



SARS MUSINA WAREHOUSE

FIRE SERVICES INSTALLATION  
SPECIFICATION

AUGUST 2015

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## **PART IV**

### **GENERAL TECHNICAL SPECIFICATION**

**PART IV**  
**GENERAL TECHNICAL SPECIFICATIONS**

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## PART IV.01

### STANDARD SPECIFICATION FOR MECHANICAL SERVICES

#### GENERAL NOTES APPLICABLE TO CONTRACTS

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## **1 DEFINITIONS AND INTERPRETATION**

*Words and phrases used in this document shall have the following meaning:*

- 1.1 **"Employer"** means the party who will employ the Contractor and the legal successors in title to the Employer, but not, except with the written consent of the Contractor, any assignee of the Employer.
- 1.2 **"Principal Contractor"** means the person, firm or company whose tender has been accepted for the execution of the main building contract by or on behalf of the Employer and includes the Contractor's personal representatives, successors, and permitted assigns as the case may be.
- 1.3 **"Sub-contractor"** means any nominated Sub-contractor or any person, firm or company (other than the Contractor) named in the Contract for any part of the Works or any person to whom any part of the contract has been sub-let with the consent in writing of the Engineer, and the Subcontractor's legal personal representatives, successors and permitted assigns.
- 1.4 **"Engineer"** means the person, firm or company appointed by the Employer to act as Engineer for the purposes of the Contract and designated as such in the Special Conditions of Contract, or any other Engineer appointed from time to time by the Employer and notified in writing to the Contractor.
- 1.5 **"Works"** means all Plant to be provided and work to be executed in accordance with the Contract.
- 1.6 **"Contract"** means these General and Special Conditions of Contract, Specification, Drawings, Schedules, Tender, the Letter of Acceptance and the Contract Agreement (if completed).
- 1.7 **"Contract Sum"** means the sum named in the Contract Agreement as the Contract Sum.

- 1.8 "**Contract Price**" means the Contract Sum subject to such additions thereto and deductions therefrom as may be made from time to time under the provisions of this contract.
- 1.9 "**Site**" means the lands and other places provided by the Employer for the purposes of the Contract.
- 1.10 "**Tests on Completion**" means such tests to be made by the Contractor before the Works are taken over by the Employer as are provided for in the Contract or otherwise agreed between the Employer and the Contractor.
- 1.11 "**Month**" means a calendar month.
- 1.12 "**Day**" means calendar day.
- 1.13 "**Writing**" means any manuscript, typewritten or printed statement.
- 1.14 "**Foreign currency**" means a currency of a country other than that in which the Works are to be executed.
- 1.15 "**Letter of Acceptance**" means the formal acceptance made by or on behalf of the Employer of the Tender, including any adjustment or variations to the Tender agreed between the Employer and the Sub-contractor.
- 1.16 "**Taking Over**" means when the Works are set in operation for the beneficial use of the Employer or when the Works are available for such beneficial use.
- 1.17 "**Special Conditions of Contract**" means any addition to departure from or amendment of these General Conditions as set out in the Special Conditions of Contract.
- 1.18 "**Tender**" means the Sub-contractor's offer to perform the Works described in the invitation to tender.
- 1.19 Words importing persons or parties shall include firms and corporations.
- 1.20 Words importing the singular only also include the plural and vice versa where the context requires.
- 1.21 The headings and marginal notes in these General Conditions shall not be deemed part thereof or be taken into consideration in the interpretation or

construction thereof or of the Contract.

- 1.22 The word "Cost" shall be deemed to include overhead costs whether incurred on or of the Site.
- 1.23 **"Time for Completion"** means the time for completion of the Works or any section or portion thereof as stated in the Special Conditions of Contract and shall be calculated from whichever is the later of:
- the date specified in the Contract;
  - the date of receipt by the Contractor of such payment in advance of commencing the Works as may be stipulated in the Contract;
- 1.24 **"Contractor's Equipment"** means all appliances or things of whatsoever nature required for the purpose of completing the Works but does not include plant, materials or other things intended to form or forming part of the Works.
- 1.25 **"Section of the Works"** means the stages or phrases into which the Works are divided for the purposes described and set out in the Specification.
- 1.26 **"Specification"** means the specification annexed to or issued with the General Conditions and modifications thereto made in writing.
- 1.27 **"Drawings"** means the drawings referred to in the Specification and any modification of such drawings approved in writing by the Engineer and such other drawings as may from time to time be furnished in writing by the Engineer.

## 2 ABBREVIATIONS:

Abbreviations referred to in this document shall have the following meaning:

- **BS** British Standard
- **ARI** Airconditioning and Refrigeration Institute
- **ASA** American Standards Association
- **ASHRAE** American Society of Heating, Refrigeration and Airconditioning Engineers.
- **UL** Underwriters Laboratories
- **SI** The International System of Units
- **DIN** Deutsche Industrie Norm
- **AMEU** Association of Municipal Electricity Undertakings
- **CSIR** Council for Scientific and Industrial Research

- **SABS** South African Bureau of Standards
- **SAIEE** South African Institute of Mechanical Engineers

### **3 SPECIFICATIONS AND DRAWINGS**

3.1 The whole of the work specified and indicated on the drawings and such extras as may be authorised, shall be carried out by the Sub-contractor. The Specification shall be read in conjunction with the accompanying drawings. Tenders shall include such items as are specified but which may not appear on the drawings and vice versa.

3.2 Part IV of the Specification, shall apply to the work specified in Part V of the Specification, and vice versa. Part V of the Specification and the accompanying drawings shall govern where they differ from Part IV.

3.3 The tenderer will be deemed to have included all items for the proper operation of the work, notwithstanding that such items may not be referred to in the Specification or drawings, unless he specifically states in his tender that such items have been omitted. In such instances he shall submit a quotation at the time of tendering for the items omitted.

3.4 Where statements or items in drawings and subsequent sections of the Specification are at variance with corresponding statements in earlier sections of the Specification, then the statements in the drawings and the later sections shall always take precedence.

#### **3.5 Workshop Drawings**

3.5.1 The Contractor shall submit, with reasonable promptness and in orderly sequence so as to cause no delay in the Works, all shop drawings and samples required by the Architect, Engineer and Principal Contractor. Shop drawings and samples shall be properly identified as specified, or as the Architect, Engineer and Principal Contractor may require. By approving and submitting shop drawings and samples the Sub-contractor thereby represents that he has determined and verified all field measurements, field construction criteria, materials, catalogue numbers and similar data, and that he has checked each shop drawing and sample with the requirements of the Works and Sub-contract.



- 3.5.2 The Architect and Engineer will review and approve shop drawings and samples submitted through the Principal Contractor with reasonable promptness so as to cause no delay, but only for conformance with the design concept of the Project, and with the information given in the contract documents. The Architect's or Engineer's approval of a separate item shall not indicate approval of an assembly in which the item functions.
- 3.5.3 The Subcontractor shall make any corrections required by the Architect, Engineer or Principal Contractor, and shall resubmit the required number of corrected copies of shop drawings, or new samples, until approved. The Sub-contractor shall direct specific attention in writing on resubmitted shop drawings to revisions other than the corrections made by the Architect, Engineer or Principal Contractor on previous submissions.
- 3.5.4 Approval, comments, amendments or corrections on shop drawings by the Architect, Engineer and Principal Contractor are not intended to cause any variation in the cost of the work. Should such approval, comments, amendments, or corrections in the opinion of the Sub-Contractor, involve additional cost, the Sub-contractor shall notify the Principal Contractor in writing within seven days of receipt of such approval, comments, amendments and corrections and shall not proceed with such portion of the work until the Principal Contractor has obtained instructions from the Architect or Engineer to do so. In the event of notification of additional costs not reaching the Principal Contractor within the required seven days, no claims for such additional costs of work will be entertained.
- 3.5.5 The Architect's or Engineer's approval of shop drawings or samples shall not relieve the Sub-contractor of responsibility for erection or installation fit or for any deviation from the requirements of the Sub-contract unless the Sub-contractor has informed the Principal Contractor in writing of such deviation at the time of submission of shop drawings or samples and the Architect or Engineer has given written approval to the specific deviation, nor shall the Architect's or Engineer's approval relieve the Sub-contractor from responsibility for errors or omissions in the shop drawings or samples.

### 3.6 Drawings on Completion

- 3.6.1 The Sub-contractor shall, through the Principal Contractor, furnish the Employer and Engineer with a complete signed plastic transparent set of as-built drawings as a prerequisite to completion. The as-built set shall include all mechanical,

electrical and other work where applicable, and shall be prepared jointly by the Sub-contractors involved in any section of the Sub-contract or part thereof.

- 3.6.2 As-built drawings shall be up-dated as work progresses and all deviations in work as actually installed shall be recorded on these drawings.

## **4 EQUIPMENT INSTALLATION**

- 4.1 In preparing a design the Engineer will have contact with Suppliers of equipment to allow for such normal requirements with regard to equipment size, access for installation, access for maintenance, mass, electrical supply, safety precautions, etc, that Suppliers might have, in order to ensure proper installation and future safe and optimum operation of such equipment.

- 4.2 As the final selection of equipment is, however, in the hands of the successful Tenderer, and the contract for the supply of equipment is between the Sub-contractor and the Supplier, it shall be the Sub-contractor's responsibility to ensure that the equipment ordered will be suitable for the spaces in which it will be installed and that other influences shall not interfere with the safe and optimum future operation of such equipment. Particular attention must be given to the aspects of easy accessibility for maintenance and adjustment, and specific safety requirements of particular Suppliers.

- 4.3 Installation fit is an engineering function, and not a system design function. Tenderers shall price in their contract for the required engineering undertaken during the preparation of shop drawings in co-ordinating services to suit service spaces provided. Such engineering to include co-ordination with other Sub-contractors and shall take into account the Principal Contractors preferred services installation sequence programme.

### **4.4 Detail Selection of Equipment**

- 4.4.1 Within 6 weeks after acceptance of contract, submit to the Engineer for approval a complete list in quadruplicate, of materials and equipment that the Sub-contractor proposes to furnish, including manufacturer's catalogue information as to construction, capacity, materials, etc.
- 4.4.2 Within 2 weeks after approval of the above list, arrange for purchase and delivery of materials and equipment required, in ample quantities and at proper time, the

Employer reserves the right to purchase required materials and equipment and deduct the cost thereof from the contract sum, if the items are not on the job in time to expedite completion.

- 4.4.3 Materials of similar class or service shall be of one manufacture.
- 4.4.4 Capacities, sizes and dimensions given are minimum unless otherwise indicated.
- 4.4.5 Deliver and store manufactured materials in original containers, which shall indicate clearly the manufacturer's name, brand, and identifying number. Clearly mark or stamp with manufacturer's name and rating.
- 4.4.6 It is the Sub-contractor's responsibility to ensure that all materials and equipment provided are entirely suitable for the application. Materials and equipment which are not suitable for the application, or are not to the satisfaction of the Engineer, shall be replaced by materials and equipment which are suitable and which are to the satisfaction of the Engineer. All such replacement costs shall be for the account of the Sub-contractor.

## **5 OPERATING AND MAINTENANCE MANUALS**

5.1 The Contractor shall prepare and submit to the Engineer four complete copies of the comprehensive maintenance and operating manuals in the language of the tender documents for the services installed specified in this document.

5.2 One draft copy of the manuals shall be submitted to the Engineer at least two months prior to the programmed commissioning starting date, for his comments and approval.

5.3 Four copies of the final approved manuals shall be available prior to any taking-over inspections taking place.

5.4 The operating manual shall consist of the following sections:

- 5.4.1 Operations section covering all starting-up and stopping procedures.
- 5.4.2 Comprehensive data log sheets to be kept by the Owner.

5.5 The maintenance manual shall consist of the following sections:

- 5.5.1 General system description.
- 5.5.2 General controls description.

- 5.5.3 Schedule of plant and equipment listing all model numbers and optional extras and/or modifications included for. This schedule shall include all electrical loadings for the equipment.
- 5.5.4 All orifice plates, balancing valves, pumps, fans, coils, etc data.
- 5.5.5 Schematic wiring diagrams and equipment ratings.
- 5.5.6 Detailed monthly, three-monthly, six-monthly and yearly preventative maintenance instructions.
- 5.5.7 Commissioning data of all equipment and systems indicating in tabulated form the design requirements and the actual measured performance. This section to include size A4 paper, schematic drawings of air and water systems, listing design and actual flow quantities. Operating points for pumps and fans to be indicated on performance curves.
- 5.5.8 List of equipment suppliers with addresses and telephone numbers.
- 5.5.9 Spare parts list for all equipment.
- 5.5.10 Fault finding procedures.
- 5.5.11 Shop drawing schedule.
- 5.5.12 Coded equipment guarantees.
- 5.6 The maintenance and operating manuals shall be complete with an index and be bound in a suitably identified hard cover binder.
- 5.7 Two complete sets of folded paper prints of all shop drawings shall be submitted in box files together with the manuals described above. All drawings and files must be suitably indexed and identified.
- 5.8 The main distribution board electrical diagram, the chilled, hot and condenser waterflow diagrams and the controls schematic shall be suitably framed with perspex protection and be mounted in the main plantroom in a position approved by the Engineer.
- 5.9 The Contractor must allow to do tuition of the Client's personnel during the commissioning of the works. Additional tuition might be required and as specified in Part V or as later instructed. Tuition must be done by a person suitably qualified to explain in detail the functioning of system and equipment. The complete manuals must be used during such tuition periods.

- 5.10 The Contractor shall operate the works and be responsible for all maintenance and for consumable materials required for maintenance from the time the installation is scheduled for operation until the system is handed over to the Owner. During this period the works must be kept in good running order.
- 5.11 The Contractors must allow for 12 months' free maintenance after handover and shall visit the works and carry out the maintenance to the schedules prescribed by the suppliers or as specified in Part IV.
- 5.12 The Contractor shall be responsible for all consumable materials required during the free maintenance period.

## **6 TAKING OVER TESTS AND INSPECTIONS**

### **6.1 General**

- 6.1.1 The Engineer will prescribe the methods of testing, the type of data to be recorded and may elect to have such testing or part thereof supervised by an independent body or institution.
- 6.1.2 Except where otherwise provided in the Sub-contract, the Sub-contractor shall provide all labour, materials, fuel, filters and accessories and properly calibrated and certified instruments necessary for carrying out all tests. Power and water for carrying out tests on site will be provided by the Principal Contractor or Employer provided that such tests are not unduly prolonged by the Sub-contractor.

### **6.2 Testing**

- 6.2.1 Water piping shall be tested with water pressure of not less than 700 kPa or 1,5 times the maximum working pressure, whichever is greater, at the lowest point in the system. Care shall be taken to avoid putting excessive pressures on mechanical seals, safety devices, etc. The system shall be filled and all air vented at least 24 hours before the actual test pressure is applied. Test pressure shall be applied when water and average ambient temperatures are approximately equal and constant. The pressure shall be maintained for not less than 30 minutes without appreciable drop after the force pump has been disconnected. Leaks in screwed fittings shall be corrected by remaking the joints. Leaks in welded joints

- shall be cut out and rewelded. Caulking of leaks will not be permitted. The test must be witnessed by the Engineer.
- 6.2.2 Where the Engineer is to witness tests, the Contractor shall ensure that the Engineer receives one week's prior notice in writing before such tests commence. Tests to demonstrate the capacity specified and general operating characteristics of all apparatus, etc, shall be made under the direction of the Engineer at time of final inspection under conditions imposed by him.
- 6.2.3 All field assembled refrigeration piping and apparatus shall be pressure tested in accordance with the stipulations of the American Standard Safety Code for Mechanical Refrigeration.
- 6.2.4 Capacities of refrigerating machines, cooling towers, pumps, heating and cooling coils, fans and other equipment shall be determined by operating tests of not less than 4 hours duration, after stable conditions have been established. Test procedures shall be in accordance with applicable portions of ASME and other generally recognised test codes as far as field conditions permit. The tests must be witnessed by the Engineer.
- 6.2.5 Water quantities shall be ascertained by means of a manometer measuring pressure drops across balancing valves or orifice plates.
- 6.2.6 Water quantities read from pump curves shall not be used for determining capacities.
- 6.2.7 Temperature differences required for determining capacities shall be measured by thermometers having graduations that permit interpolations having an accuracy of plus or minus 0,1 oC.
- 6.2.8 Air quantities may be measured by pitot tubes, anemometer or velometer, depending on the velocity and other conditions of flow.
- 6.2.9 Sound tests to demonstrate compliance with sound guarantees shall be made at locations selected by the Engineer.
- 6.2.10 Sound levels shall be measured with a sound meter complying with the latest American Standards Association. The A scale shall be used for overall sound level readings. Where sound levels are specified in octave bands, the above sound level meter shall be supplemented by an Octave Bank Analyzer complying with the latest American standards Specifications for an Octave Bank Filter Set No Z24.10, published by the ASA.

- 6.2.11 The Subcontractor shall provide all labour and supervision required for such operation and the Engineer may assign operating personnel as observers but such observation time shall not be counted as instruction time.
- 6.2.12 Test instruments shall be tested for accuracy by an approved laboratory or by the manufacturer, and certificates showing degree of accuracy shall be furnished to the Engineer.
- 6.2.13 If gauges, thermostats, etc, which are to be left permanently installed are used for tests, they shall not be installed until just prior to the tests to avoid possible changes in calibration.

## **7 COMPLETION OF WORKS**

- 7.1 The Sub-contractor Works or any portion thereof shall be considered complete when:
- 7.2 The Engineer has certified that the following has been carried out in accordance with the Sub-contract agreement.
  - 7.2.1 Physical completion has been reported to the Engineer and all defects made good and the Engineer has given approval for start up. Physical completion shall include all builders' work, by other trades, associated with this installation. It is the Sub-contractor's responsibility to ensure that all such builders work is completed.
  - 7.2.2 Start-up has taken place.
  - 7.2.3 The Engineer has issued the handing over certificate, accepting the plant and equipment.
  - 7.2.4 As-built drawings have been handed over to the Principal Contractor and have been accepted by the Engineer.
  - 7.2.5 Operating and Maintenance manuals have been accepted by the Engineer.
  - 7.2.6 All measurements necessary to prepare the final account have been established.
  - 7.2.7 A complete list of claims for any extras, if any, has been submitted to the Engineer through the Principal Contractor complete with supporting documentation and agreed to by the Engineer and Principal Contractor.

- 7.2.8 When the Principal Contractor has certified that the Sub-contractor has removed from the site or portion thereof all his plant, equipment and temporary installations and all materials unused.



## **PART IV.02**

### **STANDARD SPECIFICATION FOR FIRE PROTECTION MARKING AND SIGNPOSTING**

#### **1 NOTICE**

1.1 This specification forms part of a specific tender document and is supplementary to all other mechanical standard specifications and must be read with the other relevant parts.

1.2 Where reference is made to the Contractor or Sub-Contractor, it shall be read to mean the successful Tenderer appointed to execute the contract specified in the detail specification.

#### **1.3 STANDARD MEASURES**

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

#### **2 MATERIALS AND WORKMANSHIP**

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

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

2.2.1 The National Building Regulations and Building Standards Act No. 103 of 1977 as amended in 1984 and all amendments thereafter.

2.2.2 The latest revision of SANS documentation:

- SANS 10400 Part T: The Application of the National Building Regulations.
- SANS 1186: Symbolic Safety Signs (Parts 1 through 5)
- SANS 1464 Part 22: Safety of Luminaires: Luminaires for emergency lighting

2.2.3 The Occupational Health and Safety Act of 1985 (OHS Act).

2.2.4 Any other relevant by-laws of local or other authorities.

2.3 All apparatus, components parts, fittings and materials supplied and/or installed whether especially specified herein or not shall conform in respect of quality manufacture, tests and performance with the requirements of the appropriate current South African or British Standard Specifications and Addenda thereto, except where otherwise

required by this specification or permitted by approval of the Engineer in writing. All materials and workmanship which may, in the opinion of the Engineer, be inferior to that specified for the work will be condemned. All condemned material and workmanship must be replaced or rectified as the case may be, to the satisfaction of the Engineer.

- 2.4 No second hand equipment of any description may be offered for supply in this contract.
- 2.5 Any fitting or item of equipment not specifically mentioned but obviously necessary for the successful operation or completion of the installation is to be included so as to form a complete working installation.
- 2.6 The Contractor shall, upon request by the Engineer to do so, or, where specified in the Detailed Specification, submit samples of materials for approval before such material is actually installed. The Engineer may retain these samples until the completion of the service.

### **3 DRAWINGS**

#### **3.1 Types of Drawings**

The following types of drawings, if asked for by the DETAIL TECHNICAL SPECIFICATION, shall be submitted to the Engineer.

##### **3.1.1 Tender Drawings**

The positions of all equipment shown on the drawings are approximate and are to be checked on site by the Contractor before manufacture or installation. Reference should be made to the Engineer should any doubt arise, as no extras will be allowed for alterations due to work being put in hand before verification.

To enable him to estimate the cost of the works shown, the Tenderer shall also inspect the Architect's drawings, structural drawings and Engineer's drawings for other services as well as the drawings for other services that will require co-ordination for installation purposes, and shall make the necessary allowance in his tender price for all additions and omissions which might occur through his participation in the preparation of his sub-contractor's drawings for the works.

##### **3.1.2 Contractor's Drawings**

These drawings are to be prepared by the Contractor at his expense in accordance with this document and be on a scale of not less than 1:50.

These drawings shall consist of:

#### Builder's Work Drawings

If applicable, these shall indicate all work to be done by others (bases, foundations, holes in concrete and masonry, etc) as well as the sizes, capacities and positions of service connections (electrical, water, drainage, etc) to be provided by others.

#### General Arrangement Drawings

These shall indicate all equipment, distribution systems, testing and inspection requirements as well as instrumentation positions and access requirements.

During their preparation, the Contractor shall take cognizance of all relevant architectural, structural, electrical and other services drawings in order to properly co-ordinate his layout. These drawings will be obtained via the Engineer. The drawings shall be amended as required during the contract period, and up to date copies kept on site.

#### Shop Drawings

These shall be based on the General Arrangement drawings, and shall show in detail the construction of all the parts of the works, method of assembly where applicable, erection and construction, materials and material thickness, finishes, supports and anchors, joints, connections, welds, gaskets, sealants, fastenings, reinforcing and all other necessary detail.

#### As-Built Drawings and Wiring Diagrams

These are up-to-date approved drawings at the completion of the contract. Tenderers shall allow in their price for submitting to the Engineer a sepia, or recognized original format of each of the up-to-date general arrangement, shop drawings, as well as electrical, hydraulic and pneumatic drawings which will form part of the operating and maintenance manual sets as described in the detail technical specifications.

### 3.1.3 Submission of Contractor's Drawings

Drawings shall be submitted to the Engineer in orderly fashion commencing within the following time limits or as determined by the main contract program:

Builders work drawings	:	within 2 weeks of tender acceptance
General layout drawings	:	within 4 weeks of tender acceptance
Shop drawings	:	within 6 weeks of tender acceptance
Electrical drawings	:	within 6 weeks of tender acceptance

By submitting drawings, the Contractor represents that he has determined and verified all site measurements, site instruction criteria, materials, catalogue numbers and similar data, interfaces, or will do so, and that he has checked and co-ordinated each of his drawings with the requirements of the works and the contract documents, taking into account drawings of all other relevant disciplines.

At the time of submission the Contractor shall inform the Engineer in writing of any deviation in the Contractor's drawings from the requirements of the sub-contract documents.

The Engineer will review and approve drawings with reasonable promptness so as to cause no delay, but only for conformance with the design concept of the contract works and with the information given in the contract documents.

After scrutiny the Engineer may at his discretion and depending on the number of discrepancies, require amendment and re-submittal prior to approval. Drawings shall be re-submitted until approved prior to any portion of the works related to the drawings being commenced.

Should the Contractor, during drawing amendment, alter any portion of his drawings not specifically required by the Engineer, he shall point this out in writing when submitting the drawing.

Approval of the Contractor's drawings in no way indemnifies him from being responsible for the correctness of the drawings and satisfactory operation of the installation.

#### **4 SITE CONDITIONS**

It is the responsibility of the Tenderer to visit the site during tender phase and to familiarize himself with conditions related to it. If the location of the site is not indicated in the Detail Specification, it can be obtained from the Engineer. No claim for additional payment related to ignorance of site conditions will be accepted. By submitting a tender it is accepted that the

Tenderer is fully aware of all site conditions as well as the access to it, and has allowed for this in his tender price.

## **5 DEVIATIONS FROM TENDER DOCUMENTS**

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

## **6 VARIATION ORDERS**

The Contractor shall not perform any work in addition to the contract works defined in the tender document for which additional remuneration shall be sought unless he has received written instructions in this regard from the Engineer.

## **7 PROGRAMMING OF WORK**

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

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

## **8 INFORMATION REQUIRED**

The Tenderer's attention is drawn to the fact that it is essential that the Schedules of Information listed in this document are completed in full. Failure to do this may at the discretion of the Engineer, result in disqualification of his tender. In any event, should such schedules not be completed, the tender shall be deemed to be entirely to specification.

## **9 INSTRUCTIONS AND SIGNS**

All instructions and signs provided, together with technical instruction manuals, shall be in English.

## **10 INSPECTION CERTIFICATES**

It is a requirement that suppliers of signage equipment inspect their equipment once installed, and provide the Contractor a 12 month's guarantee, as well as written confirmation

of acceptance of the installation of the equipment in the system, and the correctness of all electrical connections.

## **11 SPARE PARTS AND AGENCIES**

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

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

In deciding tenders, consideration may be given not only to the cost of the equipment offered, but also to the cost of the spares.

## **12 TOOLS**

All special tools required, i.e. tools specially designed for the particular equipment offered, must be supplied and listed in the tender offer and included in the unit price.

Tenderers shall state what general-purpose tools and equipment are considered necessary, and whether these tools are supplied.

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

## **13 ERECTION OF EQUIPMENT**

Tenderers are to allow for everything required to form the complete installation, including the provision of mobile cranes, air compressors, lifting tackle, measuring equipment, precision levels, and all other special or regular tools and equipment that may be needed to complete the entire installation in accordance with this specification, and to the satisfaction of the Engineer.

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

## **14 PACKING OF EQUIPMENT**

Only signs of the same type designation, material and size shall be packed together. The front of each sign shall be covered with a suitable material and the signs shall be so packed as to ensure that they are not damaged during normal handling, transportation and storage.

## **15 ASSEMBLY OF COMPONENTS**

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

## **16 TESTING**

### **16.1 Testing**

Visually examine and then measure each sign in the sample for compliance with all the appropriate requirements contained in the Project Specifications and drawings.

Should undue problems be encountered at any time, the Contractor may be requested by the Engineer to obtain the services of a specialist or representative of the manufacturer of specified items of equipment, at no cost to the Owner.

The following will be tested in accordance with SANS 1186:

- Test for chromaticity and luminance factor
- Resistance to immersion in water
- Resistance to artificial weathering
- Test for chromaticity co-ordinates and luminance factor: Use a spectrophotometer or another equally suitable colour measuring device to determine the chromaticity co-ordinates and the luminance factor of each colour on the sign in accordance with the method given in CIE publication 15.2 (E-1.3.1) and in CIE publication 54.2, using standard illuminant D65 and 45/0 geometry.
- Test for luminance decay of photoluminescent materials

### **16.2 Failure of Works or Tests**

Should the Engineer be notified to attend official tests as laid down, and should the equipment fail the tests for any reason whatsoever, such that the Engineer is

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

#### 16.3 Quality Testing of Equipment

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

#### 16.4 Inspection during Manufacture

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

#### 16.5 Testing

The Contractor shall be responsible for carrying out all tests laid down in the specific sections as specified in the SANS 1186 documentation.

#### 16.6 Test Certificates

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



## **PART IV.09**

### **STANDARD SPECIFICATION FOR PROTECTION, CLEANING, ADJUSTMENTS, COMMISSIONING, TESTS AND MAINTENANCE MANUALS**

#### **1 PROTECTION AND CLEANING**

The Contractor shall take all reasonable precautions to protect equipment and materials installed under this contract against damage by other trades from delivery to site to handover.

Equipment delivered to site shall be suitably crated, which protection shall only be removed once equipment can be moved into a protected storage area.

If equipment cannot be stored in an enclosed storage area, then a PVC covering of sufficient strength shall be wrapped around the equipment to eliminate the ingress of moisture and dust. This covering shall be kept in an acceptable condition until the equipment can be moved into a secure and protected area.

Internally insulated ducting shall not be stored in the open and shall be stacked in such a way that internal insulation cannot be damaged. Any damaged insulation shall be rectified to the satisfaction of the Engineer prior to the installation of such ducting.

Ducting and piping, installed in positions where it is possible that rubble, water, etc, can enter the ducting and piping prior to completion of the duct or pipe system, shall be properly capped with heavy gauge sheet metal fixed to the duct or pipe, and only be removed for the purposes of completing the system.

Installation of equipment and materials shall be programmed in such a manner, whilst taking due consideration of the installation of other services and the completion of construction work so as to protect the equipment and materials against possible damage.

Damaged equipment and materials shall be rectified to the satisfaction of the Engineer so as to be equivalent to that of the new undamaged product. All damaged surfaces must be repainted to the satisfaction of the Engineer.

Equipment and materials shall be properly cleaned and treated to accept paintwork specified under Part IV.56 of this specification.

The Contractor shall continuously remove rubble resulting from his sub-contract so as to keep the working space in a tidy and neat condition until handover.

Ducts and apparatus casings shall be thoroughly cleaned before fans and filters are put into operation.

Water piping systems shall be thoroughly flushed and drained to remove dirt and loose scale prior to chemical treatment and testing of the equipment. Water strainers shall be regularly removed and cleaned during commissioning until the water system is in a satisfactory clean condition.

Surface conduits and pipe work on floors of service areas must be suitably protected during the construction time to prevent damage to protective surfaces as a result of people and equipment moving in and out of such areas.

Storage areas must be kept clean and tidy and excess combustible and other packing materials must continuously be removed from such rooms.

## **2 ADJUSTMENTS AND COMMISSIONING**

Commissioning of equipment and systems shall not be undertaken if damage to the equipment, systems or the building could result due to incomplete and incorrect installation work.

Commissioning procedures as stipulated by the suppliers of equipment shall be strictly adhered to.

The entire control systems shall be adjusted and placed into operation by the control system specialist contractors. Re-adjustments necessary to accomplish the specified results shall be carried out at no additional cost during commissioning and up to formal handover to the Employer.

The commissioning of specialised equipment such as centrifugal refrigeration machines, boilers, vacuum pumps, air compressors, etc, shall be undertaken by approved specialist and/or specialist contractors.

Water circulating systems shall be adjusted and balanced so that water quantities circulated through condensers, coolers, coils, towers, etc. will be as specified. Tolerances of -5% and +10% would normally be acceptable but should be clarified with the Engineer in writing prior to commissioning.

Air duct systems shall be adjusted and balanced so that air quantities at outlets are as specified and so that distribution from supply outlets is free from drafts and uniform over the face of each outlet.

The entire air distribution system shall be adjusted and balanced in accordance with SABS-0173-1980.

Air quantities specified for fans include for duct leakage of 2,5%. The sum of air quantities of all outlets would normally be acceptable at a tolerance of -5% and +10% of that specified for the fans.

The air quantities at individual outlets in a single space would normally be accepted at a tolerance of -10% and +15%, as long as the total air supplied to that space is within a tolerance of -5% and +10%.

Water and airflow quantities shall not be reduced by artificially increasing the system's resistance by more than 3% of the total system resistance.

Chilled water systems shall be fully commissioned and adjusted to the design flow requirements, shall be free of air and excessive dirt and shall have the specified water treatment in working order before refrigeration equipment is commissioned.

Chilled water, hot water and condenser water systems shall not remain in operation for a period of more than 7 days without the specified water treatment systems being in a proper functioning condition.

If the Contractor should fail to comply with the above requirement, then the Contractor shall at no extra cost to the contract open up all heat exchanging equipment and clean out to the satisfaction of the Engineer.

All safety protection systems shall be fully commissioned and set points properly checked and adjusted before equipment shall be allowed to run for commissioning purposes. The responsible commissioning engineer shall be present to supervise the operation and adjustment of the equipment during the entire commissioning stage.

Water flow quantities shall be determined by a combination of the following:

- Pressure differential over-heat exchanging equipment

- Orifice plates
- Calibrated balancing valves
- Pressure differential over pump
- Pump power consumption

Airflow quantities shall be determined by a combination of the following:

- Airflow reading over filter or damper
- Airflow reading over coil
- Pressure differential over fan
- Main supply air duct pitot tube reading
- Diffuser or supply air grille quantities measured with an adapter base fitted over the outlets
- Fan power consumption

All instrumentation required to measure flows as per 80.2.11 and 80.2.12 above shall be provided by the Contractor.

All commissioning data shall be fully tabulated in conjunction with the design data and submitted to the Engineer prior to any performance inspections being carried out by the Engineer.

Measured and design air quantities shall be shown on schematic duct drawings prepared on a size A4 paper. In the case of variable volume systems, the measured flow rates for maximum conditions shall be indicated. The minimum condition shall be indicated for the overall system to verify fan performance.

### **3 TESTS**

Where the Engineer is to witness tests, the Contractor shall ensure that the Engineer receives one week's prior notice in writing before such tests commence. Tests to demonstrate the capacity specified and general operating characteristics of all apparatus, etc. shall be made under the direction of the Engineer at time of final inspection under conditions imposed by him.

All field assembled refrigeration piping and apparatus shall be pressure tested in accordance

with the stipulations of the American Standard Safety Code for mechanical refrigeration.

Field assembled refrigerating equipment shall be tested under vacuum and shall show no evidence of leakage with an absolute pressure of 5 mm mercury, sustained for a period of one hour without pumping.

Leaks in pipe joints shall be corrected by remaking the joints. Caulking will not be permitted.

The vacuum test shall follow the pressure test. Charging of the equipment with refrigerant shall follow the vacuum test as closely as is practicable to minimise the possibility of air or moisture being returned to the system. After charging and prior to capacity tests, joints in refrigerant piping and apparatus shall be checked with a halide torch or other equally sensitive leak detector. If leaks are found, the system shall be pumped down and the leaks corrected as specified above. The test must be witnessed by the Engineer.

Water piping shall be tested with water pressure of not less than 700 kPa or 1,5 times the maximum working pressure, whichever is greater, at the lowest point in the system. Care shall be taken to avoid putting excessive pressures on mechanical seals, safety devices, etc. The system shall be filled and all air vented at least 24 hours before the actual test pressure is applied. Test pressure shall be applied when water and average ambient temperatures are approximately equal and constant. The pressure shall be maintained for not less than 30 minutes without appreciable drop after the force pump has been disconnected. Leaks in screwed fittings shall be corrected by remaking the joints. Leaks in welded joints shall be cut out and re-welded. Caulking of leaks will not be permitted. The test must be witnessed by the Engineer.

Compressed air piping (except low pressure control piping) shall be tested at not less than 1000 kPa. This pressure shall be maintained for one hour without pumping. A correction of the final pressure of not more than 12,5 kPa for each 3°C change in average ambient temperature during the test will be permitted. Leaks shall be corrected as specified for water piping. The test must be witnessed by the Engineer.

Low pressure temperature control air piping shall be tested with 200 kPa air pressure. This pressure shall be maintained for one hour without pumping, during which time the pressure shall not drop more than 7 kPa. A correction of the final pressure of not

more than 3,5 kPa for each 3°C change in average ambient temperature during the test will be permitted. Leaks shall be corrected by remaking the joints. Caulking will not be permitted. The test must be witnessed by the Engineer.

Capacities of refrigerating machines, cooling towers, pumps, heating and cooling coils, fans and other equipment shall be determined by operating tests of not less than 4 hours duration, after stable conditions have been established. Test procedures shall be in accordance with applicable portions of ASME and other generally recognised test codes as far as field conditions permit. The tests must be witnessed by the Engineer.

#### Testing of Ducts

All medium and high pressure air ducts shall be tested in accordance with SABS-0173-1980.

The Contractor shall include for blank-off plates to isolate the main supply duct system from the branch ducts for test purposes. The complete main supply duct system shall be tested.

The Contractor shall provide the required test fan and approved instrumentation and the tests shall be witnessed by the Engineer.

The first completed branch duct from the main supply duct to the supply air diffusers shall be pressure tested while witnessed by the Engineer. The Contractor shall allow for the closing off of spigots.

All other branch ducts shall be visually inspected by the Engineer, and if found to be of the same standard of workmanship as the first branch duct tested and approved by the Engineer, no further testing will be done. If not, then the Contractor shall test such other supply ducts to the same standard (Clauses 80.3.10.1 and 80.3.10.4).

Ducts classified as "low pressure ducts" shall only be visually inspected by the Engineer.

All test instruments shall be provided by the Contractor.

Test instruments shall be tested for accuracy by an approved laboratory or by the manufacturer and certificates showing degree of accuracy shall be furnished to the Engineer.

Instruments and appliances required for tests shall be furnished by the Contractor. If gauges, thermometers, etc. which are to be left permanently installed are used for tests, they shall not be installed until just prior to the tests to avoid possible changes in calibration.

After completion, either in a part or as a whole, the complete installation shall be subject to acceptance tests by the Engineer. The Contractor must assist the Engineer during

any test carried out and must supply tools and instruments for testing purposes.

The Contractor must allow for reasonable assistance to the Engineer during the following inspections:

First physical and mechanical installation acceptance inspection. The completeness and correctness of the installation will be checked; all workmanship and materials will be checked for compliance with the specification.

Final physical and mechanical installation acceptance. The remedial work pointed out in 80.3.12.1 above will be checked. Any new items noticed will also be pointed out to the Contractor.

First performance acceptance inspection. The operation of all equipment in the installation will be checked.

Final performance acceptance inspection. The remedial work pointed out in 80.3.12.3 above will be checked. Any new items noticed will also be pointed out to the Contractor.

Handover inspection. The outstanding items in 80.3.12.1 and 80.3.12.3 will again be inspected. The Contractor will be given two weeks for remedial work and re-inspection.

Handover will be taken after this inspection only if the Engineer is satisfied that only minor items are outstanding.

Certificates confirming inspections and listing faults will be issued by the Engineer for every inspection held.

The Contractor must ensure that the installation is correct, complete and to specification before calling for an inspection.

The cost of any abortive inspections where the Engineer is called to site, but finds the Contractor ill-prepared for it, will be deducted from the contract price by variation order.

The Contractor shall provide a competent person to accompany the Engineer or his representative during inspections. This person shall know the installation, shall be in a position to accept and carry out instructions and shall take notes during the inspections so that the remedial work can commence immediately and is not held up while waiting for the inspection certificate.

The Contractor must replace any portion of the installation that does not meet with the requirements of this specification as may be imposed thereon by test or inspection. Such replacements shall be done at his own cost.

The stipulations of the Occupational Health and Safety Act, Act 85 of 1993, as amended, shall be fully complied with. The following clauses are specifically brought to the attention of the Contractor:

Driven Machinery Regulations. The following are some items covered by these regulations

- Fans
- Pumps
- Air compressors

Recording charts of all tests by Contractor must be submitted to the Engineer before applying for acceptance inspections.

The Contractor must preferably keep an inspection table of all tests to be witnessed and all inspections to be held by the Engineer.

The times and dates for tests and inspections must be agreed to by all parties after the receipt by the Engineer of the Contractor's written application for such tests to be witnessed or inspections to be held. Application for acceptance test can only be made when the Contractor is satisfied that the section for which application is being made complies fully with the specification.

The Contractor shall carry out all reasonable tests and measurements requested by the Engineer to prove that the system or parts thereof complies with the specification document.

The Engineer can request that any part of the system or the complete system be re-tested, recorded and measured as part of the acceptance inspections if there exists reasonable doubt about the accuracy of the test.

The actual performance of all outlet points on any water, gas, air or vacuum system must be proved by measurements when operating under design conditions.

#### **4 MAINTENANCE AND OPERATING MANUALS**

The Contractor shall prepare and submit to the Engineer four complete copies of the



comprehensive maintenance and operating manuals in the language of the tender documents for the services installations specified in this document.

One draft copy of the manuals shall be submitted to the Engineer at least two months prior to the programmed commissioning starting date for his comments and approval.

Four copies of the final approved manuals shall be available prior to any handover inspections taking place.

The operating manual shall consist of the following sections:

Operations section covering all starting-up and stopping procedures.

Comprehensive data log sheets to be kept by the Owner.

General system description.

General controls description.

Schedule of plant and equipment listing all model numbers and optional extras and/or modifications included for. This schedule shall include all electrical loads for the equipment.

All orifice plates, balancing valves, pumps, fans, coils, etc. data.

Schematic wiring diagrams and equipment ratings.

Detailed monthly, three-monthly, six-monthly and yearly preventative maintenance instructions.

Manufacturer's literature indicating lubrication points, lubricants to be used and other data related to Item 80.4.5.6 above.

Commissioning data of all equipment and systems indicating in tabulated form the design requirements and the actual measured performance. This section to include size A4 paper, schematic drawings of air and water systems, listing design and actual flow quantities. Operating points for pumps and fans to be indicated on performance curves.

List of equipment suppliers with addresses and telephone numbers.

Spare parts list for all equipment.

Fault finding procedures.

Shop drawing schedule.

Coded equipment guarantees.

The maintenance and operating manuals shall be complete with an index and be bound in a suitably identified hard cover binder.

Two complete sets of folded paper prints of all shop drawings shall be submitted in box files

together with the manuals described under 80.4.4 and 80.4.5 above. All drawings and files must be suitably indexed and identified.

In addition, one complete set of plastic sepia's of all shop drawings shall be submitted or alternatively on computer disk in a format to be specified by the Engineer.

The Contractor must allow to do tuition of the Client's personnel during the commissioning of the works. Additional tuition might be required and as specified in Part V or as later instructed. Tuition must be done by a person or persons suitably qualified to explain in detail the functioning of system and equipment. The complete manuals must be used during such tuition periods.

The Contractor shall operate the works and be responsible for all maintenance and for consumable materials required for maintenance from the time the installation is scheduled for operation until the system is handed over to the Employer. During this period the works must be kept in good running order.

The Contractors must allow for 12 months free maintenance after handover and shall visit the works and carry out the maintenance to the schedules prescribed by the suppliers or as specified in Part V.

The Contractor shall be responsible for all consumable materials required during the free maintenance period.

The Contractor must submit to the Engineer a quotation for a maintenance contract with the owner for the period after the specified 12 months free maintenance period. The proposal must include details of regular inspections and checks, rates and claims for payment.

Where required by the Occupational Health and Safety Act and Regulations (Act 85 of 1993), as amended, the Contractor shall provide all charts and logbooks properly bound and identified in such a manner that it is acceptable to the Inspector of Machines.

On completion of the Contract the Contractor shall provide the Engineer with the original signed copy of the certificate of the electrical compliance as required by the Department of Manpower.

**PART IV.72**

**STANDARD SPECIFICATION FOR**  
**FIRE HYDRANT, HOSE REEL INSTALLATIONS AND**  
**PORTABLE EXTINGUISHING APPLIANCES**

**1 .FIRE HYDRANT, HOSE REEL INSTALLATIONS AND PORTABLE EXTINGUISHING  
APPLIANCES**

**1.1 General**

- 1.1.1 The sub-contract shall allow for the complete supply, delivery, installation, testing, commissioning and handing over in working order of the specified installation and system in the building in such a way that the whole forms a complete working system without any further material, apparatus or labour being required to make it so. All work, labour, material and apparatus required for the completion of this sub-contract, whether specified, indicated on drawings or obviously required to be included in the sub-contract, shall be allowed for and shall form part of this sub-contract.
- 1.1.2 Each separate installation under this contract shall comply in all respects with the recommendations and regulations set out in the current editions of the following publications, together with such special requirements as described in these specification documents.
- 1.1.3 The Occupational Health and Safety Act and Regulations (Act 85 of 1993), as amended.
- 1.1.4 The Wiring of Premises, SABS 0142-1993, as amended.
- 1.1.5 The bylaws and regulations of the local authority for the particular area in which the building site falls.
- 1.1.6 National Fire Protection Association of the United States of America (for carbon dioxide fire extinguishing installations only).
- 1.1.7 SABS Code of Practice for the Application of the National Building Regulations, SABS 0400-1990, as amended.
- 1.1.8 Codes of Practice as compiled by the South African Bureau of Standards.

1.1.9 The Fire Prevention Section of the Department of Public Works. (Applicable only to contracts for the Department of Public Works.)

## 1.2 Erection

1.2.1 The installation must be erected and installed by specialists. Only specialist contractors who can prove that they have successfully completed similar installations will be considered.

1.2.2 Complete erection drawings and instructions must be made available to the Engineer for approval before the work is commenced.

1.2.3 The commissioning of the plant and systems is the responsibility of the sub-contractor. Within three weeks of the award of the sub-contract, the sub-contractor must furnish an erection programme showing how he proposes to complete the sub-contract within the period stated by him whilst working in close collaboration with the Principal Contractor, and clearly stipulating priority requirements.

## 1.3 Electrical

1.3.1 The electricity supply will be given at a voltage stipulated in Part V of this specification document. The sub-contractor must complete the installation to comply with the voltage, current requirements and frequency, as well as special stipulations with regard to the supply by the supply authorities.

1.3.2 All electrical work forming part of this sub-contract shall further comply with the requirements of the municipal authorities for the particular area and shall further be carried out in accordance with the standard regulations for the Wiring of Premises, SABS 0142-1993, as amended.

1.3.3 Detailed requirements for switchboards, wiring and control panels are described in this specification.

## 1.4 Painting

1.4.1 Refer to Part IV.56 of the Standard Specification.

1.4.2 Surface mounted conduits, which are visible in occupied areas of the building, shall be painted orange in colour.

- 1.4.3 All conduits in ceiling voids and building shafts shall be painted orange in colour.
- 1.4.4 The sub-contractor must ensure that conduit couplings and exposed threads and all other ferrous components of the installation which are unpainted or ungalvanised are thoroughly wire-brushed and cleaned free of dirt, scale, grease and rust, prior to painting with two coats of anti-corrosive paint.
- 1.4.5 The paintwork of all equipment and plant, which is damaged during the course of erection, and prior to acceptance must be satisfactorily made good by the sub-contractor.

## 1.5 Approvals

- 1.5.1 All the equipment offered shall have the full approval of all the following bodies:
- 1.5.2 Fire Prevention Section of the Department of Public Works. (Applicable only to contracts for the Department of Public Works.)
- 1.5.3 Fire Offices Committee, United Kingdom.
- 1.5.4 1th Edition 1973 Codes of Practice as compiled by the South African Bureau of Standards.
- 1.5.5 All the equipment offered must comply in every aspect with the officially approved standard samples. All tenderers must furnish documentary proof of their equipment approvals.

## 1.6 Operating Instruction Manuals, Maintenance Manuals, Wiring Diagrams and Control Diagrams

- 1.6.1 The sub-contractor shall submit to the Engineer for his approval a complete operating and maintenance manual. The manuals shall be complete with final as-built layout drawings, wiring diagrams, control diagrams and shall be made up as follows:
  - 1.6.1.1 System description.
  - 1.6.1.2 Detailed equipment description.
  - 1.6.1.3 Operating instructions.
  - 1.6.1.4 Trouble analysis procedures.

1.6.1.5 Preventative maintenance schedules.

1.6.1.6 Maintenance instruction for each item of equipment.

1.6.1.7 Recommended spare parts list and price list.

1.6.2 After approval of the documentation, the sub-contractor shall supply three complete sets of these documents, bound between hard covers, to the Engineer.

1.6.3 The installations shall not be accepted until the Engineer has approved the manuals.

1.6.4 Suitably framed operating instructions must be mounted on the wall adjacent to the main control unit. These instructions must be in all the official languages and must state clearly the procedure to be followed in the event of a fire or fault condition.

## 1.7 Block Plans or Identification Charts

Suitably framed zone plant charts of the installation, as approved by the Engineer, must be provided.

## 1.8 Tools

All special tools required which may be specially designed for the particular equipment offered must be supplied and included in the unit tender price.

## 1.9 Fire Hydrants

### 1.9.1 General

1.9.1.1 Fire hydrants are classified in two separate types, namely internal hydrants, which are situated within buildings, and outdoor hydrants, which are situated outside of buildings.

The two types of hydrants are specified under Clauses 72.9.2 and 72.9.3.

1.9.1.2 No pipes of less than 100 mm diameter must be used for hydrants, the only exception being short standpipes only, which may be 80 mm diameter.

1.9.1.3 The hydrants must be of a type approved by the local authority and must comprise a valve of 65 mm bore, constructed in gunmetal, screwed or flanged for attachment

to the riser and fitted with a 65 mm instantaneous female coupling which conforms to SABS 1128 (Parts 1&2)-1977, as amended.

The hydrant must be complete with fire hose couplings and ancillary equipment together with a blank cap secured by a suitable length of chain.

The valve must lift clear of the waterway and the valve cover must be securely fitted to the valve body so that it does not unscrew when operated.

The valve spindle must not be less than 22,2 mm diameter and fitted with a gunmetal handwheel of 150 mm diameter which must be marked "OPEN/OOP" - "SHUT/TOE".

The opening of the valve must be in an anti-clockwise direction. The entire hydrant construction must be robust and sound and must be hydraulically tested to a pressure of 2 070 kPa before being connected to the rising main.

1.9.1.4 All fire hydrant valves must be of an approved manufacture.

## 1.9.2 Internal Hydrants

1.9.2.1 Hydrant outlets must be installed approximately 0,76 m above floor level and shall be as described under Clauses 72.9.1.2 and 72.9.1.4.

1.9.2.2 Where outlets are required to be recessed into walls in a duct or alcove, the opening must give not less than 150 mm clearance on both sides and below the valve and not less than 200 mm clearance above the handwheel.

The depth of the opening must not be greater than is necessary and in no case should the front edge of the female coupling be more than 75 mm behind the face of the wall.

The openings must be fitted with a hinged door, the lock of which should be spring-loaded so that in an emergency, if the key is not available, the door can be opened from the inside after the glass has been broken. If this is not practicable, each outlet must be kept strapped shut, the strap being secured by means of a padlock.

If a glazed door is provided, this should be conspicuously indicated by the words "Fire Brigade - Dry Main" or "Fire Brigade - Wet Main", as the case may be, in black letters on the inner face of the glass, or a notice in similar terms must be provided above or immediately adjacent to the outlet where it is not enclosed. These notices must be in the official languages.

### 1.9.3 Outdoor Hydrants

#### 1.9.3.1 Mains

Outdoor hydrants shall be as described under Clauses 72.9.1.3 and 72.9.1.4.

The hydrants can be installed either above or underground on permanently charged mains.

The internal diameter of mains shall be normally 100 mm or 150 mm, depending on the size of the municipal main to which they are connected.

### 1.10 Fire Hydrant Fire Hose

#### 1.10.1 Jacket Construction

1.10.1.1 A circular woven jacket with all synthetic fibres. The warp to consist of filament yarns for maximum strength and stape yarns for maximum abrasion resistance.

1.10.1.2 The waft to consist of synthetic fibres giving maximum strength to the bursting pressure of the hose.

#### 1.10.2 Rubber Lining

A latex reinforced rubber lining is required. If the hose jacket is damaged right through to the rubber lining, the lining must still be capable of withstanding a pressure of 1 030 kPa without any effect. This lining must be completely uniform in thickness throughout the length of the hose.

#### 1.10.3 Plastic Coating

The hose must have an impregnated PVC coating giving superior abrasion resistance to the hose and making it maintenance free. The coating will prevent the hose from any effect by mildew and will give strong external protection against oils, greases and chemicals, etc. The coating must be evenly applied with no varying thickness' along the whole length of the hose.

#### 1.10.4 Coil Diameter (without couplings)

44,5 mm - 30 m lengths not to exceed 47 cm

63,5 mm - 23 m lengths not to exceed 44 cm



#### 1.10.5 Coil Weights (without couplings)

44,5 mm - 30 m lengths not to exceed 8,3 kg

63,5 mm - 23 m lengths not to exceed 11,5 kg

#### 1.10.6 General

1.10.6.1 The hose to be lightweight, easy to handle and very durable.

1.10.6.2 A full 30 m length is required as a sample of the 44,5 mm hose and a 23 m length of the 63,5 mm hose. No couplings need to be fitted. This is so that weights and dimensions can be checked.

#### 1.11 Fire Hose Reels

1.11.1 All reels for hoses must comply with the SABS Standard Specification 543-1992 as amended.

1.11.2 The fire hose reels are to be of the non-swinging rotary pattern type suitable for mounting on vertical surfaces in hose reel cupboards and situated in positions as indicated on the relevant drawings.

1.11.3 The sides of the hose reels are to be constructed of pressed steel discs of not less than 0,889 m diameter. The steel disc pressings shall incorporate a rolled edge for strength. Any additional pressed strengthening ribs may be included if desired.

1.11.4 The hose reels shall be finished in fire brigade red.

1.11.5 The water inlet connections to the hose reels must be fitted with a 25 mm valve of the screw-down pattern type, using a leather washer seat to effect the actual shut-off of the water supply.

Rubber compound washers may be offered for consideration. The valve seat washers must be easily replaceable.

1.11.6 The screw thread of the water inlet connections is to be standard female pipe thread.

1.11.7 The hand wheels of the hose reel inlet valves are to be of the solid disc type and shall be chromium plated. The handwheel shall be clearly engraved in red with an arrow, which indicates the direction of operation in an open position and the words "OPEN/OOP shall also be clearly engraved on the handwheel. The wording must be as large as possible.

1.11.8 Each hose reel must be provided with a 30 m long (unless otherwise stated on the Architect's drawings) rubber or reinforced plastic hose of not less than 20 mm internal diameter.

1.11.9 Each hose reel shall be provided with a nozzle, which must be fitted to the 20 mm diameter hose. The nozzle unit must be complete with a ball type valve with a tip and tail as detailed on the drawings.

#### 1.11.9.1 Nozzle Valve

The valve is to be of the ball type rotating around the spindle within approved valve seats, which will always form a seat irrespective of whether the valve is opened or closed. The ball shall be of the highest quality brass and shall be precision machined to form a watertight seal against the surface of the seat. The valve must be capable of withstanding a hydraulic test pressure of 2 000 kPa.

#### 1.11.9.2 Nozzle Valve Spindle

The valve spindle shall fit with a loose joint into the ball and must be manufactured of non-corrosive material. Provision shall be made for the necessary washer. "O" rings or pressure plates for water sealing purposes.

A "tee" type handle must be provided which shall be permanently fixed to the spindle. The spindle and spindle housing shall be designed to enable the spindle to be restricted to a 90° turning movement from the open to the closed position.

#### 1.11.9.3 Nozzle Valve Body

The body of the valve nozzle tip and tail shall be of brass or aluminium, machined or die-cast with acceptable smooth surfaces.

The body of the valve must be constructed in two halves which shall be joined together with bolts and nuts.

The tip and tail may be threaded to screw into the valve body or alternatively they may be machined or cast to form part thereof.

1.11.10 Each complete nozzle unit must be supplied with a flat metal screw type hose clamp. The clamp must be robustly constructed so that it will compress the rubber or plastic hose into serrations which are provided on the tail piece to form a sound and leakproof joint against an operating water pressure of 700 kPa, and shall further be suitable to withstand a static water pressure of 1 500 kPa.

### 1.12 Air Vessels

Each water rising main shall be fitted with an air vessel of 305 mm in diameter by 1 500 mm long. Each air vessel shall be fitted with a 20 mm air release valve.

The air vessels shall be fitted to the highest point of the hydrant water risers in positions as indicated on the drawings.

### 1.13 Portable Fire Extinguishing Appliances

All portable fire extinguishing appliances will comply with the following:

- Dry powder type extinguishers - SABS 80-1992 as amended
- CO2 type extinguishers - SABS 1567-1992 as amended
- Water type extinguishers - SABS 889-1992 as amended

The transfer on the body of the appliance will give clear instructions in English on how to operate the appliance in the case of fire.

**PART V**

**PROJECT TECHNICAL SPECIFICATION**

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## 1. GENERAL

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

## 2. APPLICABLE DOCUMENTS AND DRAWINGS

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

- General Technical Specification
- Project Technical Specification
- Schedules of Materials and Equipment Offered
- Bills of Quantities

### 1.1. LIST OF SPECIFICATIONS

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

### 1.2. SANS SPECIFICATIONS

SANS 11200	Standardized Specifications for Civil Engineering Construction
SANS 10400	The application of the National Building Regulations
SANS 11200 HC	Corrosion protection of structural steelwork
SANS 11091	National colour standards for paint
SANS ISO 11461	Hot-dip galvanized coatings on fabricated iron and steel articles – Specification and test methods.
SANS ISO 13575	Continuous hot-dip zinc-coated carbon steel sheet of commercial, lock forming and drawing qualities
SANS 10214	The design, fabrication and inspection of articles for hot-dip galvanising
SANS 10103	The measurement and rating of environmental noise with respect to annoyance and speech communication
SANS 1186-1	Symbolic safety signs – Part 1: Standard signs and general requirements.
SANS 1475-2	The production of reconditioned fire-fighting equipment – Part 2: Fire hose reels, hydrants and booster connections.
SANS 9227/ISO 9227	(SABS ISO 9227), Corrosion tests in artificial atmospheres – Salt spray tests.
SANS 200	Copper alloy ingots and castings.

SANS 665-1	Wedge gate and resilient seal valves for general purposes – Part 1: General. Amdt 1
SANS 1109-1/ISO 7-1	Pipe threads where pressure-tight joints are made on the threads – Part 1: Dimensions, tolerances and designation.
SANS 1128-2	Fire fighting equipment – Part 2: Hose couplings, connectors and branch pipe and nozzle connections.
SANS 1700	Fasteners (all parts).
SANS 1700-20-2/ISO 261, Fasteners – Part 2: Screw threads – Section 2: ISO general purpose metric screw threads – General plan. Amdt 1	
SANS 4633/ISO 4633	Rubber seals – Joint rings for water supply, drainage and
SANS 10252-1	Water supply and drainage for buildings: Water supply installations for buildings
SANS 10139	Fire detection and alarm systems for buildings — System design, installation and servicing

### 1.3. BS SPECIFICATIONS

BS 10	Specification for flanges and bolting for piping, valves and fittings.
BS 5000-99	Machines for miscellaneous applications.

### 1.4. OTHER SPECIFICATIONS

ACT 45	Atmospheric Pollution Prevention Act.
ACT 103	National Building Regulations and Building Standards.
OHS ACT	The Occupational Health and Safety Act, Act 85 of 1993.
EN 1092-1	Flanges and their joints – Circular flanges for pipes, valves, fittings and accessories, PN designated – Part 1: Steel flanges.
EN 1092-2	Flanges and their joints – Circular flanges for pipes, valves, fittings and accessories, PN designated – Part 2: Cast iron flanges.
EN 1561	Founding – Grey cast irons.
EN 12163	Copper and copper alloys – Rod for general purposes.
EN 12165	Copper and copper alloys – Wrought and unwrought forging stock.
EN 694	Fire-fighting hoses – Semi-rigid hoses for fixed systems.

### 1.5. THE ENGINEER'S DRAWINGS

**Table 1 – List of Drawings applicable**

Drawing Number	Description
F-100	Fire Water Layout
F-101	Fire Protection Layout

F-102	Fire Signage Layout
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### 3. SCOPE OF SUBCONTRACT AND SYSTEM DESCRIPTION

- 3.1. SARS is upgrading their warehouse in Musina. The fire protection equipment on site need to be moved to the new positions, as well as new equipment bought.

The site buildings consist of the following facilities:

- Warehouse building
- Office building

- 3.2. The scope of this subcontract includes the engineering, drawings, manufacture, supply, delivery, installation, testing, commissioning, handing over, contract guarantee, servicing and maintenance of the Fire Protection Equipment as specified in this document and the attached drawings.

- 3.3. The new fire protection equipment installation shall comply with the National Building Regulations and Building Standards Act, 1977 (as amended) and SANS 10400 (as amended) and all applicable documentation.

- 3.4. The fire protection equipment installation contract consists of the following:

- a) Installation of non-swing type 30m fire hose reels and associated piping and valves,
- b) Installation of portable fire extinguishers and purpose made boards,
- c) Installation of fire signage,

- 3.5. Compilation and submittal of new Operation and Maintenance Manuals including maintenance schedule.

- 3.6. The Tenderer shall include in his tender prices for the supply, fitment and painting of all the supports and brackets within the relevant equipment prices as the supports are not billed.



## **4. GENERAL REQUIREMENTS**

### **4.1. Water Supply**

The water supply is currently on site, and will be connected into as shown on the drawings. The exact position of all tie-in points will be determined on site.

### **4.2. Site supervision by Subcontractor**

This installation will be a subcontract and all site supervision and management will be the responsibility of the Subcontractor appointed in terms of this specification.

### **4.3. Submissions by Subcontractor**

#### **4.3.1. Submissions with regard to equipment**

- a) The Subcontractor should take note that all equipment selections approved (or not rejected) by the Engineer shall not free the Subcontractor to comply with the specification.
- b) The following information with regard to equipment selections shall be submitted to the Engineer before ordering and installation:
  - Manufacturer name and model
  - Diagrams, tables and graphs to explain the functioning of equipment, where applicable
  - Applicable pamphlets or catalogue information
  - Name and address of manufacturer and/or distributor
  - Number of years that equipment has been available in RSA
  - Any other relevant information required by the Engineer
- c) The above submissions are required after appointment by the Subcontractor and in accordance with the requirements of the main contract programme.
- d) The following submissions will be approved by the Engineer before ordering and installation:
  - Mounting brackets method statement and drawing details
  - Hydrant, hose reel and extinguisher type and specifications,
  - Any other components as required by the engineer
  - Commissioning and maintenance methodology

#### 4.3.2. Marked-up Drawings and Shop Drawings:

- a) Refer to part IV.01, Clauses 6 and 7
- b) Marked-up structural and other drawings:

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

- All dimensions and positions of openings and sleeves through both brick, roof and concrete building structures required to fit the piping installation,
  - Dimensions and positions of supporting brackets required to locate equipment,
  - Installation positions of wooded, glass fibre or steel frames or sleeves to be built in by the principal contractor.
- c) Shop Drawings and As-built Drawings
    - All shop drawings shall be approved and signed by the Engineer, before the installation commences,
    - Required service space around equipment.
  - d) The successful Subcontractor shall verify that provision has been made for all openings, wooded frames, sleeves, etc. as described above and that such openings, frames, etc. are in the correct position before any concrete casting or building work is done.

#### 4.4. Performance of Systems and Equipment

The systems, equipment and layout with regard to installation and performance shall be accordance with the specification. This also implies that the performance of the equipment in the system supplied and installed by the Subcontractor, shall be in accordance with the design and performance figures as published by the manufacturers and/or suppliers.

The efficiency of the design of the specified system is not the responsibility of the Subcontractor. It is, however the responsibility of the Subcontractor to see to it that the quality of the workmanship and the installation of the equipment as well as the re-commissioned equipment conform to the requirements of the Engineer and to the satisfaction of the manufacturer and/or supplier.

It is furthermore accepted that the Subcontractor has assured himself that all

equipment supplied and installed under this contract shall perform within the given limits, as stated by the manufacturer/supplier, to confirm to the specification.

4.5. Protection, Cleaning, Adjustments, Commissioning, Test and Operating Maintenance Manuals

- a) The Subcontractor shall be responsible for the installation, including the maintenance and replacement of worn parts, from the start-up date until it is handed to the Owner.
- b) The fire protection installation shall be maintained for one (1) year after the final hand over to the client. The cost for the one year (12 months from hand over to the client) maintenance shall be included in the tender price.
- c) The contractor shall provide the entire operating and maintenance manual in electronic format. The contractor shall, in addition, provide three (3) hard copies of the entire manual, and three CD's of the entire manual and as built drawings. Drawings shall be in AutoCAD Format.

4.6. Language

All notices on equipment shall be in English.

4.7. Standard Specifications

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

## **5. FIRE HOSE REELS**

- 5.1. This contract includes the supply and installation of SABS approved Fire Hose reel - 20 mm x 30 m semi-rigid hose and non-swinging type.
- 5.2. The hose reels water supply shall be permanently connected and shall be capable to supply water at any hose of not less than 300kPa pressure and 0.5l/s per hose reel.
- 5.3. The fire water installation piping shall have a nominal diameter of no less than Ø25mm to any hose reel. Supply piping sizes are indicated on the drawings and shall be installed as indicated thereon.

- 5.4. Where a fire hydrant and hose-reel is to be installed in the same location, the supply pipe to the hydrant shall be no less than Ø75mm and a tee-off may be made for the hose reel of Ø25mm. The hydrant supply will form part of the installation by others, while the hose reel supply, along with the required fittings and piping will be part of this contract.

## **6. WATER SUPPLY PIPING**

- 6.1. The supply piping from the main fire water supply shall be HDPE piping for all underground installations, and galvanised mild steel piping, above ground, to the fire hydrants and hose reels, installed in accordance with SANS 10400 and other relevant SANS specifications.
- 6.2. The water pipe installation for the fire hydrants and hose reels shall be installed as per the drawings and tested by a qualified plumber.
- 6.3. All testing certificates must be made available to the engineer upon completion. This includes all pressure testing as well as all equipment testing required by the engineer.

## **7. PORTABLE FIRE EXTINGUISHERS**

- 7.1. This contract includes the installation of SABS approved portable Fire Extinguishers; 9kg Dry Chemical Powder fire extinguishers shall be used.
- 7.2. The portable fire extinguishers shall be installed in locations in accordance with the fire protection plans.
- 7.3. The portable fire extinguishers shall be installed on purpose made boards, fixed to the wall, where they are not likely to be blocked or hidden.

## **8. SIGNPOSTING AND MARKINGS**

- 8.1. All escape doors, routes and equipment shall be clearly marked with SABS approved signs.

- 8.2. All signposts shall be suspended from the ceiling or mounted on the walls 350mm from the ceiling level.
- 8.3. All markings and signs shall be of Photoluminescent type and be no less than 150mm in height.
- 8.4. All markings and signs shall be fitted with aluminium frame and fitted with hanging/mounting brackets.

**PART VI**

**SCHEDULE OF INFORMATION**

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## 1. SCHEDULE OF RATES

The following information is required to enable the Engineer to determine the costs of variations.

### 1.1. MATERIALS/EQUIPMENT

The rates shall be calculated on the following basis:

- Net costs of equipment/materials supplied, hoisted, rigged and installed on site.
- Including profit, overheads, financing, insurance and guarantee costs.
- Including engineering, management and quality control.
- Excluding Value Added Tax and Builder's Discount.

### 1.2. LABOUR

Rate per hour including travelling time and travelling costs. The rates do include:

- profit, overheads finance, insurance and guarantee costs
- engineering, management and quality control
- They exclude Value Added Tax only.

Description	Labourer	Fitter	Welder	Team	Supervisor
Normal Time					
Evening Time (Weekdays)					
Saturday					
Sunday					
Public Holiday					



### 1.3. MATERIALS

The mark up on proven costs of material must include all costs involved:

- delivery on site, hoisting, rigging.
- profit, overheads, financing, insurance and guarantee costs
- engineering, management and quality control.

The mark up excludes Value Added Tax only.

The mark up rate is ..... %.

### 1.4. SUB-CONTRACTOR S

The mark up on proven costs of material must include all costs involved:

- delivery on site, hoisting, rigging.
- profit, overheads, financing, insurance and guarantee costs
- engineering, management and quality control.

The mark up excludes Value Added Tax only.

The mark up rate is ..... %.

### 1.5. RATES FOR MATERIALS

#### 1.5.1. New Hose Reels

The rates under this sub-section will be used for calculating the value of additional work, unless there is specialised work which requires substantially more materials, in which case subsequent pricing will be applied:

Description	Rate
New piping and equipment	

#### 1.5.2. Piping, Bends and Tees (galvanised steel piping)

Steel piping, equal bends and tees painted to specification, supplied installed and commissioned:

Size (Ø mm)	Per Metre	Per Equal Elbow/Bend	Per Equal Tee
25			
32			
40			
50			

#### 1.5.3. Unequal Elbows (galvanised steel piping)

Description	Rate
32 x 25mm elbows	
40 x 25mm elbows	
40 x 32mm elbows	
50 x 25mm elbows	
50 x 32mm elbows	
50 x 40mm elbows	

#### 1.5.4. Male and Female Elbows (galvanised steel piping)

Description	Rate
25mm M&F elbows	
32 mm M&F elbows	
40 mm M&F elbows	
50 mm M&F elbows	

1.5.5. Red Tees (galvanised steel piping)

Description	Rate
32x25x25	
32x32x25	
40x32x25	
40x40x25	
50x40x25	
50x50x25	
50x40x32	

1.5.6. Red Bush (galvanised steel piping)

Description	Rate
50x25	
50x32	
50x40	

1.5.7. Reducers (galvanised steel piping)

Description	Rate
32 x 25mm	
40 x 25mm	
40 x 32mm	
50 x 25mm	
50 x 32mm	
50 x 40mm	

1.5.8. Flanges and Joint Sets (galvanised steel piping)

Description	Rate
100mm Flange	
150mm Flange	

1.5.9. Klambon Couplings

Description	Rate
50mm @ 6m centre	
65mm @ 6m centre	
80mm @ 6m centre	
100mm @ 6m centre	

1.5.10. Hangers

Description	Rate
25 mm hangers	
32 mm hangers	
40 mm hangers	
50 mm hangers	