PART II

FORM OF BID

NOTICE TO BIDDERS

HEAT PUMPS & PANEL HEATERS REPLACEMENT INSTALLATION

FOR

SABC RADIO PARK, 35 HENLEYWEG AND ARTILEY ROAD, AUKLAND PARK, JOHANNESBURG

THE SUPPLY, INSTALLATION, COMMISSIONING, MAINTENANCE AND GUARANTEE OF SABC AUCKLAND PARK HEAT PUMPS AND PANEL HEATERS REPLACEMENT

1. TENDER PRICE

Having examined the Conditions of Contract, Specifications, and Drawings listed in this document for the above-named works, I / We the undersigned are willing to contract for, perform and complete the whole of the works required to be done in the supply, installation, commissioning, maintenance, and 12 months guarantee to the wet services installation to the Engineers satisfaction.

The contract price will be a fixed price.

Tender Price R.....

In words:

.....

.....

Made up as follows:

1.1 Nett amount for SABC AUCKLAND PARK BOILER ELECTRODE REPLACEMENT installation from pricing schedule

R.....

1.2 Builder's Work at 5% of Nett amount from pricing schedule. (Including Painting, Bricking up, Plastering, Tiling and Ceiling Repairs).

R.....

1.3 Add VAT at 15% R.....

1.4 TOTAL TENDER PRICE. R.....

Name of Tenderer .....

Name of Signatory .....

2. GENERAL

2.1 I / We agree to abide by this Tender for a period of 180 days from the date fixed for the closing of tenders and it shall remain binding upon us and may be accepted at any time before the expiration of that period.

2.2 The Tenderer shall enter into an agreement with the building owner. The conditions of contract shall be in accordance with the JBCC latest edition. The tenderers are requested to review the conditions of contract and preliminaries and general in consultation with the principal contractor.

2.3 The Subcontractor shall execute the works in accordance with a programme determined by the Principal Contractor.

2.4 Payments by the Principal Contractor to the Sub Contractor shall be in accordance with the relevant clauses of the Principal Contract.

2.5 The priced bill shall be submitted with the tender.

2.6 I / We understand that you are not bound to accept the lowest or any or the only tender that you may receive. Any conditions appended by the tenderer that is at variance with the conditions in this document may invalidate this tender.

2.7 I / We undertake, if our Tender is accepted, to commence the work on receipt of the engineer's instructions and to complete and deliver the whole of the work described in the contract in accordance with the Principal Contractors programme.

2.8 Unless and until a formal agreement is prepared and executed between the Client and yourselves this Tender, together with your written acceptance thereof, shall constitute a binding contract in terms of the true meaning of this document. I/We confirm that we accept the conditions of contract as contained in the document as well as the Principal Contractors letter of appointment.

2.9 I / We undertake to enter into a contract in terms of the "Conditions of Contract" and other clauses contained in this document should our tender be accepted.

2.10 Contractor shall carry out all noisy works after hours or during weekends.

3. PERFORMANCE GUARANTEE.

I / We undertake to supply a Performance Guarantee of 10% of the contract sum which shall not be reduced in any way until being returned to the contractor.

A letter from the Company that will provide the Guarantee shall be attached confirming that they are prepared to provide the appropriate Guarantee.

Failure to comply will result in disqualification.

NAME OF BANK OR INSURANCE COMPANY.

SIGNATURE OF TENDERER

DATE

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4. ALTERATIONS BY TENDERER.

4.1 Explanatory remarks with regards to variations to the design of the installation, or remarks regarding the specification, drawings or conditions of contract, shall be described in the space provided below or in a separate letter enumerated in the space below and accompanying the tender. Should no remarks be made, it shall be interpreted that the tender offered fully complies with this document and that there are no ambiguities which require clarifications.

_____

Signature of Tenderer

_____

Date

PART 2.5

SCHEDULE OF SIMILAR PROJECTS COMPLETED WITHIN THE LAST 10 YEARS

Tenderers shall complete the following form showing all similar installations completed during the past 10 years.

Should no contracts be listed, it will be assumed that no such work has been previously performed.

PROJECT	TYPE	VALUE	YEAR	CLIENT

PART III

CONDITIONS OF CONTRACT

HEAT PUMP AND PANEL HEATER REPLACEMENT INSTALLATION

FOR

SABC RADIO PARK, 35 HENLEYWEG AND ARTILEY ROAD, AUKLAND PARK, JOHANNESBURG

CONDITIONS OF CONTRACT SHALL BE AS PER THE JBCC CONDITIONS OF CONTRACT AGREEMENT.

THE TENDERERS SHALL IN ADDITION FAMILIARIZE THEMSELVES WITH THE JBCC CONDITIONS PERTAINING TO THIS PROJECT.

NO EXTRA'S OR ALTERNATE CONDITIONS WILL BE CONSIDERED FOR TENDERERS LACK OF KNOWLEDGE OF THE CONDITIONS OF CONTRACT.

PART IV

GENERAL TECHNICAL SPECIFICATION

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PART IV

PART IV.1 GENERAL NOTES APPLICABLE AND PROJECT SPECIFICATION

1. GENERAL INFORMATION

- The General Technical requirements cover the delivery, installation, testing, commissioning and maintenance of the Heat Pump, Calorifier, Pumps, Cold-Water reticulation, Hot Water reticulation Installation and Builder's work.

    - The complete Cold Water and Hot Water System shall comply with the requirements of this specification and SANS 10252 as amended. Should any discrepancies or contradictions arise between this part of the Specification and the Detailed Technical specification (Part V) then the latter shall take preference. Should any discrepancies appear between the written specifications and the drawings, tenderers shall ascertain the position before tender closing date, otherwise the worst or any case may be assumed by the Engineer entirely at his discretion.
    - This specification is of simplified form and includes abbreviated sentences. The omission of words or phrases shall be implied by inference.
    - The Contractor is required to provide all material, equipment, labour and services and to perform all operations required for the installation to be complete and operative.
    - Document" shall mean the complete set of contract and specification documents including all drawings variation orders and Engineers instructions issued in terms of the contract.
    - The Engineer will inspect the installation from time to time during the progress of the work. Discrepancies will be pointed out to the Contractor and these shall be remedied at the Contractor's expense.
    - Under no circumstances shall the above-mentioned inspections relieve the Contractor of his obligations in terms of these Documents.
    - The Contractor shall notify the Engineer timeously when the installation reaches important stages of completion (e.g. equipment installation, pressure testing, proving connections etc.) so that the Engineer's representative may schedule his site inspections in the best interests of all concerned. It will be the Contractors responsibility to schedule all inspections so as to give the Engineer at least 7 days advance notice. No claims for delay will be considered where the Engineer is unable to attend having been given less than 7 days notice.
    - Unless it is explicitly stated to the contrary and words "Subcontractor" and "Contractor" shall refer to the successful tenderer for the Heat Pump, Calorifier, pumps, Cold water and Hot Water reticulation Installation and heater installation.

2. REGULATIONS

- The installation shall be erected and tested in accordance with the following regulations:
  - The Factories, Machinery and Building Work Act of 191 as amended.
  - The SABS Code for the Wiring of premises -SABS 0142-1987 as amended as well as SABS 0180-1974 as amended.
  - The local Municipal By-Laws and Regulations as well as the regulations of the local Supply authority.
  - The local Fire Regulations.
  - The Occupational Health and Safety Act (current edition)
  - The Specifications of the Gauteng Province Public Works Department
  - The Specifications of the Gauteng Province Department of Health.
  - CIBSE Guide G – Plumbing and Sanitation Installations.

- The Contractor shall issue all notices and pay all the required fees in respect of the installation to the authorities, and shall exempt the Owner from all losses, claims, costs or expenditures which may arise as a result of the Contractor's negligence in not complying with the requirements of the regulations.
- It shall be assumed that the Contractor is conversant with the above-mentioned requirements. Should any requirements, by-laws or regulations, which contradict the requirements of this Document, apply or become applicable during erection of the installation, such requirement, by-law or regulation shall overrule this Document and the Contractor shall immediately inform the Engineer of such contradiction. Under no circumstances shall the Contractor carry out any variation to the installation in terms of such contradictions without obtaining written permission to do so from the Engineer.

3. SITE CONDITIONS

- Tenderers are instructed to visit the site and acquaint themselves with all local conditions pertaining to the execution of the installation before tender closing date. No claims from the contractor which may arise from insufficient knowledge of site access, type of site, labour conditions, establishment space, transport and loading/unloading facilities power, water, supply, etc. will be considered after submission of tenders. For services where prior permission is required before contractor can visit the site, a visit will be arranged for all interested parties at their request. (Site Address: SABC RADIO PARK; 35 Henleyweg and Artiley Road; Auckland Park; Johannesburg)

4. ARRANGEMENTS WITH THE SUPPLY AUTHORITY

- The Contractor shall give all notices required by and pay all necessary fees, including any inspection fees, which may be required by the local supply Authority unless otherwise specified.
- On production of the official account, only the net amount of the fee charged by the Supply Authority for connection of the installation to the supply mains will be refunded to the Contractor by the Owner.
- It shall be the responsibility of the Contractor to make the necessary arrangements at his own cost with the local supply authority and to supply the labour, equipment and means to inspect, test and commission the installation to the requirement of the local and supply authorities.

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

5. MATERIAL, EQUIPMENT AND WORKMANSHIP

- All material shall be new and of high quality and suitable for the conditions on site. Should the materials not be suitable for use under temporary site conditions then the Contractor shall at his own cost provide suitable protection until these unfavourable site conditions cease the exist. All materials and workmanship shall comply with the relevant SANS or BS standards.
- The Contractor shall where requested to do so, submit samples of equipment and material to the Engineer for this approval prior to installation. Samples may be retained in the Engineer's possession until the contract is completed after which they will be returned and no charge will be made for such samples.
- **Locally manufactured equipment** shall be used where possible and practical in preference to imported equipment. The owner in no way binds himself to assist the Contractor in obtaining import permit for imported equipment, and by virtue of this, any custom charges for imported goods are deemed to be payable by the successful contractor and not the client.
- The works shall be designed to provide ease of inspections, cleaning and maintenance.
- All artisans employed on site shall be competent in terms of the Regulations and Acts.
- The contract shall be executed to a high standard and to the satisfaction of the Engineer. Should any workmanship, equipment or material not be to the satisfaction of the Engineer, it shall be rectified at the cost of the Contractor and all rejected materials shall be removed from the site.
- If, in the opinion of the Engineer, any member of the Contractor's staff is not competent to carry out the work to the required standard, then that person shall be removed from the project if so instructed by the Engineer.

6. OPERATOR TRAINING

- On completion of all tests to the satisfaction of the Engineer the Contractor shall continue to be responsible for the complete operation and maintenance of the systems for a period of one week during which time instruction shall be given to the Employer's staff on the proper operation and maintenance of the systems
- The operation and maintenance of the systems for the duration of the instruction period shall not in any way relieve the Contractor of his responsibility under the terms of the contract.

7. TOOLS AND EQUIPMENT

- Unless otherwise specified, the Contractor shall provide all tools, materials, scaffolding, power, water, etc. necessary for the proper and efficient execution of the work covered by this specification.
- No extra payment will be made for plant equipment, materials required by the contractor to complete the work.
- The Contractor shall provide all rigging, cranes, lifting equipment, etc. necessary to execute the works.

8. MAINTENANCE TOOLS

- The Contractor shall provide one set of all special tools, gland keys, valve keys, etc. required for testing, maintaining and operating of all items of equipment.
- Duplicate keys shall be provided for all control panels, instrument locks, safety valve locks, etc.
- All special tools etc. referred to above shall be handed to the client when the system handover is done.

9. STORAGE OF EQUIPMENT AND MATERIALS

- The Contractor shall ensure that all stored materials and equipment are safely stacked and that stacking does not damage them.
- The Contractor shall ensure that stored materials and equipment do not overload the structure of floor construction.
- The storage of combustible materials on site shall be kept to a minimum. The Contractor shall be responsible for ensuring that such combustible materials are safely stored. Suitable firefighting equipment shall be provided by the Contractor, who shall further ensure that staff capable of using the equipment is at hand.

10. LOCATION OF EQUIPMENT

- The Contractor shall check on doorways, passages, openings, lifts, etc. provided and shall ensure that all equipment offered can be moved through them to its final position. If necessary, equipment shall be ordered in a partially dismantled condition so that is suitable for moving through the restricted openings or areas of restricted height or areas of restricted load.

11. PROGRAMME AND PROGRESS

- The Contractor shall provide a detailed programme for the complete works within 14 days of appointment. The programme for the carrying out of the works shall be submitted in detailed form covering all significant operations and shall be in the form of a bar chart.
- The Contractor shall liaise with all necessary parties (contractors, consultants, equipment suppliers, etc.) to ensure that the programme is as accurate and as realistic as possible.
- The Contractor shall submit the programme in a format agreed with the Engineer.
- The programme shall list each scheduled item of equipment in the contract and shall indicate periods for:

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

- The Contractor shall build into the programme a period of two weeks for approval of drawings by the Engineer.
- The Contractor shall allocate to a senior member of his staff the duties of studying and evaluating the works in relation to the approved programme, of devising methods to overcome or prevent delays and of co-operating with the Engineer and other contractors working on site. He shall report to the Engineer and draw his attention timeously to anything that may cause a delay in the execution of the works.
- The programme shall be updated as and when necessary to take account of changed circumstances.

12. CO-OPERATION WITH OTHER TRADES

- The Contractor shall ascertain the extent of the work of other trades on site.
- The Contractor shall give all necessary assistance to other trades to ensure that the work of all trades can be installed satisfactorily and without delay.
- The Contractor shall liaise with other trades working in close proximity to the work covered by this specification and shall assist in working out equipment and material positions to ensure that all trades can complete their work satisfactorily.

13. BUILDERS WORK

- The successful tenderer shall, within 30 days, or any shorter period which may be necessitated by the construction programme, submit two copies of all drawings showing all builders works required for the project.
- The drawings shall provide the builder with all the dimensions, details, etc. for the work to be carried our correctly.
- The Engineer will scrutinise the drawings and request changes and adjustments as required. After such changes are satisfactorily made the Engineer will fix his stamp of approval to the drawings.
- The successful tenderer shall provide all the necessary copies of the drawings to the Engineer for issue to all parties.
- It is the responsibility of the Contractor to check the builder's work as it is completed to ensure that the work has been correctly carried out in accordance with the drawings. The Contractor shall point out any problem areas as soon as possible to the builder so that they can be rectified. No claims shall be considered for delays or other additional costs, which arise out of the contractor's failure to check the builders, work in good time.

- The builders work drawings shall be fully dimensioned and shall include the following:

    - Details of all plant bases required.
    - Positions of all drain points.
    - Details of all openings in walls and concrete work
    - Details and positions of all equipment to be built into walls.
    - Any other work required.

- The contractor and builder to the approval of the Engineer shall carefully detail all areas where the Cold Water and Hot Water Services Installation pierces

waterproofing. All necessary sleeves, caulking and flashing as required to make the installation waterproof shall be provided as part of this contract.

14. SUPERVISION AND SITE ORGANISATION

- For the full duration of this Contract the Successful Tenderer shall employ at least one good and competent Supervisor careful and skilled in all aspects of the trades and skills required by this Contract. This supervisor shall be on site whenever work associated with this contract is being carried out and shall at all times be available to attend to queries by the Engineer.
- The supervisor shall be the contractor's authorised representative for the project and on site and shall be available to attend progress meetings when called upon to do so by the Engineer whether or not these take place prior to work actually starting on site.
- The supervisor shall be empowered to make all decisions necessary for the execution of the contract.
- The supervisor shall not be transferred from his position unless on the express instructions of the Engineer.
- The contractor shall at all times have on site copies of all relevant drawings as well as a copy of the specification. The contractor shall institute the necessary procedures to ensure the drawings on site are the latest drawings and that all superseded drawings are removed from site.

15. DRAWINGS

- The Engineers drawings for the contract shall be those issued at the time of tender together with any others issued to cover the variations to the contract.
- As part of this contract the Successful Contractor shall provide the following drawings:

Manufacturing and Installation Drawings

The manufacturing and installation drawings ("shop drawings") shall provide all details of the plant necessary for the manufacture and installation of the system in accordance with this specification.

Wiring Diagrams

The wiring diagrams shall provide details of all the electrical wiring associated with the Hot Water Installation. The same drawing symbols and system shall be used as used in the Engineers drawings.

Builders Work Drawings

All necessary builders work drawings as described elsewhere in this specification shall be provided as part of this Contract.

Record Drawings

On completion of the installation but before the plant is handed over the Contractor shall provide a complete set of drawings showing the completed installation including wiring.

- In addition to the drawings listed above the Contractor shall provide all drawings necessary for the execution of the Contract and shall submit such general and detailed drawings of the plant and apparatus as the Engineer may require to approve construction of the plant.
- Details and drawings of all major items of equipment made by the Contractor or his suppliers shall be submitted for approval without specific request from the Engineer.
- All required drawings shall be submitted to an agreed programme to suite the construction of the plant.
- All drawings shall be clearly numbered or marked with the equipment item numbers, area references, etc.

- **Approval of Drawings:**

    - The Contractor shall submit for approval, in principle, copies of all above - mentioned drawings prior to starting work or issue to other parties. Any work started (off site or on site) prior to receiving the Engineers approval of drawings shall be at the Contractors own risk.
    - The Engineer may require from the Contractor further detailed drawings and/or calculations which clarify features not adequately shown on the layout drawings. The request for additional details shall not be construed as extending the scope of this contract or altering the programme.
    - The Contractor shall submit two copies of each drawing to the Engineer for approval.
    - The Engineer will return to the Contractor within ten working days of their receipt by him, one copy of each drawing marked "APPROVED IN PRINCIPLE" or marked with any changes, which are necessary.
    - The Contractor shall modify the details and drawings as required by the Engineer. The nature and date of each modification and a distinguishing symbol shall be added and the drawings submitted again for approval.
    - Alterations to drawings by the Engineer are not intended to change the scope of work unless explicitly stated as doing so. Should any alterations, in the opinion of the Contractor, change the scope of work the Contractor shall notify the Engineer immediately on receipt of the altered drawings before any further drawing work or fabrication is carried out. Claims for a change of scope, made after performance of the work, constituting the claimed change of scope will not be considered.
    - The approval in principle of drawings by the Engineer shall not relieve the Contractor of any responsibility in terms of the contract. The Engineer will check the drawings for design only and approval of the drawings, schedules and catalogues shall not be construed as a complete check.
    - The Contractor shall be responsible for any discrepancies, errors or omissions in the drawings and other particulars supplied by him whether such drawings or particulars have been approved by the Engineer or not, provided that such discrepancies, errors or omissions are not due to inaccurate information or particulars furnished in writing to the Contractor.
    - The Contractor shall issue five copies of the Final Manufacturing and Installation Drawings to the Engineer within ten days of receipt of approval in principle. Further copies shall be provided as may be required by the Engineer either before or after final approval.
    - The Contractor shall provide at his own expense, all copies of drawings by him in the execution of the work and shall also, at his own expense, supply

to the Engineer such drawings and copies thereof as are provided for in the specification.

- **Record Drawings**

  - On completion of the installation, but before final handover, the Contractor shall provide two transparencies plus the necessary prints of each of the following drawings showing the services as fixed:

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

  - The drawings shall be sufficient in detail to enable the Employers staff to maintain, dismantle, reassemble and adjust all parts of the works.
  - The layouts shall show the location of all manual and automatic valves, controls, control panels, outlets, etc.
  - A copy of the wiring diagram shall be mounted in the Plant room in a glass-fronted frame. The diagrams shall be printed by a non-fading process.

16. MAINTENANCE AND GUARANTEE

Maintenance

- The Successful Tenderer shall maintain the entire installation as described in this specification for a period of one year from the date of final handover.
- The maintenance visits shall be carried out at regular monthly intervals.
- The maintenance shall cover all items of plant and equipment and shall include replacement of all expendable items, e.g. Flush valves, Washers, Fuses, etc.
- In addition to the monthly maintenance visits, the Contractor shall carry out all necessary visits due to failure of any item of the plant or equipment. The contractor shall attend to all complaints by the Employer.
- The Contractor shall report to the Owners nominated representative, both on arriving and leaving the site. The Contractor shall provide the Owner and the Engineer with a Service Report for each visit whether scheduled or breakdown.
- At each maintenance visit, the Contractor shall check the function of each item of plant and equipment and shall ensure that the plant is performing to specification. All automatic controls and bulbs, etc. shall be checked and adjusted or replaced as necessary.
- The equipment and plantrooms shall be cleaned at each scheduled visit.
- The Contractor shall notify the Engineer prior to the final monthly service so that the Engineer may accompany the Contractor.
- The Engineer may at his discretion allow the maintenance period on any item of equipment or section of the installation start at a date prior to final handover if it is put into operation for beneficial use of the owner prior to final handover. This will not be permitted in cases where final handover is delayed due to the Contractor not carrying out remedial work in good time.

Guarantee

- The Contractor shall guarantee the entire installation as described in this specification for a period of one year from the date of final handover. The guarantee shall provide that all pats, spares, equipment that becomes defective during the guarantee period shall be replaced free of charge. The guarantee shall cover all costs including material, labour, overheads, travelling etc.
- The complete installation shall be guaranteed against defects whether patent or latent as well as against faulty materials and workmanship.
- The guarantee shall cover all materials, plant and equipment whether or not it is covered by the manufacturers guarantee. The one-year guarantee in terms of this contract on the entire installation shall not be affected by the prior expiry of any guarantee provided by the manufacturer of any item of equipment or plant.
- The Contractor shall cede to the Owner the remainder of any equipment guarantee which he has received from his suppliers and which extends beyond the one-year period. It shall be the responsibility of the Contractor to ensure that the guarantee is transferable.
- The Engineer may at his discretion allow the guarantee period on any item of equipment or section of the installation start at a date prior to final handover if it is put into operation for beneficial use of the Owner prior to final handover. This will not be permitted in cases where final handover is delayed due to the contractor not carrying out remedial work in good time.

17. OPERATING AND MAINTENANCE MANUALS

- The Successful Tenderer shall provide three copies of the Operating and Maintenance Manuals.
- The Contractor shall submit for approval to the Engineer, four weeks before completion of the installation, two copies of the maintenance and operating manuals for the plant and equipment supplied. The contract will not be accepted for handed over until the Operating and Maintenance Manuals are approved.
- The Engineer will return to the Contractor within ten working days of their receipt by him one copy marked with all changes which are necessary.
- The Contractor shall modify the manuals as required by the Engineer and submit to the Engineer, within ten working days, two revised copies of the manual. On completion of the installation, but before the plant is handed over to the Employer, the Contractor shall provide three copies of the final Operating and Maintenance Manuals for the plant and equipment supplied. The manuals shall be bound in book form with hard plastic covers to withstand constant use.
- The manuals shall be properly indexed to facilitate easy reference.
- The manuals shall include:

    - A list of recommended servicing tools and specialist equipment.
    - A list of spares to be supplied by the Contractor to cover the period of warranty.
    - A priced list of recommended spares necessary for a period of 2 years in operation.
    - Exploded drawings or detailed spares list from which every item of every piece of equipment can be positively identified for ordering replacements.
    - A list giving the name and address of the local agent of each item of equipment.

- A list giving the name and address of the manufacturer of each item of equipment.
- A copy of all test certificates obtained with the plant.
- A list of recommended lubricants.
- A preventative maintenance programme for all equipment.
- Operating instruction for each item of equipment.
- Performance date and/or characteristic curves.
- Commissioning data.
- Record drawings.

PART IV.2 STANDARD PIPE INSTALLATION SPECIFICATION

1. GENERAL

- Piping shall comply with BS 1387/1957 or SABS 62 - 1971.
- Valves, pipes, strainers, etc. up to and including 65 mm., may be screwed or flanged 80 mm and over shall be flanged or welded. Valves, strainer and other fittings larger than 50 mm shall be flanged.
- Threads shall be in accordance with BS 3643.
- Flanges shall be in accordance with BS 4504.
- Pipes smaller than 50 mm dia. connected to equipment shall be flanged to the equipment for maintenance purposes.
- All piping with a diameter larger than 50 mm shall be welded, except where galvanised pipes are used.
- Galvanized piping shall be screwed when smaller than 50 mm dia. and flanged above 5O mm.
- Generous allowance shall be made for expansion and contraction in pipework installations.
- No pipe work shall cause any stress on any equipment due to thermal movement, nor shall it bend or distort from such factors.
- No pipe work shall cause any stress on any equipment due to pipe and/or fluid mass.
- Horizontal pipes shall be installed at an angle of at least 1 in 500. All low points shall be drained by means of a dirt leg and drain cock.
- All high points in piping handling fluids shall be fitted with an automatic and manual air vent.
- Where pipes pass through walls or floors, pipe sleeves with a minimum wall thickness of O.5 mm shall be installed. Pipe sleeves shall be hot dipped galvanised.
- Pipe sleeve lengths shall match the wall or floor in which it is installed.
- The pipe sleeve diameter shall be chosen to permit a minimum space of 10 mm between the pipe and pipe sleeve or insulation material and pipe sleeve.
- Pipe sleeves shall be built in and anchored or flanged in position.
- Pressure and temperature ratings of valves and other pipeline equipment shall be suitable for the system into which it is installed and shall be selected according to ratings given by the manufacturer.
- Matched flanges shall correspond in construction and dimensions to flanges on equipment.
- Flanges shall be provided with the correct bolts, nuts and packing rings.
- Care shall be taken that all piping is clean and free of rust before connecting
- All equipment of one type installed under one contract shall be of the same manufacture, supported by a well-established SA organization. Other makes lay only be used on the engineer's written approval.

2. STEEL PIPES FOR CLOSED CHILLED WATER SYSTEMS AND WATER SYSTEMS UP TO 65°C

- Pipes shall be medium black steel.
- Fittings shall be malleable steel or malleable iron to BSS 1740 or SABS 509 - 1975 specifications.
- Flanges shall be of cast iron or steel to BS 4501 standards.
- Flange packing shall be of the reinforced rubber type.
- Screwed joints shall be made with P.T.F.E. jointing tape equal to 3M manufacture.
- Sealing compounds shall only be applied to the external thread of pipes.
- Chilled water piping shall be thermally insulated as specified elsewhere in part 4.

3. STEEL PIPES FOR HOT WATER OF 65°C AND OVER

- Pipes shall be of Carbon Steel pipe ASTM A106/A106M.
- Fittings shall be as specified in A182 Gr F1.
- Flanges shall be provided with compressed asbestos fibre packing or suitable metal packing.

4. STEEL PIPES FOR CONDENSER WATER, DRAIN WATER AND SOFT WATER.

- Pipes shall be of medium or heavy black to BS1387
- Piping shall be hot dipped galvanized with minimum covering of 300g per sq.m.
- Fittings shall be of heavy galvanized malleable steel or malleable iron.
- Hot dipped galvanizing shall take place after manufacture
- Flange packings shall be of a material approved by the Engineer.
- Sealing compounds on screwed piping shall be suitable for the system fluid and shall be approved by the Engineer.

5. STEEL PIPES FOR STEAM

- Pipes up to 150mm dia. shall be Schedule 40.
- Pipes over 150mm shall comply with BS 3601 or BS 3602 specifications for carbon steel pipes suitable for high pressure and temperatures.
- Fittings shall be of wrought steel for screwed connections and butt weld fittings for welded connections.
- Butt weld fittings shall be to BS 1640 specification.
- Flanges shall be provided with compressed asbestos fibre gaskets.
- Materials and fittings shall be suitable for the pressures and temperatures as specified in part 5 of this specification.
- Pipes shall be provided with a fall in the direction of steam flow.
- If not shown the slope shall not be less than 1 in 500.
- Pipes shall be drained by means of steam traps at all low points in the system.
- Offset bends shall be given a sufficient pre-tension at installation so that bends will return to normal at working temperature.
- Where the size of horizontal steam piping changes eccentric reducers shall be used with the straight edge at the bottom.
- Pipes shall be thermally insulated as specified elsewhere in part IV.5.

- Pipes 40 mm and over shall be flanged or welded.

6. PIPES FOR CONDENSATE DRAINS

- All condensate piping shall be installed to a fall in the direction of flow whether pumped or gravity drains. If not shown the fall shall not be less than 1:200.
- All pumped condensate piping shall be Schedule 40 with fittings and manufacture as for Steam piping.
- All gravity drain condensate pipes shall be made of copper.
- Pipes shall be of heavy-duty solid drawn copper tubes in accordance with SABS 460-1975.
- Pipes shall be suitable for a working pressure of 1 000 kPa.
- Fittings for gravity drain shall be of copper or bronze. (Brass fittings will not be allowed).
- Where gravity return is employed, vacuum breakers shall be installed.
- All joints shall be brazed or silver soldered and pipe ends shall be flared.
- All condensate piping laid underground shall be buried not less than 400 mm beneath the surface and shall be run in half round asbestos cement pipe sections for ease of expansion movement and maintenance purposes. Offsets shall be installed to allow for expansion.
- Underground expansion bends shall be situated in masonry chambers.
- Pipes shall be insulated as specified in Part IV.5.

7. COMPRESSED AIR PIPES

- Materials and installation shall comply with clause 2.
- All piping shall be installed with a slope in the flow direction as indicated on the engineer's drawings.
- If not shown the slope shall not be less than one in 400.
- Piping shall be drained by means of water traps at all low points in the system, and where indicated on the Engineer's drawings.
- Water trapping shall be by means of automatic water trap installations.
- Where the size of horizontal compressed air piping changes, eccentric reducers with the straight edge at the bottom shall be used.
- Pipes shall be galvanized.

8. VACUUM PIPING

- Materials and installation shall comply with clause 2.
- All low points in the system shall be provided with moisture pockets and a valved 15 mm drain pipe to the nearest drain point.
- All piping shall be installed with a slope in the flow direction as indicated on the Engineer's drawings.
- If not shown the slope shall be not less than 1 in 200.

9. HANGER AND SUPPORTS

- The maximum horizontal support spacing, and hanger rod diameters shall be as follows for steel chilled water, hot water, compressed air and vacuum pipes.

Normal pipe size (mm)	Hanger Rod dia (mm)	Span (m)
12-32	10	2.5
40-65	10	3.0
80-100	12	3.5
125-150	16	4.0
200-300	22	5.0
350-500	25	6.0

The maximum horizontal spacing for steam and condensate pipes are as follows:

Nominal Pipe Size	**Span (m)**		
Gradient	**1:120**	**1:240**	**1:480**
20	2.5		
25	3.5		
32	4.5	3.0	1.5
40	5.5	4.0	2.0
50	6.0	5.0	3.5
65	7.0	5.5	4.5
80	8.0	6.5	5.0
100	9.5	7.5	6.0
125	11.0	8.5	7.0
150	12.0	10.0	7.5
200		11.5	9.0
250		13.0	10.0

- The maximum horizontal support spacing for condensate pipes shall be as follows:

Nominal Pipe Size (mm)	Span (m)
12-20	1.0
25-40	2.0
50 and over	2.5

- Hangers shall be provided at a maximum spacing of 1 metre from each elbow or pipe fitting.
- Hanger rod dimensions for steam and condensate piping shall be not less than that specified in 5.9.1.

10. VALVES FOR WATER, AIR OR GAS UP TO 65° and 1000kPa WORKING PRESSURE

- Valve materials shall be selected for the particular application

- Gate valves up to 50 mm dia. shall consist of bronze valve bodies with screwed bonnets and screwed alloy stems and solid tapered wedge type discs of bronze.
- Gate valves of 65 mm dia. and over shall have cast iron valve bodies with flanged ends. Bonnets and yokes shall be bolted. Rising brass or bronze stems with outside screw and yolk shall be utilized. Wedge discs shall be solid cast seat rings on body and disc. Trim shall be bronze
- Gate valves shall only be used as isolating or shut off valves.
- Gate valves shall be provided with back seating on stems to facilitate repacking under pressure.
- Globe and angle valves up to 50 mm dia. shall have bronze bodies with screwed bonnets and screwed ends. Stems shall be rising copper alloy with inside screw. Trim shall be bronze. Bronze seat rings and replaceable composition or bronze discs shall be with compressed air or liquid oxygen.
- Globe and angle valves over 65 mm dia. shall have cast iron bodies with flanged ends, bolted bonnets and yokes, rising bronze stems with outside screw and yoke, replaceable bronze seals, replaceable discs and bronze trim.
- Globe valves shall be used for throttling or balancing purposes.
- Butterfly valves of a diameter over 50 mm shall have cast iron bodies with suitable rubber lining inside and flanged ends, or wafer type fitting between flanges. Lever operation is acceptable, but gearbox operation shall be provided above 500m size or with a pressure above 350 kPa. Both lever and gearbox operation shall have position indication and locking mechanism.
- Butterfly valves shall be used for throttling or balancing purposes.
- Diaphragm valves up to 50 mm dia. shall have screwed ends and above 65 mm flanged ends. Cast iron bodies are acceptable.
- Diaphragm valves shall only be used as shut-off valves unless otherwise specified in part 5.
- Check valves for water or non-pulsating air or gas shall have cast iron or cast steel bodies with screwed ends up to 50 mm and flanged ends for valves with a diameter of 65 mm and over.
- Working parts of check valves are to be spring loaded, completely guided or swing flap operation and fabricated of stainless steel or bronze with elastic seats.
- Check valves shall be of the non-slam type with horizontal or vertical installation.
- Check valves with stainless steel perforated cone and resilient conical diaphragm are also acceptable if flange mounted in a short straight removable flanged type section or bobbin for easy removal of the valve. Diaphragm to be suitable to the system fluid characteristics.
- Float valves up to 40 mm dia. shall have bronze valve bodies and working parts, screwed connections and shall be suitable to open against the system pressure.
- Float valves of a diameter of more than 50 mm shall have cast iron bodies with flanged ends and bronze seat rings.
- Plug cocks up to 50 mm shall have bronze bodies and plugs, screwed ends with gland and square heads.
- Plug cocks of a diameter of 65 mm and over shall have cast iron bodies and bronze plugs, flanged ends with square heads.
- Plug cocks shall be used for balancing purposes.

11. VALVES FOR HOT WATER, STEAM, AIR OR GAS FROM 65^{O}C AND 1000kPa AND OVER

- Valve materials shall be selected for the characteristics of the fluid and system it is to be used in.
- Gate valves up to 50 mm shall have bronze valve bodies with union bonnets and screwed ends, rising copper alloy stems with inside screw, nickel alloy or solid bronze wedge discs and bronze or stainless-steel seats. Stainless steel seats only shall be used with steam.
- Gate valves of 65 mm dia. and over shall have SG cast iron or cast steel valve bodies with flanged ends, bolted bonnets and yokes, rising stainless steel or bronze stems with outside screw and yoke, solid SG cast or cast steel wedge discs with replaceable stainless steel or bronze seats on discs and bodies.
- Gate valves used for steam application of above 700 kPa pressure shall have stainless steel trim.
- Gate valves shall be provided with back seating on stems to facilitate re-packing under pressure.
- Gate valves shall be used as isolating or shut-off valves only.
- Globe and angle valves up to 50 mm dia. shall have bronze, SG cast iron, forged or cast steel bodies with screwed ends and union bonnets, rising stems of copper alloy, replaceable bronze or stainless-steel discs and body seats. Stainless steel seats only shall be used with steam.
- Globe and angle valves of 65 mm dia. and over shall have SG cast iron or cast steel bodies with flanged ends, rising stems of stainless steel or bronze with outside screw and yoke, bolted bonnet and yoke, stainless steel or bronze trim, replaceable stainless steel or bronze discs and seats. Stainless steel trim to be used for steam application above 700 kPa.
- Globe and angle valves shall be provided with back seating on stems to facilitate repacking under pressure.
- Globe valves shall be used for throttling or balancing purposes.
- Check valves up to 50 mm dia. shall have forged steel or bronze valve bodies and screwed ends.
- Check valves with a diameter of 65 mm and over shall have cast steel valve bodies with flanged ends. Working parts shall be spring loaded and completely guided and shall be of stainless steel. Elastic seats suitable for the temperature and application shall be provided. Valves shall be installed horizontally or vertically with flow upwards. Valves may also be of the double swing flap with spring loading on the swing plates. Springs and swing plates shall be of stainless steel.
- Check valves shall be of the non-slam type.
- The stainless-steel cone and diaphragm type non-return valves are not acceptable.
- Check valves for pulsating compressed air shall be of the "Belliss and Morcom" manufacture or equivalent.
- Check valves for condensate up to 50 mm shall have bronze bodies with screwed ends and be of the swing type with bronze discs.
- Check valves for condensate of 65 mm dia. and over shall have cast iron bodies with flanged ends, replaceable bronze or stainless-steel disc and replaceable bronze or stainless-steel body seats.

12. CALIBRATED BALANCING VALVES

- Calibrated balancing valves shall be of the plug cock type with bronze or cast-iron valve bodies, bronze disc, internal seals, screwed ends up to 50 mm and flanged ends for 65 mm dia. and over.
- Calibrated balancing valves shall be of the globe type with bronze or cast-iron valve bodies with screwed ends-up to 50 mm and flanged ends for 65 mm diameter and over.
- Valves shall be provided with screwed take-off connections to which a pressure differential gauge can be coupled and provided with check valves in the take-offs.
- A valve position indicator shall form integral part of the valves.
- Valves shall be suitable for a working pressure of 1000 kPa and a working temperature of 90°C unless otherwise specified.
- A removable polyurethane cover shall be provided for each valve.
- Portable differential pressure gauges shall be supplied with the above valves, complete with all necessary tubing, shut off and ventcocks and carrying cases. At least one differential pressure gauge shall be supplied for each project and one additional gauge for every 20 valves after the first 30 valves.
- Graphs and charts showing the flow quantities against valve openings and pressure differential across the valves shall be supplied for each portable pressure differential gauge.
- The pressure gauges shall be calibrated to the latest SI units.
- On completion of the installation, the pressure gauges and charts shall be handed over to the owner's representative.

13. PRESSURE REDUCING VALVES

- Pressure reducing valves up to 32 mm dia. for steam, air or water shall have bronze bodies with screwed ends, stainless steel working parts and built-in stainless-steel strainers. Valves shall be direct acting and shall be suitable for the system fluid characteristics, pressure and temperature.
- Pressure reducing valves of 40 mm dia. and over for steam, air or water shall have cast steel or malleable iron valve bodies with flanged ends, stainless steel working parts and built-in strainers.
- Valves shall be pilot operated.
- Pressure reducing valves shall be selected in accordance with the manufacturer's recommendations for inlet pressures and shall be designed to give a constant downstream pressure with varying upstream pressure.

14. SAFETY RELIEF VALVES

- Safety relief valves for compressed air shall be according to BS 1123.
- Safety relief-valves shall be of the spring-loaded type with side outlet and screwed connections. Valve bodies shall be of bronze or cast iron and working parts and trim of bronze.
- The outlet of safety relief valves shall be piped to a safe position.
- Safety relief valves for hot water and steam shall be in compliance with BS 759.

15. AIR VENTS

- Air vents for steam shall be of the automatic balanced pressure type, with bronze or brass bodies with screwed ends, stainless steel liquid filled bellows and stainless-steel working parts.
- Air vents for steam shall be selected to the manufacturers' recommendations regarding working steam pressure, temperature, etc.
- Outlets from air vents for steam shall be piped to the nearest safe drain point.
- Air vents for water shall be automatic and shall have bodies of cast iron with screwed ends, floats, float mechanisms and all working parts of stainless steel.
- Air vents for water shall be selected to the manufacturers' recommendation regarding working water temperatures and pressures.
- Outlets from air vents for water shall be piped to the nearest drain points.
- Vent pipes of 15 mm dia. shall be installed at all high points in the systems or as shown on the engineer's drawings.
- Vent pipes shall be provided with globe valves in a position readily accessible.
- Vent pipes shall be taken up to 200 mm above the highest point in the system and then bent and taken down to a position 200 mm above the finished floor level.
- The globe valve in the vent pipe shall be installed at a position 2000 mm above finished floor level and permanently connected to the nearest drain by means of rigid steel piping.
- Air bottles with vent pipes shall be installed at the highest points in the system or as shown on the engineer's drawings.

16. STRAINERS

- Strainers shall be of the angle or Y-type. Strainers up to 50 mm shall have screwed ends and strainers of 65 mm dia. and above shall have flanged ends.
- Strainers for cold water up to 65°C and 1000 kPa and over shall have bronze bodies and bronze screens.
- Strainers for steam or hot water at 65°C shall have cast steel bodies and stainless-steel screens.
- In lieu of bronze screens stainless steel screens will be acceptable.
- Screens shall be perforated as follows:

Strainer Size (mm)	Perforation Size (mm)
10-50	1.0
65-150	1.5
200 and over	2.0

- Strainers shall be provided with a 50 mm blow down pipe and cock on the cap piped to the nearest drain point. Flexible piping shall be used.
- The screen area shall be at least 3 times the pipe area served.

17. WATER SEPARATING EQUIPMENT

- Steam traps shall be installed at all low points in the system and where indicated on the engineers drawing
- Steam traps shall be of automatic operation and shall have bronze or stainless-steel bodies and working parts.
- The selection of steam traps shall be submitted to the engineer for approval before ordering.
- Steam traps shall be suitable for the system working pressure and temperature.
- Drain traps for compressed air services shall be of automatic operation and shall be of the float type with bodies of malleable iron stainless steel or bronze.
- Compressed air drain traps shall be suitable for the system working pressure and shall be installed at all low points in the system and where indicated on the engineer's drawings.
- Water separators for compressed air or steam services shall have cast steel bodies with flanged ends and shall be suitable for the system working pressure and temperature.

18. GAUGES

- Pressure gauges for water or air shall be of the Bourdon type.
- Pressure gauges for steam services shall be of the turbine movement type.
- Pressure gauge dials shall have a diameter of at least 100 mm.
- A gauge cock and siphon tube shall be provided with each gauge.
- Gauges shall be calibrated to the latest SI units to a minimum reading of 50% higher but nor more than 75% higher than the system working pressure.
- A red line shall be provided on the dial at the maximum system pressure.
- Pressure gauges shall be of the heavy-duty type with adjustable zero point.
- Vacuum gauges shall be as specified for pressure gauges for air.

19. FLOW METERS

- Flow meters shall be of the stainless-steel orifice plate type fitting between flanges.
- Corner pressure tapping shall be used.
- Flange tapping shall be used.
- D, D/2 pipe tapping shall not be permit
- A reputable manufacturer shall supply the complete flow meter including flanges.
- The screwed take-off connections shall have built-in check valves.
- Flow meters shall be suitable for the system working pressure and a temperature of 120°C unless otherwise specified.
- A differential pressure gauge, complete with tubes, shut-off cocks, air vents and a carrying case shall be supplied for the flow meters. Graphs or charts on which the flow quantities are plotted against pressure differential across the flow meter shall be supplied.
- The differential pressure gauge shall be matched to the orifice plates and shall give a direct fluid quantity reading.

- Orifice plates permanently connected to direct reading differential pressure gauges as described above shall be fitted in each condenser water circuit each chilled water supply line to each chiller the common chilled water supply and return pipes.

20. THERMOMETERS, THERMOMETER POCKETS AND THERMOSTAT POCKETS

- One thermometer shall be installed on the inlet side and one thermometer on the outlet side of each piece of heat exchange equipment.
- Thermometers shall be of the replaceable glass type of straight or angle pattern with bronze casings and calibrated in degrees C.
- Scale length shall be at least 170 mm and calibration shall be suitable for the system temperature range.
- Loose thermometer and thermostat wells shall be provided.
- Thermometer and thermostat wells shall be manufactured of brass with a wall thickness of not less 1.5 mm around the thermometer or thermostat bulb.
- Thermometer and thermostat wells shall project at least 50 mm into the pipe.
- Thermometer and thermostat wells shall project a distance into the pipe equal to at least two thirds of the pipe diameter.
- Wells shall have dust excluding caps with gaskets and chains.
- Pipes smaller than 65 mm dia. shall be enlarged at the points where the wells are installed
- Wells shall be oil filled and be installed vertical or at an angle of at least 45^{o} to the horizontal so as to retain oil.
- The position of each thermostat shall be such that they can be read easily by a man standing on the floor with normal room illumination.

21. PIPE HANGERS

- In all plantrooms spring hanger mount mountings for vibration damping shall be used.
- Spring hanger mounting shall be selected in accordance with the supplier's recommendations.
- Springs shall not be compressed fully due to pipe and fluid mass, but there shall be a minimum deflection in accordance with the supplier's recommendations.
- Spring hanger mounting shall be provided with neoprene washers.
- Hangers shall be constructed to allow for the expansion and contraction of pipes except where an anchor point is used.
- Pipe hangers shall be adjustable in height to set the pipe gradient.
- Pipe hangers shall be designed to prevent pipe movement on starting and stopping pumps.
- Before manufacture or installation details shall be submitted of anchors, supports, expansion loops, guides, load calculations and a statement that the manufacturers of such equipment have reviewed the work.
- The material of hanger rods, hangers, clamps and all other support devices shall be compatible with the supported pipe and supporting structure.
- Horizontal and vertical; pipe guides shall be installed where required.
- All flexibly supported piping shall be sway braced without interfering with proper thermal movement of the piping.

- Anchors and guides for all horizontal and vertical piping (for proper control of thermal movement) shall be included. These shall be designed to prevent undue strain on branches, to provide proper performance of expansion joints and expansion loops and to avoid overloading of hangers and supports.

22. EXPANSION OF PIPES

- Proper provision for the expansion and contraction in all parts of the piping systems shall be made.
- Where pipe loops or changes in direction of piping cannot be employed to absorb the expansion and contraction, expansion joints shall be provided.
- Guides shall be provided on both sides of all expansion joints and loops and in additional allocations recommended by the expansion joint manufacturer.
- Expansion joints, connecting piping, anchors and guides shall conform to the manufacturers' recommendations.

23. CONNECTIONS TO VIBRATING EQUIPMENT

- Stainless steel bellows type flexible connectors shall be used for equipment connections to vibrating equipment or where shown on the engineers' drawings.
- All flexible connectors shall have flanged joints and be designed for 1000 kPa or one and a half times system working pressure, whichever is the higher value.
- Only connections manufactured and supplied by a reputable manufacturer, which is well represented in South Africa, shall be acceptable.
- Rubber isolated tension members shall be provided to prevent excessive elongation.

24. TESTING OF PIPE INSTALLATIONS

- All piping and fittings shall be tested hydrostatically up to a pressure of l000 kPa or 1.5 times the maximum system pressure, whichever is the higher value.
- Tests shall be carried out before the application of insulation.
- Water systems shall be filled with water and air vented at least 24 hours before the test.
- The test pressure shall be maintained for a period of at least 2 hours after the pump has been disconnected.
- Leaks in screwed joints shall be corrected by re-making the joints.
- Leaks in welded joints shall be cut out and re welded.
- Test instruments shall be tested for accuracy in a laboratory approved by the engineer or by the manufacturers. Test certificates showing the degree of accuracy shall be furnished to the engineer on request.
- The Tenderer shall supply instruments, equipment and labour required for the tests.
- Testing of parts of the system shall be permissible but the total system shall be tested at the engineer’s discretion.
- Piping systems shall be pressure tested with the fluid it was designed for.
- Vacuum systems shall be tested with nitrogen at a pressure of 1000 kPa or at a pressure of 3 kPa (absolute) at the discretion of the Engineer.

25. WITNESSING OF TESTS

- The Contractor shall notify the Engineer in writing at least seven working days prior to the test.
- The Engineer will certify acceptance of all tests. Such certification does not in any way alter the responsibilities of the Contractor under this Contract.

26. CONSTRUCTION MATERIALS

Construction and materials of valves shall comply with the following specifications:

• Bronze valves		BS 1400 LG 2 - C, or ASTM B62 - 63
• Cast-iron valves		BS 1452 GR 14, or ASTM A126-61T
• Class B		
• SG Cast-iron valves	:	BS 2789 - 1961, or ASTM A445-63T
• Cast steel valves	:	BS 1504 - 161A, or ASTM A216

PART IV.3 STANDARD PAINT SPECIFICATION

1. GENERAL

The clauses, which appear under this heading, shall be considered as forming part of each of the following paint specifications:

- Paint shall not be applied over any surface containing traces of grit, grease, oil etc. loose rust, loose millscale or corrosion products of any kind.
- All metal surfaces to which paint is applied shall be moisture dry. Paint surfaces, which are to be overcoated, shall be hard dry before overcoating, unless the specification states otherwise.
- All traces of soluble salts and corrosive air-borne contaminants shall be thoroughly washed from the surface prior to painting, dried and painted immediately thereafter.
- Unless otherwise stated, no paint shall be applied within 50 mm of areas, which are to be welded.
- Welds and adjacent parent metal shall be deslagged, inspected and approved and all spatters shall be removed prior to painting.
- The weld area shall be wire brushed and all contaminants shall be removed prior to painting. The weld area shall then be flushed with fresh water and allowed to dry. In the case of rust formation, the weld area should again be wire brushed.
- Surfaces, which are to rest on concrete or other floors, shall receive the full paint system prior to erection.
- Areas where the paint coating has been damaged during transportation, erection or by any means whatever, shall be repaired as follows:
- Rust spots shall be removed by means of a wire brush or emery paper and the surrounding paint, which is still intact, shall be feathered for a distance of 20 mm beyond the damaged area.
- Spot priming shall consist of all the coats previously applied and shall overlap the undamaged area by 20 mm.
- Where the shop coat has been allowed to age for a few months before painting, it shall be light sanded or rubbed with steel wool or scrubbed with Polycell Sugar Soap Solution, using a bristle brush. The surface shall then be rinsed with drinking water.
- Mating or contact surfaces shall be brought together by ensuring that the two surfaces brought into contact with each other are prepared and primed in accordance with the specification. The primed surfaces shall while the paint is still wet.
- Areas, which will be inaccessible after erection shall receive the full, specified coating system, before erection or assembly.
- Unless otherwise specified, steel embedded within concrete shall not be painted except to within 50 mm below the concrete/ air interface.
- All sharp edges and cut ends shall be filed smooth and shall then receive the specified dry film thickness of paint.
- All air used for blast cleaning or spraying shall be free from all traces of water and oil.
- When blast cleaning, a satisfactory blast profile (i.e. anchor pattern) shall be achieved. If the abrasive used for blast cleaning is sand, then it shall be free of clay. Alternatively, approved grit shall be used.
- The Contractor shall ensure that the final finishing coat obscures the previous coat.

- The Contractor shall ensure that the manufacturer's recommended thinners are used for any particular paint.
- The Contractor shall ensure that primed steelwork, piping etc., which is to be delivered to site, is stacked on bearers and is clear of the ground. Wherever possible channels, angles, etc. shall be stacked so that water cannot collect on the steel.
- Surfaces, which are to be friction bolted, shall be prepared in accordance with the specification (i.e. wire brushed) but shall receive no paint coating.
- Paint dry film thickness shall be measured using a non-destructive thickness gauge such as the Mikrotest or equivalent.
- All the mixing of paints shall be done using either a flat-sided paddle or by means of a mechanical mixer.
- Where a specified volume ratio of components must be mixed together, provision shall be made on-site for a practical yet accurate method of volume measurement.
- All air used for abrasive blast cleaning or for spraying shall be free from all traces of oil, water and other contaminants.
- The paint manufacturer's instructions shall be strictly adhered to.

2. PAINTING OF CHEQUER PLATE OR EGG-CRATE FLOORING AND SUPPORTING FRAMES

- This paint specification will be referred to as Class “C” painting. Chequer plate and egg-crate flooring shall not be delivered to site with a bituminous coating.

3. FINISHING

- Three coats of HYSHEEN EPOXY TAR (SAR 681 - BROWN, SAR 682 - BLACK) to SABS 801-1973, Type II, shall be applied, at a dry film thickness of 70-80 micrometres per coat. Overcoats shall be applied within a minimum of 16 hrs, and a maximum of 48 hrs.

4. PAINTING OF STEELWORK, PUMPS, MOTORS, GEARBOXES ETC.

- This paint specification will be referred to as Class "D" painting.

5. STEELWORK

- All steelwork, which is not galvanised, chrome plated or otherwise protected against corrosion shall be given a coat of protective paint at the Manufacturers’ works and the Contractor shall maintain this protective coat until the work is finally painted.

6. SURFACE PREPARATION

- All surfaces shall be thoroughly degreased with AQUASOLV DEGREASER (Code AR), then rinsed with fresh water and allowed to dry. The surfaces shall then be wire brushed to remove loose rust and loose millscale to an St 3 finish to Swedish Standard 515 05/59/00-1967.

7. SHOP COAT

7.1 Priming:

- One coat NAMELCOAT PRIMER (U 53) shall be applied to a dry film thickness of 30-40 micrometers

8. SITE PAINTING

8.1 Undercoat

- One coat of MERIT UNIVERSAL UNDERCOAT (UC1) shall be applied to a dry film thickness of 30 - 40 micrometers.

8.2 Finishing

- One coat of UNIVERSAL HIGH GLOSS colour shall be applied, to a dry film thickness of 30-40 micrometers
- The total dry film thickness for be less than 90 micrometers.

9. MOTORS, GEAR-BOXES, PUMPS AND OTHERS

9.1 Surface Preparation

The surfaces to be painted shall be abrasive blast cleaned to Grade C 5a $2^{1/2}$ of the Swedish Standard SIS 055900-1967.

9.2 Priming

One coat of EPIMIDE EPOXY PRIMER ZINC/CHROMATE IRON OXIDE (EPD 41) shall be applied to form a uniform coat and to fill all porosities in the castings.

9.3 Undercoat

One coat of EPIDUCT CHEMICAL RESISTANT EPOXY ENAMEL (EPD 700/699 series), tinted to a shade just lighter than the finishing colour with UNIVERSAL STAINERS (X 14-20), shall be applied.

10. FINISHING

- One coat of EPIDUCT CHEMICAL RESISTANT EPOXY ENAMEL (EPD 700/699 series) in the specified colour shall be applied.
- The blast profile for this system shall be between 25 and 40 micrometers.
- If overcoating the primer after two weeks, abrade to a matt surface with 220-350 grit waterproof paper and rinse with fresh water.

10.1 Piping (other than Steam Piping)

- Piping which is not galvanized is to be protected as follows after installation.

10.2 Above Surface

10.2.1. Surface Preparation

- The surfaces shall be wire brushed to remove loose rust and loose millscale to an St 3 finish to Swedish Standard SIS 05/59/00-1967.

10.2.2. Priming

- One coat NAMELCOAT PRIMER (UC 53) film thickness of 30-40 micrometres

10.2.3. Undercoat

- One coat of MERIT UNIVERSAL UNDERCOAT (UCI) shall be applied to a dry film thickness of 30-40 micrometers.

10.2.4. Finishing

- One coat of UNIVERSAL HIGH GLOSS ENAMEL (G) in the specified colour shall be applied to a dry film thickness of 30-40 micrometers.
- The total dry film thickness for the coating system shall not be less than 90 micrometers.
- Underground or in trenches
- Piping installed underground or in trenches shall be painted with bitumastic paint whether the pipe is insulated or not.
- Galvanised Iron

10.2.5. Surface Preparation

- All grease and other deposits shall be removed from all surfaces-faces with galvanised; iron cleaner (Code G.I.C.). The surface shall then be rinsed with clean water to give a water break-free surface. All surfaces must be thoroughly clean and dry prior to the application of any materials. Should this state not be achieved, the cleaning process must be repeated.

10.3 Galvanised Cladding Inside Buildings

10.3.1. Priming

- One coat CALCIUM PLUMBATE PRIMER to a dry film thickness of 25 - 35 micrometers.

10.3.2. Intermediate coat

- One coat UNIVERSAL UNDERCOAT (UC 1) to a dry film thickness of 25 - 35 micrometers.
- The total dry film thickness shall not be less than 75 micrometers.

10.4 Galvanised Cladding Exposed to Atmosphere

10.4.1. Priming

- One coat CALCIUM PLUMBATE PRIMER to a dry film thickness of 25 - 35 micrometers.

10.4.2. Intermediate coat and finishing

- Two coats of IRONGUARD MIO MICACEOUS IRON ORE ROOF PAINT to a dry film thickness of 50 - 70 micrometers.
- The total dry film thickness shall not be less than 75 micrometers.

10.5 Galvanised Cladding in Moist Conditions

10.5.1. Priming

- One coat CHEMICOTE HIGH BUILD CHEMICAL RESISTANT PRIMER (CHC 1) to a dry film thickness of- 60 - 80 micrometers

10.5.2. Intermediate coat

- One coat CHEMCOTE HIGH BUILD CHEMICAL RESISTANT INTERMEDIATE COAT (CHC 101) to a dry film thickness of 60-80 micrometers

10.5.3. Finishing

- One coat CHEMCOAT ENAMEL (CHC 3000) to 25 - 35 micrometers.
- The total dry film thickness shall not be less than 145 micrometers.

PART IV.4 TESTING AND COMMISSIONING

1. GENERAL

- The Engineer or his representative shall be advised of all testing and commissioning and shall be given the opportunity to witness all tests. However, the Engineer will only be on site to witness the tests and takes no responsibility for the acceptance of test results.
- The testing and commissioning procedure shall form part of the Quality Verification Plan submitted by the Contractor and shall be the subject to the same prior approval by the Engineer. The testing and commissioning procedure shall embody the following principles:
- All plant shall be tested off site prior to delivery. No plant or equipment will be accepted and paid for if the manufacturer/supplier certificate verifying that it has been tested does not accompany it.
- All plant and systems on site shall be tested as early as possible after installation to verify that the plant/system/subsystem is operating correctly.
- No testing or commissioning shall take place without an approved written procedure.
- The responsibility for the proper testing and commissioning of the system rests fully with the Contractor. This includes the provision of all necessary test equipment, measuring and test points, valves and dampers, etc. to test and commission the system.
- At the time of submitting equipment for approval full details of the commissioning requirements shall be provided.

2. TESTING AND COMMISSIONING PROGRAM

- At least four weeks before commencing any testing and commissioning the contractor shall submit a complete program for such work so that the Engineer can arrange to be on site at the appropriate time. The programme shall embody the agreed testing and commissioning procedure.
- The programme shall include -
- A bar chart covering all activities.
- Names and addresses of companies involved in each activity.
- The way in which each test will be carried out complete with pro forma forms for tabulating results.

3. EQUIPMENT AND PROCEDURE

- The equipment supplied under this Contract shall be subject to inspection by the Engineer or his Nominated Agent at all stages of manufacture.
- The tests and commissioning procedure as laid down and such additional tests as the Engineer may reasonably require to prove compliance with the Specification shall be carried out at the Contractor's Works and at Site.
- The Contractor shall give reasonable notice of time and place in writing to enable the Engineer to inspect and witness tests of materials and equipment. He shall provide the Engineer with facilities for witnessing the tests and for any additional tests or inspection of any portion of the works as required by the Engineer.
- The Contractor shall at his own cost render all assistance and supply all labour, appliances and any other materials, as the Engineer may require to check the setting out, measure up and inspect any portions of the works at any stage

during fabrication, construction, erection or painting. During such operations, the Contractor shall if required, suspend any or all of the Works, without having claim for loss or damage as a result thereof.

- The testing of the plant (or any part thereof) supplied under this contract shall be carried out through its full operating range (or part thereof) as required by the Engineer.
- All such tests and inspections and the necessary inspection facilities shall be provided as part of the Tendered price for the Contract.
- At the commencement of and during the whole of the Commissioning and Testing Periods, the Contractor shall have available on site all essential spares and tools considered necessary to enable repair work of defective parts to be carried out immediately in the event of a breakdown or adjustments being necessary.
- The Contractor shall be responsible for the proper operation and maintenance of the plant throughout the period of the tests and until the operator training period is complete.
- Acceptance by the Engineer of any plant item, following such inspection or tests, shall not relieve the Contractor of any obligations under this Contract.
- All pumps shall be lined up and tested as a complete set. Test certificates shall be supplied before dispatch.
- All rotors and motor/impeller combinations shall be statically and dynamically balanced. Test certificates shall be supplied before dispatch.
- All such other tests as required by the Engineer to prove compliance with the specification, shall be carried out.

4. TEST CERTIFICATES

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

5. INSULATION TESTS

- All electrical wiring and equipment shall be subjected to insulation tests. The Contractor shall provide all instruments and other equipment for the tests.

6. DRAINING AND CLEANING

- On completion of the pressure test on a section of pipework the water used for testing shall be drained away as quickly as possible to remove as much dirt and dross as possible. After completion of a pipework circuit the circuit shall be flushed through to remove all pipe scale, dross and similar materials.
- The Contractor shall provide all necessary connections, by-pass pipes, temporary strainers, and temporary make-up pieces, to enable the systems to be drained and cleaned.

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

7. PLANT COMMISSIONING

- The Contractor shall arrange at his cost for the manufacturer's representatives to check over and fully commission all major items of equipment. This work is to be carried out by skilled engineers preferably employed by the manufacturers, who are completely familiar with the equipment involved and shall be capable of training the operating and maintenance staff in the duties they are to perform.
- On completion of the plant commissioning the Contractor shall obtain written confirmation from the various manufacturers that they have completed all commissioning work and are satisfied that the items of plant for which they are responsible are functioning satisfactorily
- Copies of the manufacturers written confirmation shall be sent to the Engineer.

8. TESTS ON COMPLETION

- On completion of the balancing and commissioning of equipment the plant shall be put into normal operation and the final adjustments of the equipment shall be made.
- Thereafter the Tests on Completion shall be carried out to ensure that the plant meets the specification.
- Such tests shall include the following:
- Simulated tests for all alarm and safety cut out equipment to prove the operation of the equipment.
- Simulated tests on automatic controls to prove the ability of the controls to correct conditions, which are outside the required design conditions. The tests shall be carried out by manually changing the desired values to produce an incorrect condition and then re-setting the controls to the design conditions and checking the operation of valves, etc. to restore the design conditions.
- An operational test on the Plant to demonstrate that it is giving the rated output and efficiency.
- The Contractor shall provide all necessary temporary measuring and recording equipment. The equipment shall be of a type generally used for this type of testing and shall be to the approval of the Engineer. All instruments shall be accurately calibrated before the tests begin.
- On completion of the whole of the tests and when the Contractor is satisfied that the entire plant is operating satisfactorily and will fulfil the function for which it has been supplied, he shall submit to the Engineer triplicate copies of all test records and charts together with reports on all the tests required in terms of the approved Quality Verification Plan. The Engineer shall reserve the right to ask for any reasonable additional tests or for the repetition of previous tests in order to prove that the operation of the plant is satisfactory and in accordance with the Performance Specification.

PART IV.5 STANDARD THERMAL INSULATION INSTALLATION

1. GENERAL

- A specialist in this specific field shall execute all thermal insulation work.
- The work shall be executed in a workmanlike manner and the final surface shall be of a neat, smooth and symmetrical finish.
- Thermal insulation of equipment shall comply with BS CP3005 - 1969, provisions of BS 1334, BS 1558 and BS 476 or the latest amendments as applicable.
- Oil, grease, rust, scale and dirt shall be removed from surfaces by means of a suitable cleaning agent before the application of insulation.
- No equipment shall be insulated until tested and approved.
- No equipment shall be insulated until tested and approved,
- Adhesives, sealant and coatings shall be compatible with the insulation material,
- Certified test reports from an instance approved by the Engineer shall be submitted by the contractor in which the following information is given:

    - The thermal conductivity of insulating materials at operating temperature.
    - The surface spread of flame or insulating materials, adhesives and other finishes.
    - The permeance of vapour barrier systems (cold water systems).
    - The sound absorption co-efficient of insulating materials (internally insulated ducts).

- Pipes shall be painted with bitumastic paint before application of insulation.
- Surface spread of flame of insulation cladding shall be in accordance with BS 476 Class I Specification,
- The permeability of insulation cladding around chilled water pipes shall not be more than 1.
- The Engineer will check thickness of insulation cladding after completion of insulation work. If any thickness are less than that recommended by the manufacturer, the contractor will be requested to apply one extra coat over the whole installation at his own expense,
- Insulation, adhesives and finishes shall be resistant to rotting, mould. fungus growth, decay or attack by vermin.
- Continuity of the vapour barrier shall be ensured.

2. METAL CLADDING OF PIPES

- All chilled and hot water pipes in plantrooms shall be provided with a O.5 mm thick galvanised sheet metal cladding over the insulation material. The cladding shall be installed after the Engineer has approved the vapour proofing.
- All steam and condensate pipes shall be provided with a 0.5 mm thick galvanised sheet metal cladding over the insulation material.
- Care shall be taken not to damage the vapour barrier.
- Cladding shall be secured by stainless steel bands every 500 mm. Self-tapping screws shall not be used.
- The sheet metal covering shall be cut at pipe supports or hangers.

- No dents or any damage to sheet metal covering will be accepted at the final inspection.

3. VALVES AND FITTINGS

- Valves and fittings shall be insulated with resin-bonded mineral, wool or glass fibre with a minimum density of 96 kg/m .
- Plaster of at least 13 mm thick shall be applied over a steel mesh covering the insulation. The plaster shall be of the asbestos hard setting compound type, trowelled to a neat, smooth and symmetrical finish.
- The insulation of valves and fittings shall fit neatly to the rest of the pipe insulation.
- Care shall be taken that all valves and fittings can be operated without damaging the insulation.
- The end plates of strainers shall be insulated with suitable closed cell foam rubber to prevent any dripping.

4. HOT WATER PIPES

- Hot water pipes shall be insulated as described for chilled water pipes.

5. STEAM PIPES

- Steam pipes shall be insulated as for hot water pipes but with the following insulation thickness:
- Pipes up to 40 mm dia. - 40 mm
- Pipes bigger than 40 mm dia. - 50 mm
- Steam valves, flanges and fittings shall be insulated as for hot water valves and fittings but with the insulation thickness as specified above.
- Condensate pipes shall be insulated as specified for hot water
- Condensate valves, flanges and fittings shall be specified as for steam valves, flanges and fittings.

6. THERMAL STORAGE VESSELS AND HEAT EXCHANGERS

- Insulation shall consist of a 100 mm thick layer of resin-bonded mineral, wool or glassfibre with a density of 96 kg/m .
- The insulation shall be covered with a 0.5 mm thick sheet metal covering properly dished and strengthened to ensure a neat installation.
- All manholes and inspection-welded seams shall be provided with easily removable sections.
- Where pipes are connected to the equipment a flange of sheet metal shall be provided fitting neatly around the pipe and welded or screwed to the sheet metal covering over the insulation.
- No dents or any damage to the sheet metal covering will be accepted at the final inspection.

PART IV.6 STANDARD STEEL FABRICATION SPECIFICATION

1. STEEL FABRICATION AND BASEPLATES

- The manufacture of all fabricated items of plant shall be generally in accordance with BS 449 as amended, Part S.
- The fabrication and manufacture of the plant and equipment shall be completed in the Contractor's workshops before delivery to site.
- No fabrication of completed units shall take place on site, site work shall be confined to only such minor alterations and adjustments as are found to be necessary during erection. If major alterations are found necessary, the items of plant concerned shall be returned to the Contractor's workshops for modifications or replacement and shall be tested and checked before re-delivery to site- Drive baseplates shall be robustly constructed and adequately stiffened to prevent twisting and distortion. The ratio of the base length to its height shall not be more than 10:1.
- Fabricated baseplates shall be of all-welded construction and formed of rolled mild steel plates and sections.
- Surfaces shall be free from recesses and cavities wherever possible to prevent the accumulation of dirt and/or waste material,
- Where driving units are directly coupled to the driven component all mounting surfaces shall be accurately machined to ensure correct alignment. After final shop assembly and testing, the individual items Of plant shall be accurately dowelled in position on the baseplate to prevent any misalignment during installation or ducting operation.

2. STRUCTURAL STEELWORK

- The structural steelwork used in this Contract shall be in accordance with BS 15.
- Black bolts and nuts shall be in accordance with BS 916. Black metal washers shall be in accordance with BS 3410, Part 2. High strength friction grips, bolts, nuts and washers shall be in accordance with BS 3139, Part 1, and their application shall con-form to BS 3294, Part 1, torque wrenches or impact tools where used shall be recalibrated before each shift- All fabrication and erection procedures shall be in accordance with BS 449 as amended, Part 5.
- Before commencing the fixing of the steelwork an erector shall check the seating for line. level and bolt setting and any errors which cannot be accommodated by the steelwork shall be reported to the Engineer

3. WELDING

- All oxy-acetylene welding and testing shall be in accordance with B.5. 1821 or BS 2640, as applicable, for oxy-acetylene welds in mild steel pipe lines up to 1670 kPa and/or temperatures up to 218°C.
- Metal arc welding shall be in accordance with B.5. 1856 or BS 2633, as applicable.
- Before any welding is undertaken each welder to be used on the Contract Work shall make a sample weld in the Works or on Site of an average size pipe or

section of the same physical and chemical analysis as that to be used for the Contract. These test welds shall be executed in the presence of a representative of the Engineers and when completed the welds shall, after stress relieving or normalizing, be cut up and specimens prepared for micro and macro examination and physical tests- After the welding samples have been approved only the welders who have been responsible for these samples shall be employed on the Contract Works.

- The Engineer shall reserve the right to ask for welded joints to be removed for detailed testing at the Contractor's expense.
- On completion each weld shall be coated with one coat of red lead paint.

PART IV.7 BUILDER'S WORK SPECIFICATION

1. GENERAL

- The successful tenderer shall, within 30 days of appointment, or any such shorter period which may be necessitated by the construction program, submit two copies of all drawings showing all builder's work required for the project,
- The engineer will scrutinize the drawings and request changes and adjustments as required. After such changes are satisfactorily made the Engineer will fix his stamp of approval on the drawings.
- Five copies of the approved drawings shall be issued by the successful tenderer to the Engineer for distribution,

2. CONTENTS OF DRAWINGS

Builder's work drawings shall be fully dimensioned and shall include the following:

- details of all plant bases required
- positions of all drain points
- details of all openings in walls and concrete work required
- details of external louvres
- any other work required.

PART V

PROJECT SPECIFICATION

PART V

DETAILED TECHNICAL SPECIFICATION

HEAT PUMPS, CALORIFIERS, PUMPS, WATER TREATMENT AND THE COLD WATER AND HOT

WATER RETICULATION SERVICES

AT

SABC RADIO PARK AUCKLAND PARK

TABLE OF CONTENTS
PART V

1. GENERAL

This specification covers the design, (insofar as design is required for the correct selection of equipment), supply, delivery, installation, testing, commissioning, and maintenance during the twelve months guarantee period of the General Cold Water and Hot Water Installations.

The project involves the installation of the new Heat pump, Calorifier, Pumps and associated hot and cold-water reticulation for the SABC BOILER ELECTRODE REPLACEMENT Project.

All Tenderers are instructed to price strictly in accordance with the Bill of Quantities Provided.

2. DESCRIPTION OF INSTALLATION AND PROGRAMME.

- This specification covers the Cold Water and Hot Water Installations, Heat pump, Calorifier, pumps and water treatment plant for SABC BOILER ELECTRODE REPLACEMENT.
- The Contract includes the design (insofar as design is required for the correct selection of equipment), supply, delivery, installation, testing, commissioning, maintenance, and guarantee of the installation as described herein.
- Tenderers are instructed to visit the site. No claim arising out of lack of knowledge of the site or environs will be considered.
- The work will be carried out in accordance with the agreed programme set out by the Engineers and Successful Contractor.
- The Successful Tenderer shall, by submitting a tender accept that any penalties arising from the inability to complete the works in accordance to the programme, will be payable by the Successful Tenderer.

3. SCOPE OF WORK

This contract shall include but shall not be limited to:-

- The design (insofar as design is required for selection of equipment), supply, delivery, installation, commissioning, maintenance and guarantee of the Heat pump, Calorifier, Pumps, water treatment plant and the associated Cold Water and Hot Water reticulation Installations.
- The supply, delivery, installation, commissioning, maintenance and guarantee of the Heat pump, Calorifier, Pumps, water treatment plant and the associated Cold Water and Hot Water reticulation Installations.
- Replacement of panel heaters in offices with Econo heaters.
- The preparation of all necessary workshop drawings, detail drawings, submission of samples and performance specifications as detailed herein. This will include taking whatever on site measurements is necessary for the preparations of the drawings and for the design work required.
- The co-ordination of all plant, etc, with both new and existing structures and systems.

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- The provision of all wiring, distribution boards, control panels and control systems necessary to complete and make operational the Hot Water Installation operational
- The painting and finishing of all equipment, piping, etc. as described herein.

- The Tenderer shall ensure that the equipment offered can be installed in the positions indicated taking into account the existing stairs, doorways, access etc. Where access is a problem, the equipment shall be delivered to site in sub-assembly form and assembled on site. No claims for extras will be considered, where equipment offered at the time of the tender does not fit through the available access routes.
- The Tenderer shall ensure that the equipment offered fits into the spaces provided with adequate access and maintenance space. If, in the opinion of the Engineer, the equipment does not fit into the space provided with adequate access and maintenance space, other equipment selected by the Engineer shall be provided at no additional cost.
- The tender price shall include an allowance for all tools, equipment, scaffolding, hoisting, transport, etc. necessary for the completion of the works.
- Provision of all openings in the structure, roof and ceilings for duct, pipe and other equipment penetrations, including waterproofing enclosures, where applicable. The opening positions and dimensions shall be to drawings provided by the Sub-Contractor. If timber frames are required these shall also be detailed.
- Equipment support plinths to suit equipment required strength and dimensions.
- Building in of door grilles or weather louvres, to be supplied by this contractor, to doors or walls where shown on the layouts.
- Provision of plantrooms, and plant enclosures.
- Flashing around pipe penetrations through roof slabs and roof sheeting.
- Provision of undercuts under doors for air flow.
- Sealing of openings through the building, where applicable for gas and fire protection purposes.
- Builder's work inclusive of : Bricking up and making good were necessary, painting, core drilling (including scanning for clashes), plastering, tiling and repair/replacement of ceilings.
- Removal of existing panel heaters.
- Removal of existing boiler electrodes, pumps, piping and supports.

4. WORK BY OTHERS

- Electrical Power Supplies
- Suitably rated isolators within 1 metre of each calorifier, heat pump and circulation pump unit, to the detailed requirements of the Wet Services Contractor.
- Power supply cables, of sufficient free length to each Hot water generation plantroom, suitably rated for the required load. Connection of the cables to the control panels fall under this contract.

5. SITE VISIT

It is a specific requirement of this contract that Tenderers visit the site prior to submitting a tender to familiarize themselves with the exact nature and scope of the work to be done.

No claims stemming from the non-compliance with this requirement will be entertained.

6. PROGRAMME

The successful Tenderer will be required to commence work in accordance with the agreed programme.

7. SERVICE CONDITIONS

- All equipment offered shall be selected (and give specified capacities), and suitable for continuous operation at the following site conditions:

Ambient temperature	33ºC db 20 ºC wb
Humidity range	43% RH
Altitude	1243
Lightning	severe
Dust	severe
Nominal LV supply	400V/231V 4 wire 3 phase system with earthed neutral (+/- 5%)
Water Pressure	4.5 bar operating minimum

8. STANDARDS AND REGULATIONS

The Installation shall be designed and installed in accordance with the following standards, Design Codes and regulations:

- Wiring of Premises SABS 0142-1987 as amended.
- National Building Regulations SABS 0400
- Identification Colour Markings SABS 0140
- Refrigeration and Hot Water Installations SABS 0147-1978
- The Occupational Health and Safety Act.
- Prevention of Explosive and Electrical Hazards in Hospitals SABS 051

SANS 1307	Domestic solar water heating systems.
SANS 1808-5	Water supply and distribution system components – Part 5: Flexible connectors.
SANS 1808-53	Water supply and distribution system components – Part 53: Drain cocks for hot-water storage containers.

SANS 1848	Geyser drip trays.
SANS 10021	The waterproofing of buildings (including damp-proofing and vapour barrier installation).
SANS 10142-1	The wiring of premises – Part 1: Low-voltage installations.
SANS 10243	The manufacture and erection of timber trusses.
SANS 10252-1	Water supply and drainage for buildings – Part 1: Water supply installations for buildings.
SABS 0252-2	Water supply and drainage for buildings – Part 2: Drainage installations for buildings.
SANS 10254	The installation, maintenance, replacement and repair of fixed electric storage water heating systems.
SANS 10400 (SABS 0400)	The application of the National Building Regulations.
SANS 10400 A	The application of the National Building Regulations – Part A: General principles and requirements.
SANS 10400 XA	The application of the National Building Regulations – Part X: Environmental sustainability – Part XA: Energy usage in buildings.
SANS 10400 L	The application of the National Building Regulations – Part L: Roofs.
SANS 60335-2-21/IEC 60335-2-21	Safety of household and similar electrical appliances – Safety – Part 2-21: Requirements for storage water heaters.

9. DRAWING REGISTER

Drawing Number	Drawing name	Paper Size
A3281MW-PL-003	PLANT ROOM M3 (D5/D6) HEAT PUMP PLANT LAYOUT	A0
A3281MW-PL-004	PLANT ROOM M3 (29TH FLOOR) HOT WATER STORAGE TANK PLANT LAYOUT	A0
A3281MW-PL-005	PLANT ROOM M1 HOT WATER GENERATION SYSTEM	A0
A3281MW-PL-006	PLANT ROOM M2 HEAT PUMP PLANT LAYOUT	A0
A3281MW-PL-007	PLANT ROOM M2 (K2) HOT WATER STORAGE TANK PLANT LAYOUT	A0
A3281MW-PL-008	HOT WATER GENERATION PLANT PLAN	A0

A3281M-AC-001	OFFICE HEATER REPLACEMENT LAYOUT	A0

These drawings will be made available in electronic format to the contractor, at his own risk, for preparation of shop drawings, should he/she so require.

10. GENERAL WATER RETICULATION INSTALLATION

- In general, the hot and cold water will be reticulated around the new structures and piped into the building to the required areas.
- This includes the following support buildings:
    - GROUND FLOOR OB AREA
    - RADIO PARK K1 PLANTROOM
    - RADIO PARK K2 PLANT ROOM
    - RADIO PARK GROUND FLOOR PARKING
    - RADIO PARK K3 PLANT ROOM
    - RADIO PARK K4 PLANT ROOM
    - RADIO PARK D1 PLANTROOM
    - RADIO PARK D2 PLANTROOM
    - RADIO PARK D5 PLANTROOM
    - RADIO PARK D6 PLANTROOM
    - RADIO PARK 29TH FLOOR PLANTROOM

- New pipe supports shall be provided at the specified spacing.
- The new Cold-water system shall be provided as indicated on the drawings
- The new Hot Water system shall be provided as indicated on the drawings

10.1 Definitions and Abbreviations

Definitions

Pipe Vent Valve: A valve specifically designed and constructed to be fitted to a ventilation pipe to provide controlled ventilation.

Pressure relief: The release of positive air pressure where the air pressure in a pipe exceeds atmospheric pressure.

Rodding Eye: A permanent access opening to the interior of a drainage installation that permits full-bore access to the interior of the drain for internal cleaning, but does not include and inspection eye or manhole

Abbreviations

ABS - Acrylonitrile butadiene styrene

BSPT - British standard pipe thread

CA - Copper Alloy

CB - Caulking bush

CCCJ - Cold compound caulked joint

CI - Cast iron

CMJ - Cement Mortar joint

COP - Copper

FC - Fibre cement

FI - Female Iron

GI - Galvanized Iron

GMS - Galvanized Mild Steel

HDPE CLASS12 PN12.5 - High Density Polyethylene

L/CE - Lead to copper alloy

LCJ - Lead caulked joint

MI - Male iron

MJ - Mechanical Joint

MuPVC - Modified unplasticized Polyvinyl Chloride

OG - Overflow Gully or overflow device

PE - Polyethylene

SSN - Stainless Steel Shield and rubber gasket coupling

VC - Vitrified Clay

PPR - Polypropylene Pipe

11. WATER SUPPLY INSTALLATION.

11.1 COLD WATER INSTALLATION (200mm to 80mm)

The cold-water system shall comprise of the use of HDPE CLASS 12 piping for external underground water supply tapping off from the civil water ring main and all Internal water

reticulation piping to be of “HDPE” Piping. The joint between the “HDPE” piping and the Galvanised steel piping shall be of the HDPE CLASS12 PN12.5/BSPT adaptor above ground.

Pressure from the mains will be reduce from a mains static pressure of 4.5 bar to a minimum of 1.4 bar to ensure correct operation of the flush valve units. Cold water will be reticulated as per the drawings and shall include a shut off ball valve at each sanitary fixture.

The piping on the external perimeter of the building shall be “HDPE class 12” in construction and the piping entering the buildings shall be of the “Carbon Steel piping” material construction. The successful Tenderer must ensure that the correct connex compression fitting is provided between the Galvanised Steel and HDPE CLASS12 piping.
All piping shall be supported as per the Standard Specifications for Piping in this document. Allowance for pipe supports have been catered for in the Bill of Quantities.

All piping shall be supported as per the Manufacturers details. Allowance for pipe supports have been catered for in the Bill of Quantities.

All connections shall be as per the manufacturer’s details and training.

System Pressure & Temperature Rating

System Operating Perimeters to be 6 Bar @ 95°C / 12.5 Bar @ 20°C
Pressure testing to be done at minimum 15bar or 1.5 times the operating pressure (Whichever is highest).

11.2 HOT WATER INSTALLATION (250mm to 80mm)

The hot water system shall comprise out of the use of Carbon Steel piping from the Main Hot Water Calorifiers/Hot water generation system. The joint between the Carbon Steel piping and “Galvanised Steel” run and the branch take-offs shall be of the connex type.

Cold water shall be provided to the Calorifiers at a balance pressure to that of the cold-water system. Pressure from the mains will be reduce from a mains static pressure of 4.5 bar to a minimum of 1.4 bar to ensure correct operation of the mixed water fixtures. Hot water will be reticulated as per the drawings and shall include a shut off ball valve at each sanitary fixture.

The piping on the external perimeter of the building shall be “Carbon Steel” in construction and shall be insulated in accordance with this specification. The piping entering the buildings shall be of the “Carbon Steel” construction.

All piping shall be supported as per the Standard Specifications for Piping in this document. Allowance for pipe supports have been catered for in the Bill of Quantities.

Calorifiers/Geysers will be strategically placed to ensure the hot water requirements of the complex are met.

All connections shall be as per the manufacturer’s details and training.

Special reference is made to SANS 10112:2003 for the installation of Polyethylene piping materials which the tenderer should be aware of.

System Pressure & Temperature Rating

System Operating Perimeters to be 11.5 Bar @ 70°C / 12.5 Bar @ 20°C

Insulation

Insulation material of type cross linked polyethylene or equally approved other.
Material thermal conductivity of 0.035W/mK or lower.

11.3 PIPING, ACCESSORIES AND FITTINGS

- Piping shall be installed and manufactured in accordance with the specification and the typical details included as part of the specification.

- Details of proposed pipe support system shall be submitted to the Engineer for approval prior to installation.

- Thermometers and pressure gauges shall be provided as indicated.
- All water supply fittings to be compression fitted as per supplier's installation requirements.

12. BUILDING CALORIFIERS, HEAT PUMPS AND HOT WATER CIRCULATION

Where the new calorifiers are provided the rate shall include the following:

Supply and install, where shown on the drawings, factory built by a specialist manufacturer an insulated thermal hot water storage tank of the volume, temperature and pressure ratings as specified in the technical schedules.

The tank is to be manufactured to the latest applicable Factory Act, National Building Regulations and applicable SABS standards for size and application of tank in accordance with but not limited to ASME VIII.

The tank shall be the vertical standing, round type with "domed" ends on top and bottom. The vertical round tank shall have a minimum thickness of 8mm when manufactured of steel in accordance with specification BS-1501-151-43A and the domed ends (ratio 2:1) in accordance with specification BS-1501-151-430A. The tank shall be fitted with a minimum diameter 450mm manhole with cover in accordance with BS-4360-43A.

The tank shall be supported by a minimum of four support legs or round skirting. The welding manufacturing shall be in accordance with ASME VIII. The tank shall be supplied with factory fitted and suitable hoisting lugs.

Welding joints shall be "staggered" to avoid concentrations of welding joints which could create "hot spots". Weld sockets shall be in accordance with ASA B16-11 and shall be long enough to extend at least 50mm outside the tank to penetrate the tank insulation up to the cladding surface.

Over and above the referred standards the tank shall have a test pressure, a working pressure, and an operation temperature as indicated in the technical schedules.

12.1 Fittings, Controls, Safeties and Instruments

The tank shall be manufactured with sufficient sockets to accommodate the connections for the controls and safeties and other devices as stipulated in the technical schedules including but limited to (see annexure):

- ø 50mm cold water inlet bottom side (sponge pipe)
- ø 50mm water connection on the top
- ø 38mm drain valve (minimum)
- ø 35mm air vent on the top of the tank
- Vacuum breaker
- Pressure relief valves as specified in the technical schedules with suitable "Copper" "blow off" discharge piping to the nearest drain.
- ø 20mm socket to accommodate a ø 100mm glycerine filled pressure gauge with stainless steel casing.
- ø 25mm dial type(100mm) thermometers
- Socket for radiation loss heater to meet the requirements as detailed in the technical schedules
- ø 20mm socket for radiation loss heater thermostat
- ø 20mm socket for manual reset safety thermostat
- ø 20mm socket near the cold water inlet for heat pump
- control cut-out thermostat
- ø 20mm socket for heat pump control cut-in thermostat
- as required in the technical schedules sockets for stand-by
- electric heater elements in accordance with the technical
- schedules.
- ø 20mm socket for the electric stand-by heating
- control thermostat
- ø 20mm socket at high level for low temperature alarm thermostat

Steel tanks which are to be internally copon coated, shall have weld flanged connections in lieu of threaded sockets for instruments, safeties and pipe connections. Threaded sockets are not approved.

The tanks shall be factory fitted with suitable hoisting lugs.

External Finish (Steel tanks only)

After completion of the tank manufacturing, and prior to applying tank insulation, the external surface shall be cleaned to remove grease and dirt and wire brushed and scraped to remove all rust and scale before applying two coats of suitable red oxide type priming paint.

Internal Finish (Steel Tanks only)

After completion of the tank manufacturing, all welding and pressure testing, and after all pressure test results have been received and approved by the Engineer, the internal surface of the vessel shall be sandblasted in accordance with S. A. 2.1-2.

Within 4 hours of the sandblasting, a first coat of culturate 'TCPCSF" shall be applied and after a minimum period of 12 hours and a maximum of 7 days, a second coat of the culturate shall be applied. A third and fourth coat of culturate shall be applied with the same time limits in between. The thickness of the coats shall be between 125 – 150 micron dry film thickness each. The copon culturate is manufactured by AECI. The sandblasting and copon coating shall be extended to include all pipe, instrument connections and flange surfaces to ensure a full protective coat over the entire area exposed to the hot water.

After 7 days of the final copon coating, a pinhole test shall be conducted. If pinholes are found then the area shall be marked and slightly abraded and brush applied to the area (s) in question.

After rectifying any pinholes found, the pinhole test shall be carried out again until no pinholes are detected.

Tank Insulation

The tank shall be insulated using 50 mm fibreglass blankets affixed to the tank with "pin straps", "spikes" or other approved means to prevent sagging of the fibreglass insulation.

The fibreglass insulation shall be covered with "removable" galvanised sheet metal or aluminium cladding as detailed in the technical schedules. The insulation and cladding may be applied on site after the tank has been situated in its final position to prevent damages to the insulation. The manhole and other items requiring access for servicing shall have easily removable aluminium jackets.

Fixtures and Fittings

The tank shall be supplied with all necessary control and safety devices, immersion heaters, instrumentation (pressure gauges and thermometers), valves and other devices in accordance with the technical schedules and capable to meet the specified pressure and temperature requirements.

For hot water applications gate valves are not approved.
Valves should either be of the "ballcock" type, butterfly, globe or neoprene diaphragm (Sanders) rated for the specified pressure and temperature conditions.

Test Procedures

In view of the pressure and temperature ratings the following test procedures shall be strictly adhered to:

Test Procedures:

1) Tank to the factory pressure tested with water at the rated test pressures prior to sandblasting and copon coating. A certificate to be issued to the Engineer for approval. The Engineer to be notified of the date of such test at least two days prior to testing to enable him to witness the test at his discretion.

2) After the tank has been installed and piping connected, the tank will be pressure tested full of water on site up to the rated test pressures with the tank pressure relief valve plugged off.

3) A pressure relief valve downstream from the presume reducing valve of the mains water supply ensures that the mains water pressure at the tank never exceeds 300 kPa upon failure of the pressure reducing valve. This relief valve to be tested on site by increasing the building mains pressure reducing valve in excess of 250 kPa as part of the commissioning procedures.

4) The tank itself is also fitted with at least two pressure relief valves each adequately sized to allow sufficient steam to blow off as generated by the electric heater

elements. The tank to be isolated and pressure tested to make sure that the pressure relief valve opens as soon as the tank pressure reaches the rated relief pressures.

5) No electrical supply to the heat pumps and/or electric heating elements should be connected before all the above and necessary pressure tests have been successfully completed and approved.

6) The operation of the control thermostat of the small “heat loss” heater (3kw) stand-by heater thermostat as well as the manual reset type high temperature safety cut-out to be tested to the approval of the Engineer.

As part of the commissioning procedures the contractor is required to submit a signed test report to the engineer for review and approval as documentary evidence that all tests have been carried out in accordance with the requirements and to the approval of the engineer.

Approval of the design drawings, technical submittal data, test results and plant operation does not relieve the contractor and the tank manufacturers and suppliers of their responsibility with respect to compliance of the system and its components with all local applicable regulations, laws and by-laws with respect to this contract from a legal point of view.

13. Special Requirements

13.1 Special Requirements No. 1

The tank and internal protective coating shall be guaranteed against corrosion and/or weld leaks for a period of minimum 3 years after handover or beneficial occupation whatever occurs first. In case of failure within that period the contractor/supplier shall replace the tank for a new tank without cost to the Client.

- The calorifier shall be of the storage cylindrical type with a capacity as shown on the drawings with an electric element as specified.
- The calorifier shall be insulated with mineral fibre wool and externally cladded with galvanised sheet metal.
- New temperature gauge, new pressure gauge, new safety valve, new temperature control valve and isolating valves shall be provided.
- All fittings and accessories necessary to complete the installation and make the calorifier operational and as indicated on the typical details.
- The calorifiers shall be galvanised, suitable for the maximum pressure of the domestic water system 450 kPa, and a tested pressure of 1.5 times the operating pressure.

- Each calorifier shall be provided with a hot water circulating system consisting of a circulating pump (with capacities specified elsewhere), isolating valves, pressure reducing valve, etc. The rate in the Bill of Quantities shall include the piping, fittings, electrical installation and controls necessary to complete the installation and make it operational. The hot water flow and return shall terminate in gate valves in the plantroom and the connection from these points to the heat exchangers forms part of the contract.
- The system shall be a one pipe system with insulated “Carbon Steel Pipe” hot water piping routed against the wall on the outside of the building supplying to

heat exchanger coils in the Air handling units. The following points shall be noted with respect to the "Carbon Steel" piping system:

- The installation of the system shall conform to BS 5449 and SABS 0252
- The piping shall be thoroughly flushed out after installation to remove all flux and "Carbon Steel pipe" shavings.
- All necessary fittings between "Carbon steel" and galvanised piping shall be provided as part of this contract where necessary. The fitting shall be of the Conex type suitable for plumbing installations.

13.2 Special Requirements No. 2

Heat Pump system

The system shall comprise of a domestic water heat pump and geyser complete with an electrical heating element (backup). The system shall be installed on a plinth on the ground floor, water supply to the heat pump shall be drawn from the geyser reserve and fed back to the geyser. The heat pump shall be the primary sauce of heat generation and during maintenance or breakdown the electrical heat element shall function as a temporal back up.

Hot Water Heater Geyser Installation related regulations:

- SANS 204-Energy Efficiency in Buildings
- SANS 10106-The Installation, maintenance, repair and replacement of domestic solar water heating systems.
- SANS 10252-1 Water Supply Installations for Buildings

- Each heat pump shall have a minimum COP (Coefficient of Performance) of 3.9
- All system components are to be SABS approved.
- The system shall be completely installed in line with the manufacturer's installation guide. Complete with the recommended circulation pump.
- When mounted on to a horizontal surface so that the supporting feet of the heat pump unit are securely fixed to a plinth or a stand.
- Be mounted in such a manner to prevent water or debris from being collecting by under the heat pump unit (or both),and
- Be mounted with anti-vibration mountings and properly secured piping to prevent possible vibration and resultant noise transmission of the heat pump unit.
- All the fittings installed are to be approved or provided by the manufacturer of the heat pump.
- The heat pump unit & storage water heater, and all their operating components, shall be:
    - connected to the heat pump unit's primary circulation loop by means of union type couplers, to facilitate the replacement or maintenance of the unit or operating components, as relevant.
    - Flexible connectors shall not be used.

- Hot water pipelines of any kind in colder regions will be fully insulated from the point of draw of water from tank to delivery points. In other regions also care will be taken to avoid heat losses in the pipelines.
- System will be installed nearest to the point of hot water usage to avoid longer pipeline & higher heat losses.
- Where water quality is bad either FPC based systems with Heat Exchanger or ETC based systems will be installed.
- The installation shall be tested and commissioned by the manufacturer with certificates provided.
- The workmanship & aesthetics of the system shall be good, and it should be visible to anybody.
- There will not be any leakage observed in the system from tanks/ heat pump/ pipelines.
- The system shall be tested in the presence of the engineer on a date arrange 7 days prior inspection.

14. Circulation Pump Installation

The pump installation shall comprise of a set of 2 vertical Single-stage, close-coupled, volute pump with in-line suction and discharge ports of identical diameter. pumps as indicated on the Plant room layouts.

The pump shall:

- Operate in an alternating method.
- Be linked to the float meter for cut off conditions in a cases where the tank is low on water.
- Be installed with pressure and flow valves.
- Be installed on a plinth.
- Circulation pumps shall be suitable for the operating temperature and adequately resistant to corrosion.
- Pumps shall not be audible above the background noise and the inlet and outlet connections to the pumps shall be fitted with full-way (full bore) valves.
- Pumps to be vertical multistage centrifugal pump with inlet and outlet ports on the same level.
- Pumps shall be suitable for the following fluid operation conditions:
    - Fluid type: **Water**
    - Temperature: **75 degrees Celsius**

All piping shall be supported on the floor and walls to ensure minimal movements.

Pipes must be clamped to the wall.

15. WATER TREATMENT INSTALLATIONS

15.1 Water Softening Plant

15.1.1. The water softening plant shall be of the fully automatic base exchange type.

15.1.2. Regeneration shall be controlled via an integrating type water meter, or

15.1.3. Regeneration shall be controlled via a sensing device monitoring discharge water hardness.

15.1.4. The soft water shall not contain more than 10 mg/litre of total dissolved solids, expressed as CaCO3.

15.1.5. Water softeners shall be of the duplex type unless otherwise specified and shall be able to exchange the full specified flow per vessel at the exchange rate of 46 kg/m3 with a minimum exchange time of 12 hours based on raw water at 200 mg/litre expressed as calcium carbonate.

15.1.6. Exchange vessels shall be mechanically or electrically interlocked to ensure that only one cylinder is open at any one time and controls shall be designed so that change-over will not take place before a vessel has been exhausted even after power interruption.

15.1.7. Piping shall be as shown on the schematic pipe drawing, and shall include an inlet waterflow meter and all necessary controls and valves. The piping shall include a by-pass pipe with shut-off valve.

15.1.8. Others will provide a supply water connection within two metres of the water softener.

15.1.9. Drain piping shall be taken to the nearest drain point, which can be assumed to be within 2 metres of the equipment.

15.1.10. Brine tanks of suitable material and with a capacity sufficient for two weeks' operation, shall be provided.

15.2 Chemical Treatment – General

15.2.1. The chemical treatment programme shall perform the following functions:

- Inhibit corrosion
- Inhibit scale forming
- Protect system against algae growth
- Protect system against sludge formation
- Prevent Legionella

15.2.2. Chemicals shall comply with the local health authority regulations and shall be compatible with all materials forming part of the piping system.

15.2.3. Chemicals shall be readily available from a recognised supplier.

15.2.4. Chemicals shall be selected so as not to interact with or neutralise each other.

15.2.5. Concentration of chemicals in pipe system shall be in accordance with suppliers' recommendations.

15.2.6. Twelve service visits at monthly intervals shall be provided. Recognised corrosion tests and water analysis shall be carried out during each visit. Reports on the above shall be sent to the engineer.

15.2.7. The sub-contractor shall provide twelve months' supply of chemicals of an approved manufacture and suitable for the water treatment equipment.

15.3 Chemical Treatment for Open Cooling Tower and Air Washer Water System

15.3.1. The sub-contractor shall install a chemical injection system and bleed-off control, complete with all necessary controls and equipment.

15.3.2. The system shall consist of a chemical feed pump and bleed-off valve controlled by a controller measuring the water conductivity with a probe. The conductivity probe shall measure the electrical conductivity of the cooling water and shall be installed in an interconnecting pipe between the supply and return pump manifolds. The probe shall be wired to the conductivity controller.

15.3.3. The sub-contractor shall provide a dosing pot to facilitate addition of the inhibitor.

15.4 Chemical Treatment for Boiler Feedwater

15.4.1. Supply and install two proportioning type, direct-acting, positive displacement, feedwater chemical dosing pumps.

15.4.2. Each pump shall have a variable discharge capacity, when operating against the system pressure, between limits as is necessary for the system specified.

15.4.3. The one proportioning pump shall be suitable for pumping a sulphide solution into the feedwater delivery line immediately below the boiler feedwater tank.

15.4.4. The second proportioning pump shall be suitable for pumping a phosphate solution directly into the boiler water space.

15.4.5. The pump shall be electrically driven through a reduction gearbox arrangement and a chemical flow adjustment shall be provided.

15.4.6. The pumping system shall be complete with two chemical solution storage tanks which shall be constructed of polythene.

15.4.7. Each pump discharge shall be provided with an automatically operated pressure relief circuit which shall discharge the contents of the pump delivery into the storage tank when excessively high pump discharge pressures are encountered.

15.4.8. The chemical solution feedlines from the storage tanks to the proportioning pumps must be fitted with an isolation valve and strainer.

15.4.9. All piping on the water treatment plant shall be of heavy-duty galvanised quality.

15.4.10. All piping and fittings must be included in this contract.

15.4.11. Each chemical storage tank must be provided with a valved drain and suitable manually operated stirrer.

15.4.12. A 15 mm cold water connection, complete with tap with hose connection and a length of hose, must be provided above the storage tanks for water filling for the chemical mixture.

15.4.13. The chemical solution tanks shall be supplied with drain connections and shall be mounted on a rigid steel frame.

15.4.14. A screw-down, non-return valve must be provided on the phosphate delivery and sulphide delivery lines at the point of injection.

PART VI

WET SERVICES MECHANICAL INSTALLATION

BILL OF QUANTITIES

SABC AUCKLAND PARK BOILER ELECTRODE REPLACEMENT

SABC AUCKLAND PARK

GENERAL NOTES FOR WET SERVICES

1	This Bill of Quantities forms part of the contract documents and is to be read in conjunction therewith.
2	All works billed here shall include for the full scope of service specified including but not limited to supply, delivery, installation, commissioning, documentation, building tuning, project closeout and administrative requirements, and all works as necessary to provide a working product in accordance with the project performance criteria.
3	Quantities indicated here are to be verified by the contractor against the project drawings. All discrepancies shall be brought to the attention of the responsible engineer. Should no queries be raised the contract totals and rates provided shall be deemed sufficient for the due execution of the works in accordance with the engineers intent communicated through the project drawings and these specifications.
4	No variation in rates shall be due based on variation in quantities, rate of exchange or escalation.
5	Errors and omissions of equipment or material required to execute the project solution specified or indicated on the drawings shall be brought to the attention of the responsible engineer for clarification, failing which the provision of such items shall be deemed included in the project rates.
6	All works required to execute the scope of works in accordance with the project program and quality requirements are deemed included in the rates and totals provided below.
7	Rates provided shall include for fixing, hangers, fittings, transformations, sealant and all other items required to deliver a functional system in accordance with the design intent and specifications. Rate includes the supply,delivery,labour and installation of equipment.
8	The bill of quantities shall not be used as the basis for material order.
9	The values here shall be entered in South African Rands and exclusive of VAT.

SABC AUCKLAND PARK BOILER ELECTRODE REPLACEMENT

SABC AUCKLAND PARK

ITEM NO.	DESCRIPTION	UNIT	QTY	RATE	TOTAL
	In accordance with the Conditions of Contract, provide				
	for all expenses, obligations and general items pertaining				
	to such conditions and all items not specifically specified				
	or mentioned to enable the works to be completed in a				
	safe satisfactory manner.In accordance with the drawings				
	and the specification.				
1	**PRELIMINARIES & GENERAL**				
1.1	Site establishment	No.	1		
1.2	Site supervision and attendance	No.	1		
1.3	As built drawings	No.	1		
1.4	Transport of material	No.	1		
1.4	Scaffolding	No.	1		
1.6	Cranage & Hoisting	No.	1		
1.7	Certificate of Compliance	No.	1		
1.8	Plumbing Water Pressure Testing to 2,5Mpa	No.	7		
	over 8 hours per plant				
1.9	12 months maintenance guarantee and warranty	No.	1		
1.10	Workshop drawings	No.	1		
1.11	Operation & Maintennace manuals	No.	1		
1.12	Health and Safety File	No.	1		
1.13	Quality Management Plan	No.	1		
1.14	Training	No.	1		
1.15	Removal and safe disposal of panel heaters and certificate for safe	No.	1		
	disposal of redundant equipment				
1.16	Removal and safe disposal of boiler electrodes, pumps and piping	No.	1		
	and certificate for safe disposal of redundant equipment				
1.17	Testing and commissioning of complete system	No.	3		
TOTAL FOR THIS BILL:					

SABC AUCKLAND PARK BOILER ELECTRODE REPLACEMENT

SABC AUCKLAND PARK

ITEM NO.	DESCRIPTION	UNIT	QTY	RATE	TOTAL
	In accordance with the Conditions of Contract, provide				
	for all expenses, obligations and general items pertaining				
	to such conditions and all items not specifically specified				
	for all expenses, obligations and general items pertaining				
	safe satisfactory manner.In accordance with the drawings				
	and the specification.				
2	**WATER SUPPLIES**				
	Carbon Steel piping completely installed on supports, hangers				
	and including running joints as per SANS requirements				
2.1	80mm pipes minimun internal pipe diameter				
	Supply	m	445		
	Install	m	445		
2.2	100mm pipes minimun internal pipe diameter				
	Supply	m	240		
	Install	m	240		
2.3	150mm pipes minimun internal pipe diameter				
	Supply	m	145		
	Install	m	145		
2.4	200mm pipes minimun internal pipe diameter				
	Supply	m	25		
	Install	m	25		
2.5	250mm pipes minimun internal pipe diameter				
	Supply	m	700		
	Install	m	700		
3	**Extra over Carbon Steel pipes for capillary flanged fittings**				
3.1	80mm Elbow				
	Supply	No.	245		
	Install	No.	245		
3.2	80mm Tee				
	Supply	No.	10		
	Install	No.	10		
3.3	100mm Elbow				
	Supply	No.	20		
	Install	No.	20		
3.4	100mm Tee				
	Supply	No.	8		
	Install	No.	8		
3.5	150mm Elbow				
	Supply	No.	138		
	Install	No.	138		
TOTAL FOR THIS BILL:					

SABC AUCKLAND PARK BOILER ELECTRODE REPLACEMENT

SABC AUCKLAND PARK

ITEM NO.	DESCRIPTION	UNIT	QTY	RATE	TOTAL
AMOUNT CARRIED OVER FROM PREVIOUS PAGE					
3.6	150mm Tee				
	Supply	No.	1		
	Install	No.	1		
3.9	200mm Elbow				
	Supply	No.	4		
	Install	No.	4		
3.8	200mm Tee				
	Supply	No.	100		
	Install	No.	100		
3.9	250mm Elbow				
	Supply	No.	4		
	Install	No.	4		
3.10	250mm Tee				
	Supply	No.	145		
	Install	No.	145		
3.11	100mm-80mm Reducer				
	Supply	No.	18		
	Install	No.	18		
3.12	150mm-80mm reducer				
	Supply	No.	15		
	Install	No.	15		
3.13	150mm-100mm reducer				
	Supply	No.	26		
	Install	No.	26		
3.14	200mm-80mm reducer				
	Supply	No.	55		
	Install	No.	55		
3.15	200mm-100mm reducer				
	Supply	No.	15		
	Install	No.	15		
3.16	200mm-150mm reducer				
	Supply	No.	43		
	Install	No.	43		
3.17	250mm-80mm reducer				
	Supply	No.	100		
	Install	No.	100		
3.18	250mm-100mm reducer				
	Supply	No.	6		
	Install	No.	6		
TOTAL FOR THIS BILL:					

SABC AUCKLAND PARK BOILER ELECTRODE REPLACEMENT

SABC AUCKLAND PARK

ITEM NO.	DESCRIPTION	UNIT	QTY	RATE	TOTAL
AMOUNT CARRIED OVER FROM PREVIOUS PAGE					
3.19	250mm-150mm reducer				
	Supply	No.	64		
	Install	No.	64		
3.20	250mm-200mm reducer				
	Supply	No.	6		
	Install	No.	6		
4	**Class 12 HDPE PN 12,5 piping completely installed and including on**				
	supports, hangers and running joints as per SANS requirements				
4.1	50mm Pipes				
	Supply	m	15		
	Install	m	15		
4.2	75mm Pipes				
	Supply	m	35		
	Install	m	35		
4.3	100mm Pipes				
	Supply	No.	25		
	Install	No.	25		
4.4	150mm Pipes				
	Supply	No.	35		
	Install	No.	35		
4.5	200mm Pipes				
	Supply	No.	150		
	Install	No.	150		
5	**Extra over class 12 HDPE pipes for capillary fittings**				
5.1	50mm elbow				
	Supply	No.	5		
	Install	No.	5		
5.2	50mm tee				
	Supply	No.	5		
	Install	No.	5		
5.3	75mm elbow				
	Supply	No.	5		
	Install	No.	5		
5.4	75mm tee				
	Supply	No.	5		
	Install	No.	5		
TOTAL FOR THIS BILL:					

SABC AUCKLAND PARK BOILER ELECTRODE REPLACEMENT

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ITEM NO.	DESCRIPTION	UNIT	QTY	RATE	TOTAL
AMOUNT CARRIED OVER FROM PREVIOUS PAGE					
5.5	100mm elbow				
	Supply	No.	5		
	Install	No.	5		
5.6	100mm tee				
	Supply	No.	5		
	Install	No.	5		
5.7	150mm elbow				
	Supply	No.	5		
	Install	No.	5		
5.8	150mm tee				
	Supply	No.	5		
	Install	No.	5		
5.9	200mm elbow				
	Supply	No.	2		
	Install	No.	2		
5.10	200mm tee				
	Supply	No.	2		
	Install	No.	2		
6	**TAPS, VALVES, ETC., INCLUDING COUPLING TO**				
	PIPES AND/OR FITTINGS				
6.1	DN80 Flow Balancing Valve				
	Supply	No.	129		
	Install	No.	129		
6.2	DN 80 Pressure Reducing Valve				
	Supply	No.	2		
	Install	No.	2		
6.3	DN 80 Level ball shut off Valve				
	Supply	No.	129		
	Install	No.	129		
6.4	DN 80 Check (Non return) Valve				
	,	No.	41		
	Install	No.	41		
6.5	DN 100 Lever Ball Valve				
	Supply	No.	4		
	Install	No.	4		
6.6	DN 100 Check Valve				
	Supply	No.	4		
	Install	No.	4		
TOTAL FOR THIS BILL:					

SABC AUCKLAND PARK BOILER ELECTRODE REPLACEMENT

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ITEM NO.	DESCRIPTION	UNIT	QTY	RATE	TOTAL
AMOUNT CARRIED OVER FROM PREVIOUS PAGE					
6.7	DN 100 Y Strainer				
	Supply	No.	2		
	Install	No.	2		
6.8	DN 150 Pressure Reducing Valve				
	Supply	No.	4		
	Install	No.	4		
6.9	DN 200 Pressure Reducing Valve				
	Supply	No.	1		
	Install	No.	1		
6.10	DN 250 Pressure Reducing Valve				
	Supply	No.	4		
	Install	No.	4		
6.11	DN 200 Lever Ball Valve with pilot system				
	Supply	No.	4		
	Install	No.	4		
6.12	DN 200 Check Valve				
	Supply	No.	4		
	Install	No.	4		
6.13	DN 200 Y-Strainer				
	Supply	No.	2		
	Install	No.	2		
6.14	DN 250 Lever Ball Valve with pilot system				
	Supply	No.	4		
	Install	No.	4		
6.15	DN 250 Check Valve				
	Supply	No.	4		
	Install	No.	4		
6.16	DN 250 Y-Strainer				
	Supply	No.	2		
	Install	No.	2		
	On/Off Electrical Remote Control Valve				
	Body & Cover - Ductile Iron, Trim - Stainless Steel.				
	Fusion Bonded Epoxy Coated With Red Braun				
	Flanged & Drilled SABS 1123 T1600				
	Including Auxillary Pipework with Copper Tubing & Brass				
	Fittings, Complete with Solenoid (Voltage to be advised)				
6.17	100mm control valve, compatible with Johnsons control bacnet system				
	as per manufacturer's specification				
	Supply	No.	1		
	Install	No.	1		
TOTAL FOR THIS BILL:					

SABC AUCKLAND PARK BOILER ELECTRODE REPLACEMENT

SABC AUCKLAND PARK

ITEM NO.	DESCRIPTION	UNIT	QTY	RATE	TOTAL
AMOUNT CARRIED OVER FROM PREVIOUS PAGE					
6.18	150mm control valve, compatible with Johnsons control bacnet system				
	as per manufacturer's specification				
	Supply	No.	1		
	Install	No.	1		
6.19	200mm control valve, compatible with Johnsons control bacnet system				
	as per manufacturer's specification				
	Supply	No.	1		
	Install	No.	1		
6.20	DN 80 Pipe flanges A182 Gr F1 c/w holes and bolts & nuts to suit				
	manufacturer's specification				
	Supply	No.	180		
	Install	No.	180		
6.21	DN 100 Pipe flanges A182 Gr F1 c/w holes and bolts & nuts to suit				
	manufacturer's specification				
	Supply	No.	36		
	Install	No.	36		
6.22	DN 150Pipe flanges A182 Gr F1 c/w holes and stud bolts & nuts to suit				
	manufacturer's specification				
	Supply	No.	19		
	Install	No.	19		
6.23	DN 200Pipe flanges A182 Gr F1 c/w holes and bolts & nuts to suit				
	manufacturer's specification				
	Supply	No.	8		
	Install	No.	8		
6.24	DN 250 Pipe flanges A182 Gr F1 c/w holes and bolts & nuts to suit				
	manufacturer's specification				
	Supply	No.	58		
	Install	No.	58		
7	**INSULATION OF NITRILE FOAMED RUBBER WITH A CLOSED CELL**				
	STRUCTURE AND DENSITY OF 70kg/m3. INSULATION TO BE MINIMUM				
	32MM THICK COMPLETE WITH GLUE AND STAINLESS STEEL CLADDING				
7.1	80mm pipes minimun internal pipe diameter				
	Supply	m	445		
	Install	m	445		
7.2	100mm pipes minimun internal pipe diameter				
	Supply	m	240		
	Install	m	240		
7.3	150mm pipes minimun internal pipe diameter				
	Supply	m	145		
	Install	m	145		
TOTAL FOR THIS BILL:					

SABC AUCKLAND PARK BOILER ELECTRODE REPLACEMENT

SABC AUCKLAND PARK

ITEM NO.	DESCRIPTION	UNIT	QTY	RATE	TOTAL
AMOUNT CARRIED OVER FROM PREVIOUS PAGE					
7.4	200mm pipes minimun internal pipe diameter				
	Supply	m	25		
	Install	m	25		
7.5	250mm pipes minimun internal pipe diameter				
	Supply	m	700		
	Install	m	700		
TOTAL FOR THIS BILL:					

SABC AUCKLAND PARK BOILER ELECTRODE REPLACEMENT

SABC AUCKLAND PARK

ITEM NO.	DESCRIPTION	UNIT	QTY	RATE	TOTAL
	In accordance with the Conditions of Contract, provide				
	for all expenses, obligations and general items pertaining				
	to such conditions and all items not specifically specified				
	for all expenses, obligations and general items pertaining				
	safe satisfactory manner.In accordance with the drawings				
	and the specification.				
8	**EQUIPMENT**				
8.1	15000L vertical sectional hot water tank c/w 120kW electrical element				
	and 3 temperature sensor probes linked to circulation pump set				
	Supply	No.	11		
	Install	No.	11		
8.2	5000L vertical sectional hot water storage tank c/w float switch valve				
	Supply	No.	1		
	Install	No.	1		
8.3	117kW Heat Pump (Alliance or Equal Approved) c/w vibration mounts				
	Supply	No.	41		
	Install	No.	41		
	The pump must be as follows:				
	Single-stage, close-coupled, volute pump with in-line				
	suction and discharge ports of identical diameter. The				
	pump must be of the top-pull-out design, i.e. the power				
	head (motor, pump head and impeller) can be removed				
	for maintenance or service while the pump housing				
	remains in the pipework. The pump is to be fitted with an				
	unbalanced rubber bellows seal. The shaft seal to be in				
	accordance to EN 12756. Pipework connection via PN16				
	DIN flanges (EN 1092-2 and ISO 7005-2). To operate at				
	75 degrees celcius. Pump to have VSD.				
8.4	85l/s @ 25m Head Hot Water Circulation Pump c/w vibration mounts				
	Supply	No.	2		
	Install	No.	2		
8.5	64l/s @ 81m Head Hot Water Circulation Pump c/w vibration mounts				
	Supply	No.	2		
	Install	No.	2		
8.6	64l/s @ 35m Head Hot Water Circulation Pump c/w vibration mounts				
	Supply	No.	2		
	Install	No.	2		
8.7	52l/s @ 113m Head Hot Water Circulation Pump c/w vibration mounts				
	Supply	No.	2		
	Install	No.	2		
8.8	16l/s @ 61m Head Hot Water Circulation Pump c/w vibration mounts				
	Supply	No.	2		
	Install	No.	2		
TOTAL FOR THIS BILL:					

SABC AUCKLAND PARK BOILER ELECTRODE REPLACEMENT

SABC AUCKLAND PARK

ITEM NO.	DESCRIPTION	UNIT	QTY	RATE	TOTAL
AMOUNT CARRIED OVER FROM PREVIOUS PAGE					
8.9	13l/s @ 70m Head Hot Water Circulation Pump c/w vibration mounts				
	Supply	No.	2		
	Install	No.	2		
8.10	60l/s @ 81m Head Hot Water Circulation Pump c/w vibration mounts				
	Supply	No.	2		
	Install	No.	2		
8.11	64l/s @ 105m Head Hot Water Circulation Pump c/w vibration mounts				
	Supply	No.	2		
	Install	No.	2		
9	**PROVISIONAL SUMS**				
9.1	Provisional sum for link to BMS and associated accessories for				
	compatibility with existing BMS system/infrastructure				
	Supply, deliver & install	No.	1	R 3 832 326,70	
10	**WATER TREATMENT PLANT**				
	PLANT M1				
10.1	Water treatment plant as per technical specification c/w all necessary				
	ancillary/accessories for integration with supply and return pipe lines				
	Supply	No.	2		
	Install	No.	2		
	PLANT M2				
10.2	Water treatment plant as per technical specification c/w all necessary				
	ancillary/accessories for integration with supply and return pipe lines				
	Supply	No.	2		
	Install	No.	2		
	PLANT M3				
10.3	Water treatment plant as per technical specification c/w all necessary				
	ancillary/accessories for integration with supply and return pipe lines				
	Supply	No.	2		
	Install	No.	2		
11	**EQUIPMENT SUPPORT STRUCTURE**				
11.1	150mm Thick concrete Plinth 3mx3m (for calorifier)				
	Supply	No.	11		
	Install	No.	11		
TOTAL FOR THIS BILL:					

SABC AUCKLAND PARK BOILER ELECTRODE REPLACEMENT

SABC AUCKLAND PARK

ITEM NO.	DESCRIPTION	UNIT	QTY	RATE	TOTAL
AMOUNT CARRIED OVER FROM PREVIOUS PAGE					
11.2	150mm Thick concrete Plinth 3mx3m (for heat pump)				
	Supply	No.	41		
	Install	No.	41		
11.3	150mm Thick concrete Plinth 3mx3m (for pump set)				
	Supply	No.	7		
	Install	No.	7		
12	**ELECTRICAL**				
	PLANT M1 and M1-K4				
12.1	Electrical Panel to supply system				
	Supply	No	2		
	Install	No	2		
12.2	Electrics , wiring and conduits to all equipment (up to isolator				
	by electrician)				
	Supply	No	6		
	Install	No	6		
12.3	Main plant on/off DB to be linked to BMS system for remote				
	control.				
	Supply	No	2		
	Install	No	2		
13	**HEATERS (Supply, Delivery and Installation)**				
13.1	425W Panel Heater				
	Supply	No	896		
	Install	No	896		
14	**PRIME COST**				
14.1	P.C for the Design supply and installation of the electrification				
	of the complete system inclusive of all components required to make				
	the system operational under the electrical works portion of the				
	works. Design work shall be undertaken by a competent person as				
	described in SANS 10400 for electrical works. The installation shall				
	be undertaken by a qualified electrician with C.O.C issued for the work				
	done at completion of the works.	P.C	1	R 3 200 000,00	R 3 200 000,00
TOTAL FOR THIS BILL:					