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PROJECT NAME	**APPOINTMENT OF A SERVICE PROVIDER FOR THE COMPLETION OF THE DRY ROOM AND MINOR REPAIR WORK TO THE SEEDBANK FACILITY AT THE KIRSTENBOSCH NATIONAL BOTANICAL GARDEN, CAPE TOWN**
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GENERAL SPECIFICAITIONS FOR MECHANICAL INSTALLATIONS

PART 1

GENERAL SPECIFICATIONS FOR MECHANICAL INSTALLATIONS

PART 1

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GENERAL REQUIREMENTS

1. NOTICE

1.1 This Standard Specification forms part of, and is to be read on conjunction with the Supplementary Specifications for the Mechanical Installations.

1.2 In so far as the conditions herein contained are at variance with anything contained in the supplementary specifications, the contract shall be in terms of the Supplementary Specifications for each particular service.

1.3 Where reference is made to “Contractor” or “Sub-Contractor”, it shall be read to mean the successful Bidder appointed to execute the contract specified in the Supplementary Specification

2. STANDARD MEASURES

2.1 The dimensions, weights, etc., shown on the drawings and mentioned in the specifications shall be taken as the Republic of South Africa’s legal standard weights and measures.

3. MATERIALS AND WORKMANSHIP

3.1 All work is to be executed with materials of the best quality and in the most substantial manner under the inspection and to the entire satisfaction of the Engineer.

3.2 The entire installation shall be in accordance with the following:

a. The national Building Regulations and Building Standards Act No. 103 of 1977 as amended in 1984 and all amendments thereafter.
b. The latest revision of SABS 0400: The Applications of the National Building Regulations, as amended.
c. SABS Code of Practice for the Wiring of Premises No. 0142 of 1981, as amended.
d. The Machinery and Occupational Health and Safety Act No. 85 of 1993.
e. Any other relevant by-laws of local or other authorities.

3.3 All apparatus, components, parts, fitting and materials supplied and/or installed whether especially specified herein or not shall confirm in respect of quality, manufacture, tests and performance with the requirements of the appropriate current South African (SABS) or British Standard Specifications (BS) and Addenda thereto, except where otherwise required by this specification or permitted by approval of the Engineer in writing. All materials and workmanship which may, in the opinion of the Engineer be inferior to that specified for the

work will be condemned. All condemned material and workmanship must be replaced or rectified as the case may be, to the satisfaction of the Engineer.

3.4 No second-hand equipment of any description may be offered for supply or installation.

3.5 If so required, the Engineer may call for samples of material and equipment for approval. Such samples shall be submitted within 14 days of the request and if judged necessary by the Engineer may only be returned after completion of the installation in order to ensure that the quality of the installed product is the same as that of the approved sample.

3.6 Any fitting or item of equipment not specifically mentioned but obviously necessary for the successful completion of the installation is to be included so as to form a complete working installation.

4. DRAWINGS

4.1 The bid drawings issued with the Supplementary Specification are schematic and do not necessarily purport to show the exact position, size or details of construction of equipment.

4.2 Bidders must satisfy themselves that the equipment offered by them can be accommodated in the available space and positioned in such a way that access for maintenance, repairs or removal is not obstructed.

4.3 Contractor's drawings: Where indicated in the Supplementary Specification these drawings are to be prepared by the Contractor at his/her expense in accordance with this document and shall be on a scale of not less than 1:50. These drawings shall at least consist of:

a. Builder's work drawings: These shall indicate all work to be done by others (bases, foundations, holes in concrete and masonry, etc.) as well as the sizes, capacities and positions of service connections (electrical, water, drainage, etc.) to be provided by others, all in accordance with the Supplementary Specification.
b. General arrangement drawings: These shall indicate all equipment, distribution systems, testing and inspection requirements as well as instrumentation positions and access requirements. During their preparation, the Contractor shall take cognisance of all relevant architectural, structural, electrical and other service drawings in order to properly co-ordinate his/her layout. These drawings can be obtained via the Engineer. The drawings shall be amended as required during the contract period, and up to date copies kept on site for reference purposes.

4.4 Positions and sizes of air grilles, louvered openings through reinforced concrete beams and slabs, etc., as indicated on the bid drawings shall be adhered to as far as possible. Amendments will only be considered if absolutely unavoidable.

a. Shop drawings: These shall be based on the General Arrangement drawings, and shall show in detail the construction of all the parts of the works, method of assembly where applicable,

erection and construction materials and connections, welds, gaskets, sealants, fastenings, reinforcing and all other necessary detail.

b. Electrical drawings: Electrical drawings shall comprise complete control and power wiring diagrams, as well as front and side elevations giving major dimensions of control panels as well as instrumentation and switch position layouts.

c. As-Built drawings and wiring diagrams: These are up-to-date approved drawings at the completion of the contract. Bidders shall allow in their price for submitting to the Engineer a sepia of each of the up-to-date general arrangement drawings, shop drawings, as well as electrical drawings together with the O&M manuals specified herein.

4.5 Submission of contractor's drawings: Drawings shall be submitted to the Engineer in an orderly fashion commencing within the following time limits or as determined by the main contract programme (where applicable):

Builders work drawings	:	within 2 weeks of bid acceptance.
General layout drawings	:	within 4 weeks of bid acceptance.
Shop drawings	:	within 6 weeks of bid acceptance.
Electrical drawings	:	within 6 weeks of bid acceptance.
As-built drawings	:	at completion before first hand-over.

By submitting drawings, the Contractor represents that he/she has determined and verified all site measurements, site instruction criteria, materials, catalogue numbers and similar data, or will do so, and that he/she has checked and co-ordinated each of his/her drawings with the requirements of the works and the contract documents, taking into account drawings of all other relevant disciplines. At the time of submission, the Contractor shall inform the Engineer in writing of any deviation in the Contractor's drawings from the requirements of the supplementary documents. After scrutiny the Engineer may at his/her discretion and depending on the number of discrepancies, requires amendment and resubmission prior to approval. Drawings shall be resubmitted until approved prior to any portion of the works related to the drawings being commenced. Should the Contractor, during drawing amendment, alter any portion of his/her drawings not specifically required by the Engineer, he/she shall point this out in writing when resubmitting the drawing. Approval of the Contractor's drawings in no way indemnifies him/her from being responsible for the correctness of the drawings and satisfactory operation of the installation.

4.6 If the Bidder wishes to submit alternative proposals, differing from the Engineer design, drawings indicating such proposals comprehensively shall be submitted with this Bid.

5. SITE CONDITIONS

5.1 It is the responsibility of the Bidder to visit the site during the bid phase and to familiarise himself/herself with conditions related to it. If the location of the site is not indicated in the Supplementary Specification, it can be obtained from the Engineer. No claim for additional payment related to ignorance of site conditions will be accepted. By submitting a bid, it is accepted that the Bidder is fully aware of all site conditions as well as the access to it, and has allowed for this in his/her bid price.

6. DEVIATIONS FROM BID DOCUMENTS

6.1 No deviations or alterations from that of the specification, schedules or drawings shall be made without first obtaining the written approval of the Engineer.

7. PROGRAMMING OF WORK

7.1 The contract works shall proceed concurrently with the building construction or in accordance with an approved programme in all respects.

7.2 It is essential that the Contractor programmes his/her construction and all other work in conjunction with the Main Contractor and the main contract programme in order to avoid possible delays or clashes of trades.

7.3 For direct contracts the Contractor shall submit a detailed programme in the form of a bar chart based on the contract period and the various activities and components of the installation. This programme shall be submitted to the Engineer within two weeks of site hand-over.

8. MANUFACTURER'S RATINGS

8.1 All equipment such as fans, compressors, cooling towers, pumps, etc. shall be selected to be operated well within the manufacturer's ratings. Equipment offered for use beyond these limits will not be considered.

8.2 Bidders must submit manufacturer's ratings of all equipment offered. Ratings shall be given in the SI system.

9. NOTICES

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

10. GUARANTEE

10.1 The 12-month guarantee called for in the Supplementary Specification, shall apply to all items of plant related to the HVAC installations delivered to site and/or erected. It is the responsibility of the Contractor to negotiate with his/her suppliers in order to secure their equipment guarantee on this basis.

10.2 The date of acceptance shall be that appearing in the acceptance certificate issued by the Engineer and shall define the start of the guarantee period and free maintenance period (where applicable).

10.3 No claims for extended guarantee or otherwise from Suppliers, Principals, etc., will be considered even if equipment is required on site long before acceptance date.

11. LUBRICATION

11.1 All bearings must be packed with approved grease or filled with the correct oil, and all gearboxes and sumps must be filled with the lubricant specified by the manufacturer. The Contractor will be responsible for the supply of all lubricants required for the initial fill. All lubricants must be new and supplied in sealed drums or containers.

12. COMMISSIONING AND TESTING

12.1 Commissioning Engineers - The Bidder shall allow in his/her Bid price for the services of approved and expert Commissioning Engineers, as may be appropriate for the individual specialised sections of his/her contract, as well as a competent Engineer in overall control of the installation. Testing and commissioning shall be carried out by these Engineers. Should undue problems be encountered at any time, the Contractor may be requested by the Engineer to obtain the services of a representative of the manufacturer of specified items of equipment, at no cost to the Engineer.

12.2 Notice of Testing and Commissioning - The Engineer shall receive not less than two weeks advance notice of any tests to be witnessed by the Engineer.

12.3 Failure of Works, Site or Commissioning Tests - Should the Engineer be notified to attend official tests as laid down, and should the equipment fail the test for any reason whatsoever,

such that the Engineer is required to re-witness the test, the time, transport and disbursement by the Engineer in so doing will be for the Contractor's account, which amount may be deducted at the option of the Engineer from monies due to the Contractor.

12.4 Quality Testing of Equipment - The Engineer reserves the right to arrange for testing of any piece of equipment at will, to check on compliance with the relevant specifications. Should the particular piece of equipment pass the test, the cost of such testing will be borne by the Client. However, should it fail the test, the cost of the test, rectification of the shortcomings, re-testing and repetition of the same test on the remaining like items will be for the Contractor's account.

12.5 Inspection during Manufacture - The Contractor will advise the Engineer when the items to be supplied are in the course of manufacture. The Engineer reserves the right to inspect any items during the course of manufacture and witness any performance tests that may be required thereon. The Contractor shall give the Engineer at least two weeks advance notice of work tests.

12.6 Testing - The Contractor shall be responsible for carrying out all tests laid down in the specific sections elsewhere in this document, in addition to those listed hereafter and in the Supplementary Specification. Testing and balancing shall not begin until the system has been completed and is in full working order. The plant shall be tested and operated to meet the performance figures and duties specified. All safety features and interlocks will be tested. The Contractor will be responsible for all costs incurred in the testing, including the supply, calibration and use of all instruments and tools, but not the supply of water or power on site. All instruments and test equipment used shall be provided by the Contractor, and shall be accurately calibrated and maintained in good working order. All test instruments used for tests to be witnessed by the Engineer shall be provided with calibration certificates, which must be available to the Engineer.

Specific attention is drawn to the fact that calibration certificates will be required for the following:

- Watt meters, ammeters, voltmeters, frequency meters, pressure gauge, flow meters, orifices plates, temperature gauges and relative humidity meters.
- All instruments shall be of above standard grade, and test pressure gauges shall not be less than 150 mm in diameter. The maximum scale of the instrument shall not exceed 1.5 times the full test requirement.
- It is essential that the Contractor inspects and tests all equipment before requesting the Engineer to inspect or witness acceptance tests thereon.
- All acceptances tests, whether in the manufacturers works or on site, must be carried out in the presence of the Engineer.

- Should the Engineer wish to verify the calibration of any instruments, the Contractor shall make the necessary arrangements for the instrument to be re-calibrated by a recognised authority. Should the instrument prove to be correctly calibrated, the cost of the re-calibration test will be borne by the Client. Should the instrument prove to be in error, the cost of the tests will be borne by the Contractor.
- Two copies of the complete test reports shall be submitted to the Engineer, prior to the first delivery of the project. Reports shall cover all tests carried out on individual sections, including such works tests as may have been conducted. All reports shall be neatly types.

12.7 Commissioning - The Contractor shall carry out all tests and commissioning of the systems installed by him/her, in a co-ordinated and properly organised manner. Air Conditioning and Ventilation installations shall be commissioned in accordance with the following Codes or such other recognised commissioning procedure or code approved by the Department. Should the tests be carried out over an area outside the range of normal speech, it is required that the Contractor make available at least four batteries powered, two-way radio sets, to facilitate communications. The testing procedure shall be sufficiently comprehensive to prove the correct functioning of each and every piece of equipment, and its suitability for the application. After all systems and equipment have been tested and commissioned to the satisfaction of the Engineer, a detailed demonstration of all functions of the system shall be carried out in the presence of the Engineer, so as to allow him/her to become fully acquainted with the operation of the system. The commissioning tests shall include the tests laid down under the specific section's hereafter, and a full operational test of all pumps, compressors, fans and control gear in all modes of operation. The Contractor shall allow for the replacement and cost of any materials and fuel used for testing purposes, as part of the contract. The demonstration to the users shall include a repeat of the operational tests above. The planning of this demonstration shall take place in collaboration with the Engineer. A certificate of completion will not be issued until all tests have been satisfactorily completed, and the plant has operated successfully, to the complete satisfaction of the Engineer.

13. PERFORMANCE TOLERANCE

All performance figures obtained during testing and commissioning must be within –5% and +5% of the specified performance figures given in the supplementary specification. Should the plant fail to comply with these figures after it has been tested and operated for a period of seven days, then the Contractor shall have a further four weeks to meet the requirements of the specification, after which the Engineer shall have the right to reject the plant and recover all monies paid to the Contractor for the rejected plant.

14.TEST CERTIFICATES

The Contractor shall ensure that copies of all relevant test certificates, inspection reports, materials analysis certificates and similar data as may be required under various sections of this specification, or by Government Licensing and Inspection Authorities or Local Authorities, shall be provided before handing over the plant. Acceptance of the plant will be delayed if such certificates are not available. In particular, attention is drawn to pressure vessel and boiler construction and materials test certificates.

15. APPLICATION FOR INSTALLATION

The Contractor shall allow for the submission of the necessary forms, fees and drawings to the Inspector of Machinery or other relevant Authorities to obtain permission to install equipment where this is required. He shall also, in co-operation with the Engineer make any arrangements that may be required for Government Inspectors or other relevant inspectors to carry out prescribed tests.

16. POWER, WATER AND DRAIN CONNECTIONS

16.1 Power, water and drain points in the plant room will be provided by and at the expense of the Client.

16.2 All plumbing between equipment and water and drain points shall form part of this contract.

16.3 The exact details of terminal points will be set out in the Supplementary Specification.

16.4 Electrical supply shall terminate in an isolator, by Electrical Contractor, supply from this isolator to HVAC equipment by HVAC contractor.

17. QUALITY OF MATERIALS

17.1 Only new materials of high quality shall be used throughout and shall be subject to the approval of the Engineer.

17.2 All materials, where applicable, shall conform in respect of quality, manufacture, tests and performance, with the requirements of the SABS standards or, where no such standards exist, they shall conform to the appropriate current specification of the British Standard Institution. Materials manufactured in South Africa shall be used wherever possible.

17.3 Imported materials shall comply with the requirements of the relevant SABS or British Standard Specifications, although these materials need not necessarily bear the SABS mark.

17.4 All materials shall be suitable for the particular site conditions. These conditions shall include weather conditions as well as prevailing conditions during installation and subsequent permanent use.

17.5 Should the materials or components not be suitable for use under temporary site conditions, where applicable, the Contractor shall provide at his/her own cost, suitable protection until these unfavourable site conditions cease to exist.

18. SERVICE ACCESS

18.1 Where equipment such as fans, dampers, etc. are installed in ceiling voids, the Contractor shall ensure that access will be possible for maintenance purposes after installation.

19.STANDARD SPECIFICATIONS

19.1 Unless otherwise specified in the Supplementary Specification, the following standard specifications (including amendments) of the organisations indicated shall form part of this specification.

a. SABS 1125-1977 : Room air conditioners.
b. SABS 0140-1978 : Identification colour marking.
c. SABS 0139-1981 : The prevention, automatic detection and extinguishing of fire in buildings.
d. SABS 0147-1992: Refrigerating systems including plants associated with air conditioning systems.
e. SABS 1424-1987: Filters for air-conditioning and general ventilation.

19.2 Bidders shall indicate in their bid submission whether their bid and/or equipment as applicable complies with any of the above specifications or carries the SABS mark.

20. KYOTO PROTOCOL

Bids for equipment utilising chlorofluorocarbons (CFCs), hydrochlorofluorocarbons (HCFCs) or hydrofluorocarbons (HFCs), to be supplied and installed shall be within the constraints and schedules of the Kyoto Protocol and the Copenhagen Agreement and such amendments thereto as may be made by the international community. Where bids are submitted for equipment not complying with this Protocol it shall be clearly indicated, in writing, in the bid submission.

21. GENERAL MAINTENANCE AND SERVICING

21.1 Unless otherwise specified in the Supplementary Specification, the Contractor shall be responsible for all maintenance and servicing of the installation for the full 12-month guarantee period. During this period, the Contractor shall make good any defect due to inferior materials or workmanship and maintain all plant and equipment in perfect operating condition.

21.2 The Contractor shall be entirely responsible for carrying out regular inspection at intervals not greater than 1 month, unless otherwise specified, and for full servicing of all components of the installation in accordance with the manufacturer's instructions. For this purpose, the Contractor shall prepare a detailed inspection and service report in the form of a checklist and log sheet showing all functions to be carried out at each inspection and service. Copies of these service reports shall be regularly submitted to the Engineer after each service.

21.3 The Contractor shall also maintain a plant log book on site in which he/she shall record, sign and date all work carried out at each inspection as well as log all temperatures and pressure readings, etc.

21.4 The Contractor shall allow for all expendable materials necessary for servicing such as lubricating oils, grease, refrigerant and cleaning materials.

21.5 Replacement filters, if required, will be provided by and at the expense of the Client.

22. MAINTENANCE INSTRUCTION OF OWNER'S STAFF

22.1 Bidders shall make proper allowance in their bid price for instruction of the Client's / Owner's staff in the maintenance, repair and adjustment of all the equipment. Allowance must be made for the proper hands-on tuition of the owner's personnel at the appropriate time to enable them to take over operational duties.

23. SPARE PARTS AND AGENCIES

23.1 Where Bidders offer plant embodying units of manufacture other than those of their principals and for which they are not accredited South African agents, and for which they do not stock spare parts, they should state in the bid the name of the accredited South African agents from whom spare parts for such units are obtainable.

23.2 In all cases, Bidders should furnish an undertaking from agents to the effect that they are prepared to carry the necessary stock of spare parts for their particular units.

23.3 Bidders are also required to furnish the same undertakings as regards the spares for units manufactured by their own principals.

23.4 During adjudication of bids, consideration may be given not only to the cost of the plant offered, by also to the cost of the spares.

24. TOOLS

24.1 All special tools required, i.e., tools specially designed for the particular equipment offered, must be supplied and listed in the bid offer and included in the unit price. In the case of a number of identical items of plant being supplied it will only be necessary to supply two sets of tools covering all units, and not one set for each unit.

24.2 It is the responsibility of the Contractor to ensure that all tools are handed over to the Engineer on completion of the contract, in brand new condition. No damaged tools will be accepted, and the contract will not be considered complete until such tools are satisfactorily received. Tools handed over shall be suitably mounted on a wallboard or supplied in a high-quality metal box or other container as may be agreed to by the Engineer.

25. OPERATING, MAINTENANCE INSTRUCTIONS, WIRING AND CONTROL DIAGRAMS

25.1 The Contractor shall prepare and supply comprehensive manuals for the successful operation and maintenance of the installation. A draft of the manual shall be submitted to the Engineer after commissioning, for approval. The draft shall then be corrected, if required, and THREE sets of the manual shall be submitted before first acceptance of the plant will be considered.

25.2 Manuals shall be prepared in the same language as the contract documents unless otherwise required by the Engineer. These manuals shall be bound in hard file covers with clear titles and indices and shall contain the following information as a minimum, in the sections indicated:

SECTION 1: System Description

Refer to PART 6 : Drawings

SECTION 2: Commissioning Data

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

SECTION 3: Operating Instructions

i. Plant running check list and frequency of servicing.
ii. Safety precautions to be taken.
iii. Manual and automatic operation.
iv. Operator's duties.
v. Lubricating oils and service instructions.
vi. Pre-start checklist for each system.
vii. Starting and stopping procedures.

SECTION 4: Mechanical Equipment

i. Description of all major items of equipment with the make, model number, names, addresses and telephone numbers of the Supplier, Manufacturer or their Agents.
ii. Design capacities of all equipment including selection parameters, selection curves, capacity tables, etc.
iii. Manufacturer's brochures and pamphlets.
iv. Schedule of spares with part numbers recommended to be held in stock by the Engineer.

SECTION 5: Maintenance Instructions

i. Schedule of maintenance particulars, frequency of service and replacements.
ii. Troubleshooting guide.
iii. Part number of all replacement items and spares.
iv. Capacity curves of pumps, fans and compressors.
v. Serial number of main items of equipment.

SECTION 6: Electrical Equipment

i. Schedule of equipment indicating manufacturer, type, model number, capacity and address and telephone number of suppliers.
ii. Maintenance instructions.
iii. Manufacturer's brochures and pamphlets.
iv. Complete "as-built" circuit diagrams and diagrammatic representation of inter-connections of electrical equipment.

SECTION 7: Instrumentation and Control

i. Description of each control system.
ii. Schedule of control equipment indicating make, type, model number, rating, capacity and name, address and telephone number of suppliers.
iii. Maintenance instructions.
iv. Manufacturer's brochures and pamphlets.

SECTION 8: Drawings

i. Paper prints (reduced if so desired) of all "as-built" mechanical and electrical Contractor's drawings.
ii. Wiring diagrams, framed behind glass shall be mounted adjacent to each relevant control panel.

26. EQUIPMENT TO BE USED WHEN ERECTING INSTALLATION

26.1 Bids shall allow for a complete installation, including the provision of mobile cranes, air compressors, lifting tackle, measuring equipment, precision levels, and all other special or regular tools and equipment that may be needed to complete the entire installation in accordance with the specification, and to the satisfaction of the Engineer.

26.2 The Contractor will be responsible for any damage caused to buildings, equipment, etc. during the course of the erection of his/her equipment.

27. ASSEMBLY OF COMPONENTS

27.1 It is essential that all mating components such as couplings, taper lock bushes, machine faces, etc., be thoroughly cleaned with a suitable solvent before assembly. All surfaces must be free from burrs or irregularities, which may prevent the correct mating of the surfaces.

27.2 A molybdenum -disulphide lubricant similar or equivalent to Mobil- grease Super shall be used on the threads of all bolts and between the mating surfaces of all parts closely fitted together, such as shafts and couplings, keys and base plates. PTFE tape shall be used in all screwed pipe connections.

28. WELDING

28.1 Welding shall be carried out in accordance with the current edition of SABS 044 Parts I to VII where applicable.

28.2 All welder filler or butt joints shall be free from porosity, cavities and entrapped slag. Joints shall be ground smooth, if required for aesthetic reasons only, without affecting weld strength.

28.3 The joints in the weld run, where welding has been recommended, shall be as smooth as possible and shall show no pronounced hump or crater in the weld surface.

28.4 The profile of the weld shall be uniform, of approximately equal leg length and free from overlap at the toe of the weld. Unless otherwise specified the surface shall be either flat or slightly convex in the case of fillet welds and with reinforcement of not more than 3mm in the case of butt welds.

28.5 The weld face shall be uniform in appearance throughout its length.

28.6 Filler metal electrodes shall be of an approved type for the material being used and shall be kept in a dry condition. All electrodes shall conform to SABS 455.

28.7 Only welders in possession of a valid approved competence certificate shall be employed.

28.8 All welds must show proper fusion.

28.9 Where welding is contemplated in pipework systems, Bidders shall allow for the removal and testing by an approved body of 5% of the welded joints in the system. These will be removed at random as indicated by the Department and tested. Should faulty welding be discovered, all other joints shall be X-ray tested by the SABS or an approved body, all at the expense of the Contractor.

29. GALVANIZING

29.1 Unless otherwise specified in the Supplementary Specification the following items shall always be galvanized:

29.2 Fabricated mild steel sections exposed to the weather.

29.3 Steel grilles and louvres exposed to the weather.

29.4 Where hot dip galvanizing is called for, items to be galvanized shall be entirely pre-fabricated and then dismantled in sections for galvanizing. No cutting of threads or welding will be accepted after galvanizing.

29.5 All hot dip galvanizing shall be carried out in accordance with SABS 934 and SABS 763 where applicable, including preparation for galvanizing.

29.6 Mild steel plate and sections shall be of good commercial quality, best suited for galvanizing. The materials shall be free from slag or coarse laminations, fine fissures and rolled-in impurities.

29.7 Castings shall be sound, dense and clean, and free from distortion, porosity, carbon and slag enclosures, blowholes and other injurious conditions.

29.8 Welding flux shall be chipped away and all welds wire brushed before galvanizing.

29.9 The surface to be galvanized shall be free from paint, oil, grease and similar impurities.

29.10 All exposed surfaces including welds shall be thoroughly sand blasted prior to galvanizing.

29.11 The Engineer reserves the right to inspect all steel components before galvanizing and shall have the right to reject or ask for remedial treatment of any material which is considered to be unsuitable. This applies particularly to welds.

29.12 The galvanizing coating shall be smooth, adherent, continuous and free from black spots or flux stains.

29.13 Globular extra-heavy deposits of zinc which interfere with the intended use of the material will not be acceptable. Excessively protuberant lumps and nodules shall be removed by hot wiping or by the skilful application of mechanical means, however there shall remain a sufficient minimum thickness of unbroken zinc coating. Flaws on small parts and working surfaces shall be repaired only by stripping and re-dipping.

29.14 Repairs to galvanized coatings will not be accepted. Items damaged will need to be re-galvanized.

29.15 Coating thickness shall be as per table 1 of SABS 763 unless otherwise specified in the supplementary specification.

29.16 The SABS requirement for uniformity shall apply.

29.17 Galvanized surfaces specified with paint finishing shall not be passivized.

30. PAINTING

30.1 The entire installation, other than aluminium or stainless-steel pipe cladding, shall be painted, unless otherwise specified in the Supplementary Specification.

30.2 Painted items shall include plant room floors, equipment plinths and bases.

30.3 Before any painting is applied, the surfaces shall be prepared according to SABS 064, Code for Preparation of Steel Surfaces for Painting. All surfaces shall be moisture free, clean and properly prepared.

30.4 During painting, the Contractor shall ensure that all the necessary fire prevention and firefighting precautions have been taken.

30.5 Name plates, labels and notices on equipment shall not be painted.

30.6 Items which do not require painting such as diffusers and grilles, shall only be installed after the paint work on the plant, ceiling or walls have been completed.

30.7 Painted surfaces on proprietary manufactured items shall be adequately protected. Equipment on which the paint work has been damaged during installation shall be repainted before first delivery of the plant will be considered.

30.8 Unless otherwise specified in the Supplementary Specification the installation shall be painted in accordance with SABS colour coding where applicable. Colour code bands and arrow indicators shall be as per SABS 0140 of 1978, and the basic colour shall cover the full length and circumference of pipes and ducts.

30.9 Plastered surface inside plenums shall be painted with a suitable alkali resistant primer to SABS 1414-1987 followed by a universal undercoat with a final coat of high gloss enamel paint to SABS 630, Grade I. The colour of the final coat shall be white.

30.10 Lagged and plastered ductwork and plastered surfaces outside plenums shall be painted with a suitable alkali resistant primer to SABS 1414 of 1987 followed by one undercoat to SABS 681, type II and one coat high gloss enamel paint to SABS 630, Grade I or PVA exterior type emulsion paint to SABS 634 of 1974 as top coat.

30.11 Ferrous casings of cooling towers, evaporative condensers and sprayed coils including galvanized iron castings, sumps, fans and ductwork connected to outlets of cooling towers or evaporative condensers, shall be internally painted with two coats of epoxy-tar paint to SABS 801, type II.

30.12 Angle iron framework shall be similarly painted with epoxy paint before side covers are fitted. All steel surfaces shall be cleaned and painted with a wash primer or zinc chromate primer (un-galvanized iron) before the

30.13 Exposed and unlagged galvanized piping shall be painted with one coat wash primer (self-etch primer) to SABS 723 followed by one undercoat to SABS 681, type II and one coat gloss enamel paint to SABS 630, Grade 1 as top coat.

30.14 Unlagged black piping, flat iron, angle iron, rods, etc., for supports, brackets, frames duct stiffeners, etc., shall be painted on all sides with a zinc chromate primer to SABS 679 type I, followed by one coat universal undercoat and one finishing coat of enamel paint to SABS 630 Grade 1.

30.15 Where specified in the supplementary specification, aluminium shall be painted with a wash primer to SABS 723 followed by a zinc chromate primer to SABS 679, type I and one coat universal undercoat to SABS 681-1972 type II and one final coat of enamel paint to SABS 630, Grade 1.

30.16 Where specified in the supplementary specification, steel surfaces shall be cleaned and then treated with the hot phosphate process to a minimum weight of 1.6 g/m2 coating followed by two coats of backing enamel to SABS 783 type I.

30.17 All galvanized surfaces requiring painting other than those covered in 3.13.17 below shall be thoroughly degreased. In case a detergent is used, the surface shall be well rinsed and dried. It shall then be painted with one coat wash primer (self-etch primer) to SABS 723. When dry, the surface shall be painted with one undercoat to SABS 681 type II and one coat universal undercoat and one coat high gloss enamel paint to SABS 630, Grade 1 as top coat.

30.18 All galvanized surfaces inside air handling plenums and external within 50km of the coast, or as specified in the supplementary specification, shall be cleaned with a galvanized iron cleaner until a water break free surface is achieved. After drying one primer coat of “Galvo-Grip” or approved paint shall be applied followed by one coat of universal undercoat paint. A final coat of gloss enamel to SABS 630, Grade I shall then be applied.

30.19 For air handling units the entire air-conditioning unit casings, including galvanized iron eliminators, sumps, drip pans, fans, etc., shall be painted internally with two coats of epoxy-tar paint to SABS 801, type II. The white rust preventative compound on galvanized iron shall be removed as specified above before the paint is applied. Angle iron framework shall be similarly painted with epoxy paint before side covers are fitted.

30.20 Exposed piping with canvas covered insulation shall be painted two coats of bitumen aluminium paint to SABS 802 followed by the colour coding basic colour as per table 1.

31. ERECTION OF EQUIPMENT

31.1 General - Unless otherwise specified in the Supplementary Specification the design, manufacture and installation of all the mechanical and electrical equipment shall be such as to ensure compliance with the relevant sections of SABS 0103 of 1983 “The Measurement and Rating of Environmental Noise with Respect to Annoyance and Speech Communications”, as amended. Any installation where the measures residual sound level exceeds the maximum desired residual sound level as per SABS 0103 shall be rectified to comply with SABS 0103 at the Contractor’s own expense. In all plant room applications where, airborne noise cannot be limited or comply with the set standards, provision shall be made for acoustical treatment of the equipment involved or, alternatively, total enclosure thereof with acoustical panelling to comply with requirements laid down in this specification. Such provisions shall be included in the bid price and no claims for payment to comply with this requirement will be entertained.

31.2 Tenderers shall allow for a complete installation, including the provision of mobile cranes, air compressors, lifting tackle, measuring equipment, precision levels, and all other special or regular tools and equipment that may be needed to complete the entire installation in accordance with the specification, and to the satisfaction, of the Department.

The Contractor will be responsible for any damage caused to buildings, equipment, etc. during the course of the erection of his equipment.

a. **Equipment Plinths** - Plinths as specified hereunder shall not be confused with any form of inertia or anti-vibration base. Unless otherwise specified in the Supplementary Specification, equipment plinths shall form part of the air conditioning and ventilation contract. Plinths shall be provided for all mechanical and electrical equipment. Plinths cast on concrete surfaces shall protrude at least 200 mm above floor levels and depending on the position of the vibration mountings, shall be at least 200 mm wider or longer than the inertia bases mounted on top. Plinths for equipment which do not need inertia bases or plinths for inertia bases with recessed vibration mountings shall be of the same size as the equipment or bases mounted on top. Plinths shall consist of 1,6 mm thick channel or angle iron formers with 10 mm thick reinforcing bars located at 150 mm pitch in each direction and filled with concrete. The top surface of the concrete shall be floated to an even and smooth finish to allow for not less than 25 mm and not more than 50 mm of suitable cement or epoxy grout under the equipment base frame. A 25 mm 45º chamfer shall finish off all grout corners. Plinths as specified above shall also be provided for field assembled plenum chambers and other equipment.

b. **Clamping Down Bolts and Bolts for Equipment** - The Contractor shall be responsible for the supply of all necessary holding down bolts for the machines supplied by him. He shall also supply all bolts necessary for assembling all the equipment supplied by him. Holding down bolts shall preferably be cast into concrete bases when the bases are being cast. All bolts shall, in this instance, be provided with galvanised sheet metal sleeves approximately three times the diameter of the bolt, and projecting a minimum of four-bolt diameters below the surface of the concrete. This sleeve must be kept free of concrete until the final grouting takes place. Under exceptional circumstances, the provision of suitably sized pockets for the holding down bolts will be permitted. Where galvanised bolts are called for, they shall be fully galvanised all over. No re-cutting of threads will be permitted after galvanising. All nuts must run freely on the threads.

c. **Vibration Isolation** - Proper provisions shall be made in the foundations and mountings of all equipment capable of transmitting vibration forces to its environment, whether local or remote for vibration isolation.

d. **Damping** - Where static deflections in excess of 8 mm are indicated, steel springs shall be employed incorporating acoustic sound pads in series with the spring. The horizontal stiffness of the springs shall not exceed that in the vertical, in particular for systems mounted at vertical frequencies below 5 Hz. Low frequency mounts shall incorporate rubber snubbers to accommodate extreme horizontal or vertical motions such as can occur near resonance during start up. The snubbers shall however not be relied upon to

provide the necessary horizontal stability of the machine in normal operational conditions. Spring layouts and inertia blocks shall be employed to avoid this situation. For static deflections below 8 mm, rubber in sheer mounts may be used provided the frequency is above 6 Hz.

For small static deflections less than 4 mm and particularly for high-speed machines and general acoustic isolation, ribbed rubber neoprene composite pads may be employed subject to the specified requirements. No equipment shall be installed in critical areas without correct and approved vibration isolation. Sufficient stability and damping shall be incorporated in the mountings to minimise the movement of the machine during start up or changes in the operating conditions. The selection of mounts shall take proper cognisance of unequal distribution of the mounting weight of equipment and rotational and/or pressure forces acting thereon.

32. ELECTRICAL EQUIPMENT AND INSTALLATION

32.1 Unless otherwise stated in the Supplementary Specification Bidders must allow in their price for the complete electrical installation and wiring in accordance with SABS code of Practice for the Wiring of Premises 0142 of 1981 as amended.

32.2 All electrical equipment and wiring shall be in accordance with the current issue of the Standard Specification for Electrical Equipment and Installation for Mechanical Services. Copies can be obtained from the Department, Private Bag X65, PRETORIA, 0001.

32.3 Power terminal points will be as specified in the Supplementary Specification.

32.4 Ammeters and pilot lights shall be provided for electric heaters, one of each for each step of heating.

32.5 All compressor motors over 5 kW shall be provided with an approved electronic type motor protection unit in addition to the protection called for in the Standard Specification for Electrical Equipment and Installation for Mechanical Services.

32.6 Clause 1.2.1 (a) of the Standard Electrical Specification shall read “The South African Bureau of Standards Code of Practice for the Wiring of Premises as amended”.

32.7 In conventional field assembled plants lighting wired from the air conditioning control panel shall be provided for the filter chamber, coil chamber and fan chamber and shall comprise of bulkhead fittings permanently fixed to the walls or ceiling and earthed directly to the main earthing bar of the switchboard by means of a 4mm² bare copper earth continuity conductor, in addition to being earthed by means of the continuity of the conduit as specified in the Standard Electrical Specification.

32.8 The fault level of the air conditioning distribution board shall be as specified in the Supplementary Specification.

32.9 In the case of small wiring direct from busbars, e.g., voltmeter supply, suitable protection fuses shall be mounted directly onto the busbars.

32.10 The possibility of inadvertent contact with live terminals shall be avoided at all cost. All apparatus and wiring behind readily accessible hinged doors or panels shall be protected against finger contact by means of insulating panels (Perspex or similar approved material) or other approved method. Busbar mounted voltmeter fuses shall be mounted on insulated back plates to afford complete safety from hand contact with busbars or other conductors in the immediate vicinity.

33. SELECTION OF EQUIPMENT

33.1 All equipment shall be selected with due regard to the installation site conditions, particularly with respect to:

- Altitude
- Ambient temperatures
- Atmospheric conditions

33.2 Equipment shall at all times be selected to operate within the limits recommended by the particular manufacturer.

33.3 Where equipment will be required to operate at conditions deviating from the manufacturer's standard selection tables, re-rating shall be done strictly in accordance with the manufacturer's methods.