installation, painting, commissioning, operating, testing, adjusting, handing over in proper working order, all as specified.
6. The tendered rates and amounts must exclude Value Added Tax (VAT) but must include all levies, other taxes and duties on items to which they apply. Separate provision has been made in the Tender Summary for the purpose of VAT.
7. Unit prices to include all associated installation materials required to complete the installation as specified.
8. Amounts allowed for "allowances" will be spent in part or as a whole at the sole discretion of the Engineer. Items marked "allowance" to be claimed against tendered rates. Where no rates are available, cost plus an agreed mark-up shall apply.
9. The bill of quantities shall be completed in black ink. Corrections must be done by deleting; re-writing and initialling next to the amendment.
10. All quantities shall be re-measured on completion and based on the construction drawings issued by the contractor and approved by the engineer.
11. All omissions and additions will be done at the tendered rates
12. The client reserves the right to add or omit any item listed in the bill of quantities
13. The tenderer is responsible for the correctness of all calculations and formulas in the electronic bill of quantities. No claim in this regard will be considered.
14. The engineer reserves the right to adjust any individual price and to rectify any discrepancy whilst the total tender price as tendered shall remain unaltered.

SUTHERLAND OBSERVATORY PRIME BUILDING

HVAC INSTALLATION: BILL OF QUANTITIES

Item no.	Description	Unit	Quantity	Rate	Amount
	<u>SPECIFICATIONS</u>				
	The bill of quantities must be read together with the tender specifications and drawings forming part of this tender				
	403-SPEC-HVAC-00-R0				
	<u>DRAWINGS</u>				
	403-DWG-HVAC-01				
	403-DWG-HVAC-02				
1	<u>SECTION 1: GENERAL (REFER TO THE SPECIFICATIONS)</u>				
1,1	Item 6: Provide all scaffolding, lifting and plant equipment needed for the duration of the contract	item	1		
1,2	Item 12: Provide all drawings as specified	item	1		
1,3	Item 13: Provide operation and maintenance manuals as specified	item	1		
1,4	Item 14: Provide maintenance and guarantee as specified	item	1		
1,5	Item 20: Commissioning as specified and required	item	1		
1,6	Item 21: Training as specified	item	1		
Total for Section 1: General					
2	<u>SECTION 2: VENTILATION EQUIPMENT</u>				
2,1	<u>FAF-01</u>				
2,1,1	Plenum box from weather louvre (300x300)	item	1		
2,1,2	Transformation piece, galvanised steel, discharge plenum box size to filter box	item	1		
2,1,3	WP 77 washable primary panel filter, 295x295x50, complete with filter box and side access	item	1		
2,1,4	Transformation piece, galvanised steel, filter box to attenuator size	item	1		
2,1,5	Flexible connection between attenuator and transformation piece-suction side	item	1		
2,1,6	AMS C2P-031, Size Ø315x600, suction side, complete with mounting brackets	item	1		
2,1,7	Fan, FAF-01, complete with mounting brackets flanged and hard connection to attenuators, discharge side	item	1		
2,1,8	AMS C2P-031, Size Ø315x600, discharge side, complete with mounting brackets	item	1		
2,1,9	Flexible connection between attenuator and transformation piece-discharge side	item	1		
2,1,10	Transformation piece, galvanised steel, attenuator size to ducting size Ø150	item	1		
2,1,11	Ducting, galvanised sheet metal Ø150	m	1		
2,1,12	90° Bend , galvanised sheet metal, Ø150	item	6		
2,1,13	T-piece, galvanised steel, Ø150, Ø150, Ø150	item	2		
2,1,14	Transformation piece (Shoe), galvanised steel, 200x150 to fit plenum box size	item	3		

SUTHERLAND OBSERVATORY PRIME BUILDING

HVAC INSTALLATION: BILL OF QUANTITIES

Item no.	Description	Unit	Quantity	Rate	Amount
2,1,15	Plenum box to fit grill size (250x100) <u>Supply air grilles / diffusers</u>	item	3		
2,1,16	SAG-01 (200x100) <u>Weather Louvre</u>	item	3		
2,1,17	WL-01 (300x300) <u>Door grilles</u>	item	1		
2,1,18	DG-03	item	1		
Total for FAF-01					
2,2	<u>EAF-01</u>				
2,2,1	Plenum box from weather louvre 200x150	item	1		
2,2,2	Transformation piece, galvanised steel, plenum box to attenuator size	item	1		
2,2,3	Flexible connection between attenuator and transformation piece- discharge side	item	1		
2,2,4	AMS SN-015-060, Size Ø150x600, discharge side, complete with mounting brackets	item	1		
2,2,5	Fan, EAF-01, complete with mounting brackets flanged and hard connection to attenuators, discharge side	item	1		
2,2,6	AMS SN-015-060, Size Ø150x600, suction side, complete with mounting brackets	item	1		
2,2,7	Flexible connection between attenuator and transformation piece- suction side	item	1		
2,2,8	Transformation piece, galvanised steel, attenuator size to ducting size Ø150	item	1		
2,2,9	Ducting, galvanised sheet metal Ø150	m	1		
2,2,10	90° Bend , galvanised sheet metal, Ø150	item	2		
2,2,11	Transformation piece (Shoe), galvanised steel, Ø150 to fit plenum box size	m	8		
2,2,12	Plenum box to fit grill size (310x150)	item	2		
2,2,13	Transformation piece (Shoe), galvanised sheet metal, 200x200 to Ø160	item	4		
2,2,14	Ducting, galvanised sheet metal Ø160	m	2		
2,2,15	Flexible ducting Ø160 <u>Weather Louvre</u>	m	6		
2,2,16	WL-02 (200x150) <u>Return air grilles / diffusers</u>	item	1		
2,2,17	EAG-01 <u>Door grilles</u>	item	1		
2,2,18	DG-01	item	1		
Total for EAF-01					
2,3	<u>TEMPRATURE EQUALISATION</u>				

SUTHERLAND OBSERVATORY PRIME BUILDING

HVAC INSTALLATION: BILL OF QUANTITIES

Item no.	Description	Unit	Quantity	Rate	Amount
2,3,1	Trox Weather Louvre, complete with hardwood frame and galvanised sleeve - WL-03 (900x600)	item	16		
2,3,2	Trox Weather Louvre, complete with hardwood frame and galvanised sleeve - WL-04 (600x600)	item	8		
2,3,3	Trox motorised damper, multileaf, galvanised steel parallel blade, complete with drive motor - MD-01 (900x600)	item	16		
2,3,4	Trox motorised damper, multileaf, galvanised steel parallel blade, complete with drive motor - MD-02 (600x600)	item	8		
2,3,5	Control panel with all controls for open/close of dampers	sum	1		
2,3,6	Electrical installation complete with all wiring and cable trays from Control Panel on ground floor to all damper installations	sum	1		
2,3,7	Electrical installation complete with wiring, cable trays, step-down transformer from DB to damper Control Panel	sum	1		
Total for Temperature Equalisation					
Total for Section 2: Ventilation Equipment					
3	<u>SECTION 3: AIR-CONDITIONING EQUIPMENT</u>				
3,1	<u>AIR-CONDITIONERS</u>				
3,1,1	AC-01, High wall split unit, As specified, complete with indoor unit,outdoor condensing unit, refrigeration pipes, condensate drain pipes	sum	1		
3,1,2	AC-02, High wall split unit, As specified, complete with indoor unit,outdoor condensing unit, refrigeration pipes, condensate drain pipes	sum	1		
3,1,3	AC-03, High wall split unit, As specified, complete with indoor unit,outdoor condensing unit, refrigeration pipes, condensate drain pipes	sum	1		
	<u>Additional Cost</u>				
3,1,30	Bluechem treatment to condensor coils (per unit)	sum	3		
3,1,31	Cable trays between indoor and outdoor units	sum	1		
3,1,32	Unistrut support brackets for all condensing units (per set)	sum	3		
Total for Section 3					
4	<u>SECTION 4: SOUND CONTROL EQUIPMENT</u>				
4,1	Allowance for additional sound control over and above measured items	allowance			R20 000,00
Total for Section 4					
5	<u>SECTION 5: ELECTRICAL INSTALLATION</u>				
5,1	Electrical power installations from all isolators to equipment, complete as specified	sum	1		
5,2	DB mounted timers for fan control, supply to electrical contractor	sum	1		
5,3	Certificate of compliance on completion of the installation	item	1		
Total for Section 5					
SUB-TOTAL ALL ITEMS					
CONTINGENCY (10%)					
TOTAL CARRIED FORWARD TO FORM OF TENDER (Excl Vat)					