

**SARS REVENUE
BUILDING**

PORT ELIZABETH

**MECHANICAL
INSTALLATION**

ANNEXURE C

TENDER SPECIFICATION

September 2016

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Part V

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PROJECT SPECIFICATION FOR THE HVAC SYSTEM

1 GENERAL

In this document where the term “Main Contractor”, “Building Contractor”, or “Builder” is used, it shall mean the Contractor appointed in terms of this document.

Tenderer's attention is drawn to the bills of quantities generally which form an integral part of the specification and especially the following clauses:

Where the terms "or other approved" is used in connection with proprietary materials or articles, it is to be understood that approval shall be at the discretion of the Engineer.

Where brand or trade names are referred to in the bill of quantities, these shall indicate the quality and type of material or fitting required and no substitution of materials or fittings so specified will be permitted unless the authority of the Engineer has been obtained in writing before tenders close.

2 APPLICABLE DRAWINGS & STANDARDS

The supply and installation of the mechanical systems are subject to the following documents forming part of this specification:

- 2.1 Part IV - Standard Technical Specification
- 2.2 Part V - Project Specification – HVAC Systems
- 2.3 Addenda and Annexures
- 2.4 Standard Specifications

All specifications listed hereafter refer to the latest version as issued by the relevant body.

2.4.1 SANS Specifications

- SANS 10400:2010 : The application of the National Building Regulations
- SANS 10400- : Energy Usage in Buildings
- XA:2011
- SANS 1200:1986 : Standardized Specifications for Civil Engineering Construction
- SANS 10064:2005 : The preparation of steel surfaces for coating
- SANS1200C:1988 : Corrosion protection of structural steelwork
- SANS 1091:2004 : National colour standards for paint
- SANS 455:2004 : Covered electrodes for the manual arc welding of carbon and carbon manganese steels
- SANS10044- : Welding : Parts I to VII
- 1:2004
- SANS 10238:2005 : Welding and thermal cutting processes – Health and safety

SANS 32 1997/EN 10240:1997	:	Internal and/or external protective coatings for steel tubes – Specification for hot-dip galvanized coatings applied in automatic plants.
SANS 121: 2000/ISO 1461:1999	:	Hot-dip galvanized coatings on fabricated iron and steel articles – Specification and test methods.
SANS 3575: 2008/ISO 3575:2005	:	Continuous hot-dip zinc-coated carbon steel sheet of commercial, lock forming and drawing qualities
SABS 0214	:	The design, fabrication and inspection of articles for hot-dip galvanising
SANS 1186-1:2008	:	Symbolic Safety Signs Part I : Standard signs and general requirements.
SANS 62-1:2003	:	Steel Pipes Part 1 : Pipes suitable for threading and of nominal size not exceeding 150 mm, made from steel pipe.
SANS 62-2:2003	:	Steel Pipes Part 2 : Pipes and pipe fittings of nominal size not exceeding 150 mm, made from steel pipe.
SANS 719:2009	:	Electric welded low carbon steel pipes for aqueous fluids (ordinary duties)
SABS 23	:	Brazing alloys containing silver
SANS 10173:2003	:	The installation, testing and balancing of air-conditioning duct work
SANS 10103:2008	:	The measurement and rating of environmental noise with respect to annoyance and speech communication
SANS 10140-1:2008	:	Identification colour marking
SANS 630:2004	:	Decorative high-gloss enamel paint for interior and exterior
SABS 763	:	General coating thickness
SANS 1238:2005	:	HVAC duct construction standards
SANS 1062: 1985	:	Pressure gauges
SANS 1424:2008	:	Filters for use in air-conditioning and general ventilation
SANS 10142-1-2003	:	The wiring of premises Part1: Low-voltage installations

2.5 APPLICABLE DRAWINGS

M01.JNB.000014/AC/01: SARS Revenue Building, PE, HVAC Layout

3 OVERVIEW AND SCOPE OF CONTRACT

The scope of this subcontract includes the manufacture, supply, delivery, installation, painting, testing, commissioning, handing over, contract guarantee, servicing and maintenance for a minimum period of 3 year, supply of "as built" drawings and

Operation and Maintenance Manuals of the HVAC Systems, as specified in this document and the attached drawings.

The SARS Revenue Building is situated in Port Elizabeth, on the corner of Whites Road and St Mary Terrace Port Elizabeth CBD . This building has been identified as a heritage building thus the preservation of the external façade and certain internal features is a requirement.

- 3.1 The building consists of six floors and a basement parking level. The focus of this portion of the project is the replacement of the ground floor VRF air conditioning system, including necessary duct modifications.
- 3.2 The Ground Floor is currently served by a faulty VRF system. The contractor is required to strip and remove this equipment, including necessary rigging and lifting required bringing this equipment to the front door of the site. The contractor is required to include for this in his price submission. The client shall be provided the opportunity of retaining equipment for the harvesting of spares.
- 3.3 A new air-conditioning and ventilation system to be installed consists of the following:
 - Dedicated variable refrigerant flow systems per floor for the ground floor with ducted hide-away indoor units, ceiling-concealed cassette units and mid-wall split units. Condenser units shall be located on the roof on a support frame in the space allocated with piping reticulating via the vertical services shafts either side of the lifts;
 - Related electrical and control installation for all equipment;
 - All ducting modifications and ancillary equipment such as sound attenuators as necessary to suit the new ducted hideaway units and as indicated on the drawing and specified in Bill of Quantities.
- 3.4 The Contractor will also be responsible for the following:
 - The supply and installation of all condensate drainage systems including condensate pumps if necessary for all air conditioning units to the nearest vertical drainage pipe located in the vertical services shafts already provided under a previous project. These drainage pipes are required to be insulated.
 - The supply and installation of all electrical control panels pertaining to the HVAC installation, inclusive of all air conditioning units.
 - The supply and installation of all air filters and thermal insulation.
 - The supply and installation of all conduit, cable/ladder tray, etc. into the partitions for the full and complete installation of controllers.
 - Full commissioning of all systems.
 - 12 Months maintenance and guarantee of the system.
 - The supply of Maintenance and Operating Manuals including 'As Built drawings (3 hard copies, with all including drawings to be put onto a CD).

- 3.5 It should be mentioned that the time constraints required in order to complete the above are limited and contractors will be required to work in close co-operation with all other services involved on the project, according to the builders program.
- 3.6 The Tenderer shall include in his tender prices for the supply, installation and painting of all the supports and brackets in the relevant equipment price.

4 DESIGN CONDITIONS AND PARAMETERS

4.1 Ambient Conditions

Under normal operating conditions the equipment shall operate normally and deliver the specified capacities at the following ambient conditions. All equipment must be de-rated accordingly for the listed ambient conditions.

Design Parameters	
Outdoor summer temperatures	29.5°C Db/ 18.0°C Wb
Outdoor winter temperatures	6°C Db/2°C Wb
Indoor summer conditions	23°C Db +- 1.5°C /50% RH
Altitude above sea level	Sea Level

- 4.1.1 The power supply on site shall be a three phase/single phase supply, with a nominal voltage of 400/230 V – 50 Hz.
- 4.1.2 Sound levels at site boundaries shall be in accordance with the requirements of the local authorities.

5 GENERAL REQUIREMENTS

5.1 Site Supervision by Contractor

The submission of the supervisors CV is required only after the Contractor has been appointed.

5.2 Standard Specifications

Refer to Part IV.1, Clause 1 of this document.

5.3 Project Specification

Refer to Part IV.1, Clause 2 of this document.

5.4 Equivalent Manufacture

Refer to Part IV.1, Clause 3 of this document.

5.5 Equipment Installation

Refer to Part IV.1, Clause 4 of this document.

5.6 Local Representation

Refer to Part IV.1, Clause 5 of this document.

5.7 Submission by the Contractor

5.7.1 Submissions with Regard to Equipment

The Contractor shall take note that all equipment supplied under this contract shall perform the specified duties.

- (1) The Contractor shall take note that all equipment selections approved (or not rejected) by the Engineer shall not free the Contractor to comply with the Specification.
- (2) The following information with regard to equipment selections shall be submitted to the Engineer:

Manufacture, name and model
Motor capacities and Power consumption

Diagrams, tables and graphs to explain the functioning of equipment, where applicable.

Applicable pamphlets or catalogue information

Name and address of manufacturer and/or Distributor

Number of years that equipment has been available in RSA

Any other relevant information required by the Engineer.

(3) The above mentioned submissions are required after appointment of the Contractor and in accordance with the requirements of the contract program.

(4) The following submissions are required:

- Shop drawings of all HVAC installations
- Mounting brackets
- Air conditioning units
- Connection details to air conditioning units
- Extraction and fresh air supply fans selections
- Sound attenuator selections
- Grilles and diffusers selections
- Dampers
- Electrical/control panels (including wiring diagrams)
- Sound attenuators, including noise calculations.
- Duct pressure drop calculations
- Fan selections and curves
- Any other equipment as indicated by the Engineer
- De-rating calculations of equipment

(5) The following samples are required for approval prior to procurement:

Diffusers and grilles
Wall mounted controllers
Weather louvers and door grills
Any other equipment as indicated by the Engineer.

5.7.2 Marked-up Drawings and Shop Drawings

- (1) Refer to Part IV.1 of this document. Clause 6 and 7 are not applicable.
- (2) The Contractor shall submit workshop drawings showing all required mechanical equipment in its coordinated positions. The submittals shall be in accordance with the program.
- (3) The Contractor shall be responsible for any discrepancies, errors or omissions in the drawings and information supplied by him, whether they have been approved by the Engineer or not, provided that such discrepancies, errors or omissions are not due to incorrect drawings or inaccurate information furnished to the Contractor in writing by the Employer or the Engineer.
- (4) The Contractor shall, at his own expense, carry out all alterations or remedial work necessitated by reason of such discrepancies, errors or omissions for which he is responsible and modify the drawings and information accordingly or, if the same be done by or on behalf of the Employer because of the Contractors failure to undertake same, the Contractor shall bear all costs reasonably incurred therein.

5.7.3 Marked-up Structural and Other Drawings

The marked-up structural, architectural and other drawings referred to shall be submitted by the Contractor within **two weeks** after appointment of the Contractor and shall include the following information:

All dimensions and positions of openings and sleeves through both brick and concrete building structures required to fit the specified HVAC installations.

Dimensions and positions of concrete plinths (machine bases) required to locate equipment. The point loading and any forces generated by equipment shall also be shown on these drawings.

Installation positions of wooded, glass fibre or steel frames or sleeves to be built in by the principal contractor.

Any other requirements in respect of water supply points, drain points, power supplies, etc. that may be required and to not form part of this subcontract.

5.7.4 Shop and Record Drawings

Shop drawings are to be in accordance with Clause (2) and (3) above. Where equipment is indicated on the shop drawings, these drawings must also be signed by the supplier of such equipment for approval of the application, positioning and installation details of his equipment (i.e. pumps, etc). All shop drawings shall be approved and signed by the resident project manager.

All electrical diagrams shall be approved and signed by an electrical professional registered engineer and by the specialist controls supplier.

The shop drawings must show the following:

- Required service space around equipment (marked-up)
- Operating mass of equipment
- Calculated point loads at all hangers, supports, brackets, etc., used to suspend the installation from, or supporting the installation shall be shown on these drawings.
- Installation positions of wooden, glass fibre or steel frames or sleeves to be built in by the principal contractor.
- Electrical operating and motor loads
- Access doors

Record drawing of the complete installation (hard copies and AutoCAD computer discs). First Delivery will not be granted until all record drawings and operation and maintenance manuals are completed to the satisfaction of the Head's representative.

Where equipment is indicated on the shop drawings, the shop drawings must also be signed by the supplier of such equipment approving the application, positioning and installation details of his equipment (i.e. fans, sound attenuators, etc.).

The Contractor shall submit workshop drawings to the Engineer, showing all required mechanical and electrical equipment in its co-ordinated positions. The submittals shall

be in accordance with the works programme. Shop drawings include drawings, diagrams, illustrations, schedules, performance charts, brochures and other data which are prepared by the Contractor, Manufacturer, Supplier or Distributor, and which illustrates relevant portions of the work.

All shop drawings shall be approved and signed by the Engineer. All electrical diagrams shall be approved and signed by an electrical professional registered engineer (employed by the contractor) and by the contractor's specialist control supplier.

- 5.7.5 The successful Contractor shall verify that provision has been made for all openings, wooden frames, sleeves, plinths, electrical distribution boards, conduits, etc., as described above and that such openings, frames, etc. are in the correct position.

5.8 Installation Fit

Refer to Part IV.1, Clause 8 of this document.

5.8.1 Supports

Refer to Part IV.1, Clause 9. No supports are shown on the drawings nor are they billed. The Contractor shall allow for sufficient supports as specified in Part IV.34, Clause 34.10.2.2.

5.8.2 Wooden and Steel Frames and Sleeves

Refer to Part IV.1, Clause 10.

5.9 Performance of Systems and Equipment

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

The efficiency of the design of the specified system is not the responsibility of the Contractor. It is, however the responsibility of the Contractor to see to it that the quality of the workmanship and the installation of the equipment shall conform to the requirements of the Engineer and to the satisfaction of the manufacturer and/or supplier.

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

The ducting shown on the drawings have been sized according to the equal friction method, the contractor is required to perform friction loss calculations and ensure the correct selection of all fans and sound attenuators, according to the Sound Specifications contained within this document. The fan and attenuator selections as shown on the drawings are based on reasonable estimates in order to have these items priced. The contractor is required to submit these calculations to the engineer for review prior to the procurement of the associated equipment.

5.10 Protection, Cleaning, Adjustments, Commissioning, Tests and Operating and Maintenance Manuals

Refer to Part IV.80

The contractor shall be responsible for the running of the installation, including the maintenance and replacement of worn parts, from the start-up date until it is handed to the Owner.

The contractor shall provide the entire operating and maintenance manual in electronic format. The contractor shall in addition provide four (4) hard copies of the entire manual. Drawings shall be in Autocad Format.

5.11 Language

All notices on equipment shall be in English.

5.12 Guarantee

The Contractor shall guarantee all materials, equipment and workmanship for a period of twelve (12) months. This guarantee shall commence from the day that the entire system is considered complete and installed and certified to be in good working order by the Engineer. The installation as a whole shall be guaranteed against faults caused by shortcomings in the design and equipment, excluding design faults by the Engineer. Normal wear and tear is also excluded from the guarantee. The guarantee shall make provision for the replacement of defective parts and fittings during the guarantee period, without any cost whatsoever to the Engineer or Owner. The Contractor shall cede the remaining part of the guarantee, if any, after the 12 month guarantee period to the Owner.

5.13 Standard Specifications

The contractor shall in all instances refer to the standard specifications as it forms an integral part of this document. This includes Part IV, SANS specifications and BS specifications.

6 PIPING AND RELATED EQUIPMENT

6.1 Refer to Part IV.34, IV.34, IV.36, IV.38 and IV.46

6.2 Tenderers are to allow for the supply and installation of all piping required to successfully install and commission the installation. This includes refrigerant, drainage and all other piping as shown.

6.3 Joints in copper tubing shall be of the soldered capillary and compression types, as specified below. Fittings used shall comply in all respects SANS 1067 - Part 2.

6.4 Unless otherwise specified, soldered joint fittings shall be used on hard drawn annealed copper tubing. Compression fittings shall only be used on soft or semi-hard copper tubing, as SANS 460 Class 1, Class 2 or Class 3.

6.5 All soldering material and flux used shall be applied in accordance with the pipe fitting manufacturer's recommendations.

6.6 Thoroughly clean all joints before soldering or jointing.

6.7 Hangers, Supports, Guides and Anchors shall be hot dipped galvanised after manufacture and painted as specified hereinafter. Pipe hangers shall be of the threaded rod type.

- 6.8 Where pipes pass through walls and floors, suitable PVC sleeves of at least 0,6 mm thickness must be installed. Sleeves must extend over the full width of the finished wall and must extend at least 5 mm on both sides of the wall or floor slab. Sleeves must be of such a diameter that at least 5 mm is left free around the finished exterior of the pipes. These gaps must then be filled with silicone or other approved elastic compound.
- 6.9 The Contractor shall allow for expansion (or shrinking) of all pipe work.
- 6.10 Piping shall be painted in accordance with Part IV.56.
- 6.11 Tenderers are to take note that the condensate drainage is billed as a single item and tenderers are to allow for all piping, bends, elbows, tee, labour etc. so as to allow for a complete and fully functional drainage installation. No additional claims at a later date will be entertained in this regard.

7 DUCTING, INSULATION, GRILLES, LOUVRES, DIFFUSERS AND SOUND ATTENUATORS

- 7.1 Refer to Part IV.17, IV.21, IV.22 and IV.36
- 7.2 The whole of the ducting installation shall comply with the latest editions of SANS 1238 - 1979 : Standard Specification for Air Conditioning Ductwork, and SANS 0173 - 1980 : Code of Practice for the Installation, Balancing and Testing of Air Conditioning Ductwork. The ductwork shall be manufactured and installed in accordance with the recommended duct construction of the ASHRAE Guide Duct Manual and the Sheet Metal and Air-Conditioning Contractors National Association Ins. (SMACNA). The entire installation shall be considered a Low Pressure installation classification for the purposes of the above standards.
- 7.3 All ducting shall be installed in accordance with the accompanying drawings. Final duct positions shall be checked on site, before the fabrication of the ducting.
- 7.4 All branch ducts, as well as return and fresh air ducts to plant rooms shall be fitted with balancing dampers where indicated in the drawings or as chosen by the Engineer.
- 7.5 All ducts passing through concrete brick walls shall be isolated from the walls by means of high density glassfibre collars to prevent transmission of vibration to the building structure. All openings where ducts pass through plant room walls shall be sealed by means of polysulphide mastic.
- 7.6 Reinforcing angle shall be galvanized. Rivets, screws and other fastening equipment shall be completely corrosion proof. Bolts, nuts and washers shall be galvanized.
- 7.7 Standard radius elbows shall generally be used. Square elbows shall be provided with galvanised sheet metal turning vanes.
- 7.8 Overhead hangers for horizontal ducts shall be of the "Trapeze" type. Strap hangers secured to ducts with screws or snap-rivets will not be accepted.
- 7.9 Square twin-elbow tees are not acceptable.
- 7.10 Access panels shall be provided adjacent to all ductwork-mounted pressure, temperature, humidity and airflow detectors.

- 7.11 All main duct runs on the air-conditioning and ventilation systems shall be constructed of galvanised sheet steel from which flexible ducting shall be used to connect to air terminals or plenum boxes. Flexible ducting lengths shall not be permitted to be longer than 1.5m.
- 7.12 Duct dimensions indicated on the drawings refer to internal duct dimensions.
- 7.13 All ductwork shall be tested for leaks before the application of any external insulation or concealment of ducting.
- 7.14 Flexible connections shall be provided between fans, ducts, casings (AHU's) and in addition where indicated on the drawings
- 7.15 All joints in insulating material shall be neatly butted and sealed and except where portions of ductwork are not intended to be insulated there shall be no interruption gaps.
- 7.16 The contractor is to supply and install galvanized mild steel ducting in all areas as shown on the drawings. All fresh air ducting to air handling units and fan coil units, return air ducting to air handling units and fan coil units and supply air ducting from air handling units and fan coil units is to be externally insulated as per specification.

8 VARIABLE REFRIGERANT FLOW UNITS

8.1 General

- 8.1.1 Refer to Part IV.14. for cooling coil design and Part IV.47 of the Standard Specification.
- 8.1.2 Although the outdoor and evaporator units are positioned on the drawing, these positions are approximate. The exact positions will be established on site in proximity to the positions indicated on the drawing. Tenderers should allow in their pricing for insulated refrigeration pipework installed in the positions shown. Tenderers should ensure that their pricing allows for an installation that complies in every respect with the manufacturer's instructions and recommendations as stated in the installation manual etc.
- 8.1.3 The units shall be of a well-known manufacturer and spares are to be freely available in South Africa. In selecting the units tenderers are to ensure that their selections fit into the areas allocated. All unit types (ducted hideaway and mid-wall units) are to be of the same make.
- 8.1.4 Allowance must be made for suitable galvanized steel mounting brackets for the outdoor units whether floor slab mounted or wall mounted. The frames shall be suitable to allow for easy access to the unit for maintenance purposes. The units are to be orientated to ensure suitable heat emission.
- 8.1.5 The tenderers are to allow for suitable support of the evaporator units as shown on the drawings. Contractors are to submit installation details prior to installation for approval making sure that access requirements for maintenance and heat emission purposes are catered for.
- 8.1.6 The VRF systems shall be of the heat recovery type and of a high quality, commensurate with Mitsubishi, Daikin, Midea or equivalent units, and each VRF system must be approved by the engineer (via the submissions process) prior to ordering.

- 8.1.7 The refrigerant pipework is to reticulate from the Roof area to the appropriate vertical service shaft and down to each floor.
- 8.1.8 Approximate pipe routes are shown on the drawings. Where piping penetrates walls and slabs etc., adequate sleeves shall be provided under this contract. Sleeves and the building-in, making good shall be included in this contract.
- 8.1.9 All exposed pipework shall be enclosed in neat galvanized trunking with covers, adequately supported in order to protect the insulation from weathering and damage. Allowance must be made in the pricing for the same. Powder coating of visible internal trunking must also be included.
- 8.1.10 Drain piping from the indoor units shall reticulate in the ceiling void to designated condensate pipes already provided in the vertical service shafts under a previous project. Condensate pumps as may be required shall be included in the installation of evaporator units.
- 8.1.11 Drain pipes shall have a minimum slope of 1 in 50 with no sagging. The Contractor shall allow for a "p" trap in the condensate drainage piping at the drain outlet of the unit.
- 8.1.12 All electrics and controls and interlocking between the evaporator coil unit, and the outdoor unit form part of this contract. All control units shall be of the remote type and exact installation positions are still to be determined and approved by the Architect. Tenderers are to allow for the installation of conduit for the controller wiring as part of the contract.
- 8.1.13 All control wiring shall be screened wiring approved by the supplier of the equipment.
- 8.1.14 Tenderers are to ensure that the Variable Refrigerant Flow units offered are capable of operating so as to produce the specified total cooling and sensible cooling capacity at the conditions specified. Tenderers are expected to liaise with the suppliers so as to properly de-rate the units for entering conditions as shown on the equipment schedules, refrigeration pipe lengths and altitude. Selections are to be in accordance with the equipment schedules and drawings provided.
- 8.1.15 It should be noted that the de-rating will be checked thoroughly by the engineer when the units are commissioned during construction stage by the successful contractor. Units found to be undersized will be rejected and the correct size units submitted at no additional cost to the Client.
- 8.1.16 Selections of each and every unit shall be submitted for approval before ordering of the units.
- 8.1.17 All units are to have at least 2 fan speeds and a digital seven day timer.
- 8.1.18 The contractors electrical contractor will provide a suitably sized isolator within 1 meter of the outdoor unit.
- 8.1.19 The outdoor units shall be selected for the ambient conditions as indicated in 4.1.
- 8.1.20 The outdoor units shall be installed with strict adherence to the manufacturer's instructions including the following:
- Installed away from direct thermal radiation.
 - Installed out the way of strong winds.
 - Entirely treated with anti-corrosion treatment as recommended by manufacturer.

8.1.21 The VRF units are to meet the following design criteria:

- The system must be charged with an environmentally sustaining refrigerant such as R410A or similar approved
- The indoor and outdoor unit must be interconnected with copper refrigerant piping and VRF components in terms of the suppliers' recommendation. The tenderer is to note the distances between the indoor and outdoor units and the relevant pipe sizes have been indicated on the drawing. The return of oil to the compressor is to be ensured by the installation of traps at regular intervals if required.
- All piping through walls shall pass through sleeves which shall be properly sealed after installation. Insulation through sleeves shall be continuous.
- All piping and cabling above ceilings shall be installed on factory manufactured galvanised steel cable tray, hung from the roof trusses or slab.
- All refrigerant, liquid and suction, shall be separately insulated with 15 mm thick armaflex insulation. Insulation exposed to weather conditions shall be covered with cloth and be painted with "Foster seal".
- Refrigerant piping shall be SANS approved and suitable for the application. The supplier shall be responsible for refrigerant pipe sizing and layout, according to the manufacturer's specifications.
- All outdoor unit coils shall be coated with a spray corrosion protection coating application as offered by Luvata Insitu with ES₂ from Bluchem or similar approved.
- An intelligent controller is required to be installed as part of this installation to control all of the indoor evaporator units. This controller shall be the same manufacturer as the variable refrigerant flow system and shall provide for the following minimum functioning: Fire emergency stop control, temperature limits, individual control, yearly scheduling of start up and switch off, interlocking control, able to connect to a third party BMS controller, cost performance.
- The Variable Refrigerant Flow system must be commissioned and tested by the manufacturers representative, the contractor is also required to allow for pressure testing of the piping systems.
- All units offered shall meet the minimum COP values as listed in Table 14 – Minimum coefficient of performance (COP) of unitary and packaged air-conditioning equipment, of SANS 204:2011 Energy Efficiency in Buildings:

1	2	3
Equipment type	Capacity range ^a kW	Minimum COP ^{bc}
Unitary (console) and split type	< 7	2,5
Packaged and split air conditioning	7 < 19	2,6
	10 < 40	2,96
	40 < 70	2,72
	> 70	2,64
Water cooled package	< 20	3,2
^a If resistance heating is used, heating power consumption shall not exceed cooling power consumption except in the case of equipment of <10 kW. ^b COP shall be as determined under summer design condensing conditions of 35 °C dry bulb ambient for air-cooled systems and summer design wet bulb for water-cooled systems. ^c COP shall include airside fan power but exclude waterside cooling system power.		

8.2 VRF Ducted Hideaway Type Fan Coil Units

8.2.1 The ducted hideaway type units are to have the following features:

- The onus is on the tenderer to ensure that the units are selected so as to allow for successful installation and drainage of the units within the limited ceiling void.
- All key components are to be accessible from the underside of the unit without having to remove the system.
- Three speed fan, basic on/off, room temperature wall mounted control units with integral room temperature sensor.
- The cabinet is to be made from pre-painted galvanized steel.
- The unit is to include thermal and acoustic insulation, a sloped condensate drain pan, with external anti-condensate insulation.
- All AC units shall include for a condensate pump.
- Cleanable air filters as well as an access panel for easy access to all components.
- Return air plenums are to be as shown on the drawings.

9 ELECTRICAL & CONTROL REQUIREMENTS

9.1 Refer to Part IV.63 and IV.64 for the Standard Specification.

The following electrical installation forms part of the mechanical contractor's scope of work:

9.2 The provision of all electrical control systems, any control or switchboards as required for the installation, from the point of supply by the electrical contractor as indicated on the drawings. (Please refer to the drawings, all electrical isolators for fans, indoor evaporator units, outdoor condensers units shall be provided by the electrical contractor. The supply cable that feeds to AHU switchboard shall also be provided by the electrical contractor.

9.3 COC's are required for all electrical installations done by the mechanical contractor – the AHU manufacture must provide a COC for the installation.

9.4 All necessary measuring devices and protection devices shall be provided as recommended by the manufacturer. All installations are required to comply with SANS 10142-1 2012.

9.5 The contractor will be responsible for the installation of all controllers and control cabling, including all necessary sensors.

9.6 The contractor is required to liaise with the fire engineer to ensure that all necessary fire interlocks are installed as required by the fire engineer. The contractor is to ensure that the equipment offered shall be compatible with the fire system for the necessary fire locks.

9.7 The ventilation fans shall be connected to the isolators as provided by the electrical contractor, these fans shall be controlled by a 7 day timer, which shall be provided by the electrical contractor.

10 ANTI VIBRATION MOUNTINGS

- 10.1 Refer to Part IV.7.
- 10.2 Vibration isolation pads shall be provided for all moving equipment in order to prevent vibration carry-over to any structure and to prevent unacceptable noise levels.
- 10.3 Inertia bases, where required by the Supplier in order to meet the specification shall be included in the tender price.

11 WELDING

- 11.1 Refer to Part IV.38. The following clauses are not applicable:
- 11.2 Welds shall be full penetration welds. Use only coded welders. If welding work is not acceptable then all re-welding shall be for the contractors account.
- 11.3 Ten (10) percent of all welds may be cut out for testing and inspection purposes. If the welding is not acceptable then all re-welding shall be for the contractors account.

12 BUILDERS AND CIVIL WORK

- 12.1 Refer to the notes on the drawings.
- 12.2 The following builder's work shall form part of this contract:
- 12.3 The contractor shall prepare builders work drawings based on the structural drawings which he shall obtain from the structural engineer via the main contractor. The HVAC contractor shall prepare these drawings immediately after appointment in line with the main program, and shall have the drawings signed off by the mechanical engineer and the structural engineer. The contractor shall liaise with the main contractor and shall assist the main contractor to ensure that all sleeves, frames, etc. are in place prior to the casting of concrete, or the building of brick walls.. Where required, all openings shall be sealed after installation of equipment.
- 12.4 The hoisting and rigging and positioning of all equipment forms part of this contract and the contractor is required to price for this accordingly.
- 12.5 Sealing of all openings around ducting, dampers, piping, etc forms part of this contract.
- 12.6 Scaffolding as required forms part of this contract.

13 NOISE

- 13.1 Refer to the Standard Specification Part IV.17.
- 13.2 The maximum noise levels caused by the operation of the ventilation and air conditioning equipment shall not exceed the following:

Private office areas	:	NC 35
Open plan offices	:	NC 40
Boardrooms	:	NC 30
Toilets	:	NC 40
Open plan offices	:	NC 40
Kitchens	:	NC 40

- 13.3 All acoustical treatment and sound attenuators must be allowed for in the original contract price and no claims will be considered at a later stage in this regard.
- 13.4 The specified noise level shall be read at a distance of 2 meters from any air outlet, return air grille or opening.
- 13.5 The contractor shall be responsible for performing the necessary sound calculations to ensure that the equipment offered, together with the selected sound attenuating equipment shall meet the specified sound criteria. The contractor shall submit all sound calculations, fan noise curves and sound attenuator selections to the engineer to verify prior to procurement.

14 PAINTING AND LABELLING

- 14.1 Refer to Part IV.56 of the Standard Specification.
- 14.2 All visible insulated piping and un-insulated piping is to be painted as per Part IV.56 of the standard specification.
- 14.3 All fans are to be labeled with the following information:
- Functional description, kW, and air flow, from where power is fed.
- 14.4 All indoor AC units shall be clearly labeled, indicating also indicating which outdoor unit it is fed from or from which variable refrigerant volume system it is fed from. The variable refrigerant volume system shall also contain a tree diagram showing which indoor units it feeds.
- 14.5 Labels are to similar to "Traffolite" with a white background and black lettering.
(BRANDING)

15 WORKSHOP DRAWINGS

- 15.1 Three copies of all workshop drawings must be submitted for approval before the installation can commence.
- 15.2 The submission of these drawings shall be in accordance with the approved program and shall leave sufficient time to the Engineer to check these drawings properly.
- 15.3 The workshop drawings shall consist of the following:
- Equipment Layout and Sections
 - Piping Layout and Sections
 - Electric Wiring and Control Circuits
 - Builder's Work Drawings.

16 TRAINING

- 19.1 The Contractor shall provide instructors to train the Clients service personnel. These instructors shall be available for a total period of two working days (eight hours per day) after the system has been commissioned and handed over to the Client. The Maintenance and Operating Manuals shall be in the possession of the Client before the training commences. Also refer to Part IV.80, for more details regarding the Maintenance and Operating Manuals.

17 PROTECTION, CLEANING, ADJUSTMENTS AND TESTS

- 17.1 Refer to Part IV.80 of the Standard Specification.

18 EXTENDED GUARANTEE

The Contractor shall allow for extension in the guarantee of any equipment if any such equipment is not guaranteed by the supplier for twelve (12) months after the official hand over.

19 GENERAL TENDER NOTES

- 19.1 Tenderers are expected to take note of the intended installation at the compulsory site meetings. Cognizance should be taken of the nature and difficulty of the work, and allow for the same in the costing thereof.
- 19.2 Tenderers are to take note of the fast track nature of the project and familiarize themselves with the builders program in all respects.
- 19.3 Tenderers are expected to complete the BOQ in full allowing for all equipment, materials and labour to successfully complete the work.
- 19.4 Tenderers are to include in their costing for any addition work identified at the site meetings so as to allow for a fully functional system within the installation cost. No extra claims in this regard will be entertained.
- 19.5 Tenderers are expected to complete the attached equipment data sheets for the equipment offered, together with equipment submittals as details in the specification (these should include, manufactures selections, de-rating, data sheets, selection sheets etc)

PART VI

SCHEDULE OF TECHNICAL INFORMATION

APPENDIX A

VRV Unit Schedule

Unit No.	Space	Indoor Unit	Total coil load (kW)	Sensible coil load (kW)	Required SA (l/s)	Fresh Air (l/s)	Return Air (l/s)	On coil (degC DB; degC WB)	Off coil (degC DB; degC WB)
AC-G1, G2, G3	Office Outer West	Ducted Hideaways	13.5	10.8	942	564	378	27.8;18.5	15.8;14.3
AC-G4	Pause Area	Cassette	3.4	2.6	407	145	262	26.2;18.8	19.4;16.5
AC-G5, G9, G10, G11, G12, G13, G14	O/P Office Inner East	Ducted Hideaways	23.7	17.7	1540	1158	382	28.3;18.7	15.5;14.1
AC-G6	BAM Collections	Cassette	2.2	1.7	151	103	48	28.0;18.6	15.7;14.3
AC-G7	PA for BAM	Cassette	1.3	1.0	86	69	17	28.5;18.6	15.8;14.1
AC-G8	BAM Office	Cassette	1.8	1.5	127	100	27	28.7;18.8	16.5;14.5
AC-G15, G16	O/P Office Outer East	Ducted Hideaways	13.5	13.4	1168	638	530	25.4;18.6	15.7;14.4

PART VII
BILL OF QUANTITIES