# PART: 2

# PG-02.1 (EC) PRICING ASSUMPTIONS – GCC 3rd Edition (2015)

| | | | |
|---|---|---|---|
| **Project title:** | ***Kimberley Galeshewe Police Station: Replacement of air conditioners*** | | |
| **Tender / Quotation no:** | *KIM 14/2023* | **Reference no:** | *19/2/4/2/2/2327/497* |

## C2.1 Pricing Assumptions

### C2.1.1 GENERAL

The Bill of Quantities forms part of the Contract Documents and must be read and priced in conjunction with all the other documents comprising the Contract Documents, which include the Conditions of Tender, Conditions of Contract, the Specifications (including the Project Specification) and the Drawings.

### C2.1.2 DESCRIPTION OF ITEMS IN THE SCHEDULE

The Bill of Quantities has been drawn up generally in accordance with Civil Engineering Quantities 1990 issued by the SA Institution of Civil Engineers.

The short descriptions of the items in the Bill of Quantities are for identification purposes only and the measurement and payment clause of the Standardized Specifications and the Particular Specifications, read together with the relevant clauses of the Project Specification and directives on the drawings, set out what ancillary or associated work and activities are included in the rates for the operations specified.

### C2.1.3 QUANTITIES REFLECTED IN THE SCHEDULE

The quantities given in the Bill of Quantities are estimates only, and subject to remeasuring during the execution of the work. The Contractor shall obtain the Engineer's detailed instructions for all work before ordering any materials or executing work or making arrangements for it.

The Works as finally completed in accordance with the Contract shall be measured and paid for as specified in the Bill of Quantities and in accordance with the General and Special Conditions of Contract, the Specifications and Project Specifications and the Drawings. Unless otherwise stated, items are measured net in accordance with the Drawings, and no allowance has been made for waste.

The validity of the contract will in no way be affected by differences between the quantities in the Bill of Quantities and the quantities finally certified for payment.

### C2.1.4 PROVISIONAL SUMS

Where Provisional sums or Prime Cost sums are provided for items in the Bill of Quantities, payment for the work done under such items will be made in accordance with Clause 45 of the General Conditions of Contract 2004. The Employer reserves the right, during the execution of the works, to adjust the stated amounts upwards or downwards according to the work actually done under the item, or the item may be omitted altogether, without affecting the validity of the Contract.

The Tenderer shall not under any circumstances whatsoever delete or amend any of the sums inserted in the "Amount" column of the Bill of Quantities and in the Summary of the Bill of Quantities unless ordered or authorized in writing by the Employer before closure of tenders. Unauthorized changes made by the Tenderer to provisional items in the Bill of Quantities, or to the provisional percentages and sums in the Summary of the Bill of Quantities will lead to the disqualification of the Tenderer.

### C2.1.5 PRICING OF THE BILL OF QUANTITIES

The **bills of quantities / lump sum document** forms part of and must be read and priced in conjunction with all the other documents forming part of the **contract documents**, the Standard Conditions of Tender, Conditions of Contract, Specifications, Drawings and all other relevant documentation.

The prices and rates to be inserted by the Tenderer in the Bill of Quantities shall be the full inclusive prices to be paid by the Employer for the work described under the several items, and shall include

full compensation for all cost and expenses that may be required in and for the completion and maintenance during the defects liability period of all the work described and as shown on the drawings as well as all overheads, profits, incidentals and the cost of all general risks, liabilities and obligations set forth or implied in the documents on which the Tender is based.

Each item shall be priced and extended to the "Total' column by the Tenderer, with the exception of the items for which only rates are required, or items which already have Prime Cost or Provisional Sums affixed thereto. If the Contractor omits to price any items in the Bill of Quantities, then these items will be considered to have a nil rate or price.

The Tenderer is required to check the Bills of Quantities and the numbers of the pages and should any be found to be missing or in duplicate, or should any of the typing be indistinct, or any doubt of obscurity arise as to the meaning of any description or particulars of any item, or if this Tender Enquiry contains any obvious errors, then the Tenderer must immediately inform the Principal Agent and have them rectified or explained in writing as the case may be. No liability whatsoever will be admitted by reason of the Contractor having failed to comply with the foregoing instruction.

No alterations, erasures, omissions or additions is to be made in the text and/or conditions of these Bills of Quantities. Should any such alterations, amendments, note/s or addition be made, the same will not be recognized, but reading of these Bills of Quantities as originally prepared by the Quantity Surveyor will be adhered to.

The contractor is cautioned that the use of any quantities appearing in these Bills of Quantities for the purpose of ordering material, it is done at own risk and no liability whatsoever will be admitted by the Employer or Quantity Surveyor for the correctness of such Quantities. Unless otherwise stated, items are measured net in accordance with the drawings, and no allowance is made for waste.

The prices and rates to be inserted by the Tenderer in the Bills of Quantities shall be the full inclusive prices to be paid by the Employer for the work described. Such prices and rates shall cover all costs and expenses that may be required in and for the execution of the work described, and shall cover the cost of all general risks, liabilities, and obligations set forth or implied in the documents on which the tender is based, as well as overhead charges and profit. Market related prices shall be inserted as these will be used as a basis for assessment of payment for additional work that may have to be carried out. The Employer reserves the right to balance the Bill rates where deemed necessary within the Tendered Amount.

A price or rate is to be entered against each item in the Bills of Quantities, whether the quantities are stated or not. An item against which no rate is/are entered, or if anything other than a rate or a nil rate (for example, a zero, a dash or the word "included" or abbreviations thereof) is entered against an item, it will also be regarded as a nil rate having been entered against that item, i.e. that there is no charge for that item. The Tenderer may be requested to clarify nil rates, or items regarded as having nil rates; and the Employer may also perform a risk analysis with regard to the reasonableness of such rates.

Should the full intent and meaning of any description not be clear, the bidder shall, before submission of his tender, call for a written directive from the principal agent, failing which it shall be assumed that the contractor has allowed in his pricing for materials and workmanship in terms of National Best Practice.

All items for which terminology such as "inclusive" or "not applicable" have been added by the Tenderer will be regarded as having a nil rate which shall be valid irrespective of any change in quantities during the execution of the Contract.

The Tenderer shall fill in rates for all items where the words "rate only' appear in the "Total" column. "Rate Only" items have been included where:

(a) variations of specified components in the make-up of a pay item may be expected; and
(b) no work under the item is foreseen at tender stage but the possibility that such work may be required is not excluded.

For 'Rate Only" items no quantities are given in the "Quantity" column but the quoted rate shall apply in the event of work under this item being required. The Tenderer shall however note that in terms of

the Tender Data the Tenderer may be asked to reconsider any such rates which the Employer may regard as unbalanced.

Descriptions in the Bills of Quantities are abbreviated and comply generally with those in the "PW 371" and the principles contained in the latest version of the SANS 1200 in South Africa. It is the intention that the abbreviated descriptions be fully described when read with the applicable measuring system and the relevant preambles and/or specifications. However, should the full intent and meaning of any description not be clear, the bidder shall, before submission of his tender, call for a written directive from the principal agent, failing which it shall be assumed that the contractor has allowed in his pricing for materials and workmanship in terms of National Best Practice.

The price quoted against each item of this Bills of Quantities shall cover the full inclusive cost of the complete work to which it refers, as described in the Conditions of Contract and Specifications and as shown on the Drawings and shall allow for labour, material, transporting, loading, storage, supervision, commissioning, wastage, as well as the builders profit and attendance.

The Tenderer must ensure that he fully completes all columns of the Bill of Quantities including the Final Summary. The fully priced bill of quantities must be submitted with the tender **or** The Final Summary and the Section Summary pages MUST be returned with the tender document as indicated the PA-03 Notice and Invitation to Tender / PA-04 Notice and Invitation for quotation.

The tenderers are to ensure that they have read and understood the project specifications included in C3: Scope of Work. All the information provided in the Scope of Works form part of the work and must be included in the rates.

"The Contractor shall be deemed to have inspected and examined the Site and its surroundings and information available in connection therewith and to have satisfied himself before submitting his tender (as far as is practicable) as to:

(a) the form and nature of the Site and its surroundings, including subsurface conditions,

(b) the hydrological and climatic conditions,

(c) the extent and nature of work and materials necessary for the execution and completion of the Works,
(d) the means of access to the Site and the accommodation he may require

and, in general, shall be deemed to have obtained all information (as far as is practicable) as to risks, contingencies and all other circumstances which may influence or affect his Tender"

### C2.1.6 VALUE ADDED TAX

The **contract sum** must include for Value Added Tax (VAT). All rates, provisional sums, etc. in the **bills of quantities / lump sum document** shall be in Rands and cents and shall include all levies and taxes (other than VAT). VAT will be added in the summary of the Bill of Quantities. The rates must however be net (exclusive of VAT) with VAT calculated and added to the total value thereof in the Final Summary. All rates and amounts quoted in the Bill of Quantities

### C2.1.7 CORRECTION OF ENTRIES

Incorrect entries shall not be erased or obliterated with correction fluid but must be crossed out neatly. The correct figures must be entered above or adjacent to the deleted entry, and the alteration must be initialled by the Tenderer.

### C2.1.8 ARITHMETICAL ERRORS

Arithmetical errors found in the Bill of Quantities as a result of faulty multiplication of addition, will be corrected by the Engineer at the tender evaluation stage, as set out in the Tender Data.

### C2.1.9 CONTRACT DOCUMENTS

The Tenderers are advised to examine the bills of quantities, drawings and specifications including all other contract documents and make themselves thoroughly acquainted with the nature and requirements of the work, as no claim for extra payment in this regard will be entertained. Should any parts of the drawings not be clearly intelligible to the Tender, he must, before submitting his tender, obtain clarification from the Principal Agent.

### C2.1.10 UNITS OF MEASUREMENT

The units of measurement described in the Bill of Quantities are metric units for which the standard international abbreviations are used. Non-standard abbreviations which may appear in the Bill of Quantities are as follows:

| | | |
|---|---|---|
| No. | = | Number |
| % | = | Percent |
| Sum | = | Lump sum |
| PCsum | = | Prime cost sum |
| Prov sum | = | Provisional sum |
| $m^3$.km | = | Cubic metre - kilometre |
| Km-pas | = | kilometre - pass |
| $m^2$.pass | = | square metre – pass |

### C2.1.11 TRADE NAMES

Tenderers attention is drawn to the fact that wherever trade names or references to any catalogue have been made in these Bills of Quantities, it is purely to establish a standard for the required material. If use is made of any other equally approved material in lieu of the prescribed trade name or catalogue, the necessary price adjustments will be made.

### C2.1.12 CONTRACT DOCUMENTS

The Tenderers are advised to examine the bills of quantities, drawings and specifications including all other contract documents and make themselves thoroughly acquainted with the nature and requirements of the work, as no claim for extra payment in this regard will be entertained. Should any parts of the drawings not be clearly intelligible to the Tender, he must, before submitting his tender, obtain clarification from the Principal Agent.

### C2.1.13 PAYMENTS

Interim valuations and payments will be prepared on a monthly basis, all in terms of the conditions of contract.

The contractor is to note that no payment will be made for materials stored off site and in the case of materials being stored on site, payment will only be made for such materials on condition that they have not been delivered to the site prematurely, a tax invoice and proof of payment (ownership) is submitted by the Contractor.

### C2.1.14 ACCOMMODATION ON SITE

It is imperative to note that no living quarters for construction workers on site will not be permitted for the full duration of the contract unless otherwise stated in the contract data or permission be granted by the Employer.

### C2.1.15 LOCAL MATERIAL UTILISATION REPORT (LOCAL CONTENT)

Bidders to note that materials procured for the works should be from South African manufactures and suppliers. Imported materials shall only be considered under exceptional circumstances, based on compelling technical justifications, and subject to the approval by the NDPWI.

The contractor shall achieve in the performance of this contract the prescribed local content deliverables as listed in PA36 and annexures C thereto in the respective designated sectors as published by Department Trade Industry and Competition (DTIC). The Service Provider shall submit an accumulative monthly report to the Employer's representative indicating the percentage targets achieved which must be reconciled upon completion of the project and to form part of the final account.

The contractor shall be responsible for record keeping, documenting and submission of monthly local material utilization report with supporting documentation to the Employer's representative within 7 working days of the beginning of the successive month, in terms of DTI&C designated industry/sector/sub-sector schedule as per the PA36 and Annexures C attached to the tender document. The final percentage achievement to be reconciled upon completion of the project and form part of the final account. Allowance must be made for submitting reports to the Employer's Representative on a monthly basis in terms of monthly and accumulative targets achieved with audited supporting documentation.
the final account.

## C2.1.16 CONTRACT PARTICIPATION GOALS

The contractor shall achieve in the performance of this contract the following Contract Participation Goals (CPGs) as indicated below:

Provision for pricing of compliance with the achieving the CPGs is made in the Contract Participation Goal Section of the Bills of Quantities and it is explicitly pointed out that all requirements in respect of the aforementioned are deemed to be priced thereunder and no additional claims in this regard shall be entertained

Monthly progressive reports to be submitted to the Employer's representative indicating the percentage targets achieved which must be reconciled upon completion of the project and to form part of the final account.

### C2.1.16.1 MINIMUM TARGETED LOCAL BUILDING MATERIAL MANUFACTURERS CONTRACT PARTICIPATION GOAL

**Minimum Percentage Participation Goal Applicable Yes ☐ No ☒**

Provision is made within the Contract Participation Goal section in the Bill of Quantities for the Minimum Targeted Local Building Material Manufacturers CPG in the execution of this project as described in PG-01.1 (EC) SCOPE OF WORKS C3.5.2. The contractor shall price his Profit and Attendance, all inclusive of associated costs to the contractor for implementation. Allowance must be made for submitting reports to the Employer's Representative on a monthly basis in terms of monthly and accumulative targets achieved with audited supporting documentation.

### C2.1.16.2 MINIMUM TARGETED LOCAL BUILDING MATERIAL SUPPLIERS CONTRACT PARTICIPATION GOAL

**Minimum Percentage Participation Goal Applicable Yes ☐ No ☒**

Provision is made within the Contract Participation Goal section in the Bill of Quantities for the Minimum Targeted Local Building Material Suppliers CPG in the execution of this project as described in PG-01.1 (EC) SCOPE OF WORKS C3.5.3. The contractor shall price his Profit and Attendance, all inclusive of associated costs to the contractor for implementation. Allowance must be made for submitting reports to the Employer's Representative on a monthly basis in terms of monthly and accumulative targets achieved with audited supporting documentation.

## C2.1.16.3 MINIMUM TARGETED LOCAL LABOUR CONTRACT PARTICIPATION GOAL

**Minimum Percentage Participation Goal Applicable Yes ☐ No ☒**

Provision is made within the Contract Participation Goal section in the Bill of Quantities for the Minimum Targeted Local Labour CPG in the execution of this project as described in PG-01.1 (EC) SCOPE OF WORKS C3.5.4. The contractor shall price his Profit and Attendance, all inclusive of associated costs to the contractor for implementation. Allowance must be made for submitting reports to the Employer's Representative on a monthly basis in terms of monthly and accumulative targets achieved with audited supporting documentation.

## C2.1.16.4 MINIMUM TARGETED ENTERPRISE DEVELOPMENT: CONTRACT PARTICIPATION GOALS (CPG)

**Minimum Percentage Participation Goal Applicable Yes ☐ No ☒**

A provisional amount has been allowed for within the Contract Participation Goal section in the Bill of Quantities for the Minimum Targeted Enterprise Development CPG in the execution of this project as described in PG-01.1 (EC) SCOPE OF WORKS C3.5.5. The provisional amount allowed is for the appointment of training coordinator, mentor, training service providers and training of the beneficiary enterprises.

The contractor shall price his Profit and Attendance, all inclusive of associated costs to the contractor for implementation. Allowance must be made for submitting reports to the Employer's Representative on a monthly basis in terms of monthly and accumulative targets achieved with audited supporting documentation.

The contractor shall complete a separate bill of quantities upon the award of the project and identification of the respective beneficiaries and the appointment of the training coordinator, mentor, training service providers of which the cost will be offset against the provisional amount allowed in the Bills of Quantities.

## C2.1.16.5 MINIMUM TARGETED TARGETED CONTRACT SKILLS DEVELOPMENT GOALS (CSDG)

**Minimum Percentage Participation Goal Applicable Yes ☒ No**

A provisional amount has been allowed for within the Contract Participation Goal section in the Bill of Quantities for the Minimum Targeted Skills Development CPG in the execution of this project as described in PG-01.1 (EC) SCOPE OF WORKS C3.5.6. The provisional amount allowed is for:

- stipends payable to the beneficiaries
- appointment of training coordinator
- appointment of mentor (where applicable)
- appointment of training service providers
- other additional costs as per table 3 of the Standard

The contractor shall price his Profit and Attendance (all inclusive of associated costs to the contractor for implementation and reporting), based on the provisional amount in the Contract Participation Goal section in the Bill of Quantities. The contractor shall complete a separate bill of quantities upon the award of the project and identification of the respective beneficiaries. The CPG value to be achieved

will be based on the actual contract amount which will be offset against the provisional amount allowed for within the Contract Participation Goal section in the Bill of Quantities.

Allowance must be made for submitting reports to the Employer's Representative on a monthly basis in terms of monthly and accumulative targets achieved with audited supporting documentation.

Payment

The contractor shall upon the appointment of beneficiaries, provide a breakdown of all the associated costs. The contractor shall provide a payment schedule as to how the CPG costs will be claimed against for inclusion in the monthly payment certificates.

(a) Payment to the contractor to accommodate Part/Full Occupational qualification and Trade qualifications;

Should the contractor select Part/Full Occupational qualification and Trade qualifications learners, then the employer shall make provision for payment to the contractor as indicated in Table 3 of the Standard.

The contract skills participation goal, expressed in Rand, shall not be less than the contract amount multiplied by a percentage (%) factor given in Table 2 in the Standard for the applicable class of construction works. Should the contractor select Part/Full Occupational qualification and Trade qualifications learners, then the employer shall make provision for payment to the contractor as indicated in Table 3 of the Standard.

No provision for an additional payment item for the payment of the supervisor and/or mentors for the provision of training as provided for in the Contract Participation Goal section in the Bill of Quantities for the training of part/full time occupational learners and/or trade qualification learners. The associated cost is deemed to be included in general supervision on site.

The contractor shall complete a separate bill of quantities upon award, indicating the type and number of beneficiaries as well as the associated Notional Cost of Training to be provided, on which payment will be based.

(b) Payment to the contractor to accommodate Work Integrated Learners and Candidates for professional registration;

Should the contractor select Work Integrated Learners and/or Candidates for professional registration, then the employer shall make provision for payment to the contractor as indicated in Table 3 of the Standard.

Provisional amounts have been included in the Contract Participation Goal section in the Bill of Quantities for the training of Work Integrated Learners and Candidates for professional registration. The contractor shall price his Profit and Attendance (all inclusive of associated costs to the contractor for implementation and reporting), based on the provisional amount in the Contract Participation Goal section in the Bill of Quantities.

The contractor shall complete a separate bill of quantities upon award, indicating the type and number of beneficiaries as well as the associated Notional Cost of Training to be provided, on which payment will be based.

The CPG value to be achieved will be based on the contract amount as defined by the Standard, which will be offset against the provisional amount allowed for within the Contract Participation Goal section in the Bill of Quantities.

The contractor shall apportion the cost of accommodating work integrated learners (P1 and P2 learners) and candidates for professional registration by using Table 3 in the Standard and this

cost will be used to determine the Rand value and will be used in determining the contract participation goal in the Bills of Quantities.

**Table 3: Notional Cost of Training; Headcount**

| Type of Training Opportunity | Provision for stipends (Unemployed learners only) | Provisions for mentorship | Provisions for additional costs* | Total costs | |
|---|---|---|---|---|---|
| | | | | Unemployed learners | Employed learners |
| **Method 1** | | | | | |
| Occupational qualification | R7 000 | R0 | R9 000 | R16 000 | R9 000 |
| **Method 2** | | | | | |
| TVET College graduates | R14 000 | R0 | R9 000 | R23 000 | N/A |
| Apprenticeship | R14 000 | R0 | R12 000 | R26 000 | R12 000 |
| **Method 3** | | | | | |
| P1 and P2 learners | R24 000 | R20 000 | R4 500 | R48 500 | N/A |
| **Method 4** | | | | | |
| Candidates with a 3 year diploma | R37 000 | R20 000 | R4 500 | R61 500 | R20 000 |
| Candidates with 4 year qualification | R47 000 | R20 000 | R4 500 | R71 500 | R20 000 |

*Note: The notional cost of providing training opportunities will increase by CPI on an annual basis based on April CPI. Should the rates increase after bid award or during construction the rates will be adjusted as a remeasureable item.*

**Example:** Training Target Calculation for a R65,7m GB contract

| | |
|---|---|
| Contract amount | R65 700 000 |
| Contract duration | 12 Months |
| CSDG | 0,50% |
| Minimum CSDG target | 0,50% x R65 700 000 = R328 500 (Minimum requirement) |

| Skills Types | Number of learners | Notional Cost / Learner / Quarter | Notional cost/learner/year | Total Notional Cost over 12 months Contract |
|---|---|---|---|---|
| **Method 2:** Workplace learning opportunities, with unemployed TVET graduates | 1 | R23 000 | R92 000 | R92 000 |
| **Method 3:** Candidacy for an unemployed learner with a 3-year qualification | 1 | R61 500 | R246 000 | R246 000 |
| Total | 2 | | | R338 000 |

## C2.1.16.6 NATIONAL YOUTH SERVICE TRAINING AND DEVELOPMENT PROGRAMME

**National Youth Service Training and Development Programme Applicable Yes ☐ No ☒**

The programme shall be implemented in terms of the Implementation of the National Youth Service Programme under the Expanded Public Works (EPWP) and shall be priced in the CPG section of the Bills of Quantities.

Provision has been made within the Contract Participation Goal section in the Bill of Quantities for the National Youth Service Training and Development Programme CPG in the execution of this project as described in PG-01.1 (EC) SCOPE OF WORKS C3.5.7. The contractor to price all elements of this section and allowance must be made for submitting monthly reports in the prescribed manner as per examples of reports bound in the specification document.

## C2.1.16.7 LABOUR-INTENSIVE WORKS

**Labour Intensive Works Applicable Yes ☒ No ☐**

Where labour intensive work is specified in the Bill of Qualities and indicated by "LI" the contractor must price for and include in rates. Contractors are expected to use their initiative to identify additional activities that can be done labour-intensively to comply with the set minimum labour intensity target. Allowance must be made for submitting monthly reports illustrating the value of the works executed under Labour Intensive Works.

## C2.2 Submission of Accrual Reports

The Contractor shall submit accrual reports to the client representative at the end of March and September each year for the duration of the Service Contract period from the date of appointment up to and including project closeout. This is to ensure that PMTE complies with the accounting framework GRAP, which requires that PMTE disclose all its accruals as at the end of each reporting date. Allowance must be made for submitting reports to the Employer's Representative on a monthly basis in terms of monthly and accumulative targets achieved with audited supporting documentation.

## C2.3. Submission of Monthly Local Material Utilisation Report (Local Content)

The contractors shall be responsible for record keeping, documenting and submission of monthly local material utilization report with supporting documentation to the Employer's representative within 7 working days of the beginning of the successive month, in terms of DTI&C designated industry/sector/sub-sector schedule as per the PA36 and Annexures C attached to the tender document. The final percentage achievement to be reconciled upon completion of the project and form part of the final account. Allowance must be made for submitting monthly reports illustrating the value of local material utilisation report.

# PG-03.1 (EC) SITE INFORMATION – GCC 3rd Edition (2015)

| | | | | | |
|---|---|---|---|---|---|
| **Project title:** | ***Kimberley Galeshewe Police Station: Replacement of air conditioners*** | | | | |
| **Tender no:** | *KIM 14/2023* | **WCS no:** | *055617* | **Reference no:** | *19/2/4/2/2/2327/497* |

## C4 Site Information

1. *GENERAL*

(a) *The Standard for Uniformity in Construction Procurement published in terms of the Construction Industry Development Board (CIDB) Act, 2000 (Act no. 38 of 2000), the Standardized Construction Procurement Documents for Engineering and Construction Works as issued by the CIDB and any other relevant documentation pertaining thereto must be studied and all principles in this regard must be applied to all procurement documentation, practices and procedures.*

2.

(a) The work will be executed at Kimberley Galeshewe Police Station. The facility will be occupied during construction.

public works
& infrastructure
Department:
Public Works and Infrastructure
REPUBLIC OF SOUTH AFRICA

# OCCUPATIONAL HEALTH AND SAFETY
## SAFETY, HEALTH AND ENVIRONMENTAL SPECIFICATION

## FOR

## REPLACEMENT OF AIR CONDITIONERS

## AT

## KIMBERLEY GALESHEWE POLICE STATION

## MANAGED BY

# THE DEPARTMENT OF PUBLIC WORKS AND INFRASTRUCTURE

*Project Manager: Lerato Sebopetja*

*OHS Manager: Wendy Mbolekwa*

## 1. INTRODUCTION

This Health and Safety Specification has been prepared in terms of Client's responsibility[Construction Regulation 5(1)] to provide the principal Contractor and Contractors with a documented Specification of all Health and Safety requirements pertaining to the associated works on the proposed construction site/so as to ensure the health and Safety of all persons affected by the works. This health and Safety specification highlights, but in no way replaces legal requirements that the principal Contractor and Contractors are bound to comply with in terms of the Department of Public Works program.

- The client has made provisions in the tender for the Principal Contractor to price for the cost of health and safety measures before and during the construction process [Construction Regulation 5(1)(g)].The Principal Contractor in turn needs to make the same provision when Contractors(Sub-Contractors)tender or quote on work[7(c)(1).
- The principal Contractor and Contractors are required to prepare a Health and Safety plan based on the Client's health and Safety Specification, which shall be applicable from the date of commencement of and for the duration of work [Construction Regulation 7(1)(a)].This documented plan must be based on a Hazard Identification and Risk assessment (HIRA) which will serve to identify the hazards, and their associated risks, anticipated for the scope of works [Construction regulation 9].

**Principal Contractor tendering must provide the client with an appropriate Preliminary Hand Safety Plan (including a Preliminary Hazard Identification and Risk Assessment) as in Construction Regulation 5(1).This plan must be submitted with the tender.**

## 2. APPLICATION

The Health and Safety specification contains clauses that are applicable to occupational health and safety in construction and the document is intended to impose pro-active controls associated with the activities, plant 7 machinery and other aspects of the proposed construction work that impact on health and safety of persons, by means of a documented H&S Plan prepared by Principal Contractors.

Compliance to the requirements of the OHS act and relevant legislation is in addition to the requirements of the H&S Specification and forms parts of the Principal Contractor's responsibility. The Client and Client's agents will monitor the Principal Contractor to ensure that the Principal Contractor and Contractors comply with the requirement of OHS Act and will not prescribe to the Principal Contractor how such compliance is to be achieved.

## 3. PURPOSE

The purpose of the Health and Safety Specification is to provide the Principal Contractor and Contractor's tendering for the proposed construction work and /or appointed for the above mentioned construction work with the necessary detail of all health and safety requirements, and hazards pertaining to the associated scope or works, so as to enable the principal Contractor and Contractors to develop a Health and Safety Plan-to be implemented on site in order to ensure the health and safety of all persons while undertaking the said woks.

## 4. REFERENCE DOCUMENTS AND HEALTH AND SAFETY STATUTORY REQUIREMENTS

The following Acts and Regulations are referred to in this document followed by their abbreviations in brackets. Note that this is not an exhaustive list and other documents may be referred to if necessary in order to compile **your Site Specific Health and Safety plan**:

### 4.1 Occupational Health and Safety Act,(Act No.85 of 1993)-[OHSA] and Regulations as follows:

- Construction Regulations[CR]
- General Administrative Regulations[GAR]
- General Safety Regulations[GSR]
- Environmental Regulations for Workplaces[ERW]
- General machinery Regulations [GMR]
- Hazardous Chemical Substances Regulations[HCSR]
- Electrical Installations Regulations[EIR]
- Electrical Machinery Regulations[EMR]
- Pressure Equipment Regulation [PER]

### 4.2 Compensation for occupational Injury and Diseases Act-[COIDA]

### 4.3 South African National Standards, SANS 10147:2014

### 4.4 Act, Regulations and site safety rules applicable to Department of Public works Construction Sites.

With regards to workplace health and safety, the following Acts, Regulations and safety rules shall apply to all Department of Public works Construction Site and must be fully complied with at all times by all contractors on site:

- Occupational Health and Safety Act(85 of 1993) and Regulations
- Compensation for Occupational Injuries and Diseases Act and Regulations
- This Health and Safety Specification
- Any other relevant statutory laws, including Municipal By-laws where applicable
- As well as any amendments that may arise from time to time;
- As well as any draft amendments to legislation-it is good practice to comply

### 4.5 Contractor's General Requirements for Health and Safety

4.5.1 The contractor shall be solely responsible for carrying out the work under the contract.

4.5.2 The contractor shall have the highest regards for health and safety of its employees, the Company and any persons at or in the vicinity of the site. This regard shall extend to include the works, temporary work materials, the property of third parties and any purpose relating to the contractor carrying out its obligations under the Contract.

4.5.3 The contractor shall initiate and maintain safety programmes to conform to all applicable safety and health laws or other requirements, including ground rules, and the project health and safety specification.

4.5.4 The contractor shall, at its own cost, erect and maintain safeguards for the protection of workers and public.

4.5.5 The contractor shall manage all reasonably foreseeable hazards created by performance of the work under the contract.

4.5.6 Provide all things and take all measures necessary for maintaining proper personal hygiene, ensuring safety of persons and property and protecting the environment at or near the site.

4.5.7 Avoid unnecessary interference with the passage of people and property at or near the site.

4.5.8 Prevent nuisance and excessive noises and unreasonable disturbances in performing the work under Contract.

4.5.9 Be responsible for the adequacy, stability and safety of all of its site operations, of all its methods of design, construction and work and be responsible for all of the work, irrespective of any acceptance, recommendation or consent by the Client, its Contractors, employees, agents and invitees, or any Government body.

4.5.10 The contractor shall comply, and shall be responsible for ensuring that all of its subcontractors comply, with the relevant statutory regulations for safety and the Client's requirements included in the contract.

## 4.6 Site Rules for Contractor

The site rule for contractors' document is the minimum standard with regard to specifications for construction work on this site. Contractors may have existing standards for each specific trade, but where conflict may arise between the contractor's and these Site rule for contractors, the more stringent shall apply.

### 4.6.1 Rules of Conduct

Contractors and all employees under their control, including any visitors brought onto site must adhere to the following Rules of Conduct on Site:

- Partake of .possess or sell drugs or alcoholic beverages on site. Any employee or visitor whose actions and demeanour show symptoms of possible narcosis or drunkenness shall be removed from site.
- Indulge in practical jokes, horseplay, fighting or gambling.
- Make use of water from fire hydrants.
- Destroy or tamper with safety devices, symbolic signs or wilfully and unnecessarily discharge fire extinguisher.
- Bring onto site or have in your possession a firearm, lethal weapon ,camera, or any other recording device, unless authorised to do so
- Assault, intimidate or abuse any other person
- Operate construction equipment (vehicle or plant) without the necessary training and authorisation.
- Display insubordination toward any supervisor, foreman or manager in respect to carrying out of properly issued instructions or orders for health and safety reasons.
- Negligently, carelessly or wilfully cause damage to property of others.
- Refuse to give evidence or deliberately make false statements during investigations.

- Enter into any areas where you have no business unless authorised to do so by the person in charge.
- Brig animals onto site.

Insubordination towards any foreman, supervisor or manager could lead to removal from site and or dismissal and or prosecution. Except insofar as the principles of common law, or conditions as determined by any relevant statutes are concerned, the decision of the Client or his agent shall be final and binding in respect of any disputes that may arise from the interpretation of these rules.

## 5 Definitions

**The following definitions apply.**

For the purpose of the General Health and Safety Specification, the abbreviations or definitions given hereunder shall apply:

"CR" refers to the Construction Regulations, 2014

"GHSS" refers to this document (the General Health and Safety Specification (including any project specific annexures that the engineers and designers could attach.

"OHSA" refers to the Occupational Health and Safety.

"S" refers to a section in Occupational Health and Safety Act of 1993.

"H&S" refers to Health and Safety.

"Client" Department of Public Works

Incident; means any unplanned event that causes, or has the potential to cause, an injury or illness and/or damage to equipment, buildings, plant or the natural environment. Incident range from near miss incidents to serious incidents and emergencies.

"Near Miss" means an incident which has the potential to cause an injury or illness or damage to company.

"Regulations" means, specifically, the Construction Regulations, 2003 as issued on 18 July 2003, under the Occupational Health and Safety Act of 1993, but not excluding the other applicable regulations existing under the Act.

"Site" means the lands and other places, made available by the Municipality or the Client for the purposes of the Contract, on under over in or through which the construction work is to be executed or carried out.

"Principal Contractor" and contractor shall be as defined in the Regulations.

**Construction Work [CR1]:**

Means any work in connection with-

a) The erection, maintenance, alteration, renovation, repair, demolition or dismantling of or an addition to a building or any similar structure.
b) The installation, erection, dismantling or maintenance of a fixed plant where such work includes the risk of a person falling.

c) The construction, maintenance, demolition or dismantling of any bridge, dam canal, road, railway, runway, sewer or water reticulation system or any similar civil engineering structure; or
d) The moving of earth, clearing of land or making of an excavation or work on any similar type of work.

**Hazard, Identification, Risk assessment and risk control (HIRA)**

Means a documented plan, which identifies hazards assesses the risk and detailing the control measures and safe working procedures, which are to be used to mitigate and control the occurrence of hazards and risks during construction or operation phases.

**Site**
Means the area in possession of the Contractor for the construction of the works. Where there is no demarcated boundary it will include all adjacent areas, which are reasonably required for the activities for the Contractor, and approved for such use by the client.

**Hazards**
Means a source of or exposure to danger (source which may cause injury or damage to persons, or property)

**Risk**
Means the probability or likelihood that a hazard can result in injury or damage.

**Construction Supervisor [CR 8(1)]**

Means a full time, competent employee appointed in writing by the Contractor to supervise construction work. The appointment, as required by OHSA, shall stipulate health and safety responsibilities, area of responsibility and the proposed duration of the project.

**Hazardous Chemical Substance (HCS)**

Means any toxic, harmful, corrosive, and irritant or asphyxiate substance, or mixture or substance for which an occupational exposure limit is prescribed, or an occupational exposure limit is not prescribed but which creates a hazard to health.

**Construction Plant**

Encompasses all type of plant including but not limiting to, cranes, piling frames, boring machines, excavators, dewatering equipment and road vehicles with or without lifting equipment

**Contractor [CR 1]**

Means an employer who performs construction work and includes principal contractors and sub-contractor.

**Health & Safety Plan (HSP) [CR 1]**

Means a documented plan, which addresses hazards identified and includes safe work procedures to mitigate, reduce or control the hazards identified
The plan shall be applied from the date of commencement of and for the duration of construction work [CR 5(1)]

**Health and Safety File (HSF) [CR1]**
The file holding all documentation and records on health and safety for the project, which shall be available at all times for evaluation, and copy of which will be forwarded to the client upon completion of the project.

**Disabling Injury Frequency Rate (DIFR)**
The number of disabling injuries multiplied by a constant(man hours relative to period worked divided by total man hours worked over a rolling period(usually 12 months, but can be less).

**Disabling Injury Severity Rate (DISR)**
The number of days lost due to (DI's) multiplied by a constant (man hours relative to period worked) divided by total man hours worked over a rolling period (usually 12 months, but can be less).

**Confined Space**
An enclosed, restricted or limited space in which, because of its construction, location or contents, or any work carried on therein, a hazardous substance may accumulate or an oxygen deficient atmosphere may occur, and includes any chamber, tunnel, pipe, pit, sewer, container, valve, machinery or object in which a dangerous liquids or dangerous concentration of gas, vapour, dust or fumes may be present.

## 6. Responsibility of Contractors for Construction Work [CR 4, 7, 8]

### 6.1 Notification of Intention to Commence Construction Work [CR 4]

The principal contractor shall notify the Provincial Director of the Department of labour before any work commences, in accordance with the following requirements:

- The demolition of a structure exceeding a height of 3 meter; or
- The use of explosives to perform construction work; or
- The dismantling of fixed plant at height greater than 3 meters; or
- The work exceeds 30 days or will involve more than 300 person days of construction work; and
- Includes excavation work deeper than 1 meter; or
- Includes working at height greater than 3 meters above ground or landing.

The notification and submission to the local Department of labour must be done on a form similar to that shown in **Annexure A** of this document and a copy of the completed form kept in the HSF for inspection by inspector, the client or an employees

### 6.2 Principal Contractor's Responsibilities [CR 7]

**6.2.1.** Compile a HSP [CR 7]
**6.2.2.** Ensure co-operation between all contractors [CR 7(c), to comply with the Act
**6.2.3.** Ensure compliance to the Act in terms of [CR 5(v)]
a) Provide relevant sections of these specifications to contractors as required
b) Appoint each contractor in (a) above in writing. Only contractors who have the necessary competencies and resources may be appointed [CR 7(c) (iii)]
c) Ensure each contractor's HSP is implemented and maintained on site
d) Stop any contractor from work which is not in accordance with HSP's or which pose a threat to health and safety of persons
e) Sufficient information is provided to contractors where there are changes to design and construction
f) Ensure every contractor is registered an in good standing with the Compensation Commissioner

g) Ensure potential contractors have made provision for the cost of health and safety measures.
**6.2.4** Negotiate and approve the HSP of each contractor [CR 7()]
**6.2.5** All HSP's including the principal contractor's to be available on site [CR 7(b)]
**6.2.6** All HSF's including the principal contractor's to be available on site [CR 7(d)]
**6.2.7** A consolidated HSF to be handed over to the client on completion of construction including records of drawings, designs etc. [CR 7(e)]
**6.2.8** HSF to include updated list of all contractors, the agreements and their type of work [CR 7(f)]

### 6.3 Contractor's Responsibilities [CR 7] (including sub-contractors)

6.3.1 Provide their HSP to the principal contractor[CR 7(2)]
6.3.2 Where a contractor appoints another contractor(sub-contractor) it is the responsibility of that contractor to apply 4.2 above as if he were the principal contractor [CR 7(3)]
6.3.3 No contractor to appoint another contractor(sub-contractor) unless the latter has the necessary competency and resources to perform the required work [CR 7(3)]
6.3.4 To provide any information which affects the health and safety of any persons at work to the principal contractor

### 6.4. Supervision of Construction Work [CR 8]

The appointments embodied in this regulation are as follows:

6.4.1 Construction supervisor [CR 8(1)]
6.4.2 Assistant Construction Supervisor [CR 8(2)]
6.4.3 Safety Officer [CR 8(5)] or Safety Representative OHS Act S17 (1)

The detailed requirements of these appointments can be found under the relevant regulation.

The contractor shall appoint a dedicated competent Safety Officer who wills perform his duties at the work Site for the duration of the work under the Contract.

### 6.5. Legal Appointments

The principal contractor shall ensure copies of the appointment letters of all responsible persons appointed on site will be kept in the HSF. All legal appointments shall be conducted in accordance with the requirements set out in the OHSA and as per this specification. The tables below set out the appointment protocols for CR and OHSA.

**NB: It should be noted that these represent complete lists and not all these appointments may be required.**

**6.5.1**

The responsibilities of each appointment are detailed in the relevant form, which are signed by both the authorised person and the appointee and kept in the Health and Safety File.an example of an appointment form for a Construction Supervisor can be found under Annexure B.

## 7. Documentation and Procedures

All required HSE documentation for the construction work, shall be kept in the HSF, which shall be available on site. The Construction Supervisor shall be responsible for the file and the Project manager shall ensure that documentation is valid and up to date. The procedures to be used for the project are to be in accordance with contractor policy and as per the outcome of the HIRA exercise. It is required that the documentation is filled in an orderly fashion for easy access. The following sections are suggested:

- Policy permits etc.
- Health & safety plans, specifications
- Appointments
- Incidents management
- Inspection check lists
- Risk assessments
- Training
- Safe work Procedure
- Hazardous Chemical Substances

## 8. Application of COIDA and OHSA to Construction Work

### 8.1 Compensation of Occupational Injuries and Diseases Act, Act No.130 of 1993(COIDA)

Every contractor shall provide proof of registration and letter of good standing with the Compensation Commissioner.

### 8.2 Occupational Health and Safety Policy [OHSA 7]

Every contractor's OH&S Policy statement should be available for security and as evidence of their commitment to their employees' occupational health and safety

### 8.3 Health and Safety Training and Competency

Training of personnel is a necessity and a legal requirement when required. A record of all training shall be kept and provided on request.

### 8.3.1 Induction Training

The principal contractor shall be responsible for the induction of all personnel entering the site including visitors, inspectors etc. Contractors doing specific construction work shall be responsible for the induction of their employees with respect to that specific work. Records to be kept of all personnel that undergo induction training.

### 8.3.2 Awareness Training

In addition, the client would favour awareness training to be carried out such as weekly Toolbox Talks on relevant topics e.g. wearing PPE, manual lifting, safe use of portable electric tools etc.

### 8.3.3 Competency and CV's

Where applicable, valid copies of certificates of competency of appointed personnel to be provided and kept in the HSF. Other training requirements such as those identified through the HIRA process, to be completed and proof of that training also kept in the HSF. Where competency is achieved through experience, a brief CV will be required.

### 8.3.4 Specific OH&S Training

Valid certificates of training from registered service providers preferably accredited by the appropriate SETA are required for First Aiders, H&S Reps, Fire Marshals, Fire Equipment Inspector etc.

### 8.3.5 Medical Fitness

All work in elevated positions [tower crane operators (CR 20(g)), workers on elevated structures requiring fall protection (CR 8 (2b)), suspended platform workers (CR 15(12a)] and operators of construction vehicles and mobile plant (CR 21(d)) require certificates of physical and psychological fitness.

Valid certificates of training from registered service providers preferably accredited by the appropriate SETA are required for First aiders, H&S reps, Fire Marshals (CR 221 Fire Equipment Inspectors) etc.

### 8.4 Hazards and Potential Hazardous Situations [OHSA 13]

The principal contractor is responsible to ensure that all contractors and any visitors are warned of any hazardous or potentially hazardous situations, which may affect them on site and shall put any additional measures in place to assist in mitigating the risk of the these hazards.

### 8.5 Health and Safety Reps [OHSA 17 and 18]

The principal contractor shall be responsible to ensure compliance to this section of the OHSA as required and to ensure similar compliance of all contractors. If a rep is not required, the appointed Safety officer will be responsible for these functions.

### 8.6 Health and safety Committee [OHSA 19 &20]

The principal contractor shall be responsible to ensure compliance to this section of the OHSA as required. If a committee is not convened, health and safety matters will need to be tabled and discussed at site meetings.

### 8.7 General Record Keeping

The principal contractor shall ensure that all Health and safety records, required by OHSA and Regulation are kept for reference purpose and auditing.

### 8.7.1 Inspections

The principal Contractor shall keep all records of inspections undertaken during the contract. An assessment will need to be made of what inspections are required and their frequency. The principal contractor is also responsible to ensure compliance to this requirement by all contractors

### 8.7.2 Audits [CR 5(o) and 5 (p)]

The client's agent shall carry out regular audits on the principal contractor at least once per month. Similarly, principal contractor shall be responsible for carrying out regular audits on their contractors at least once per month. The results shall be tabled for action and discussed at health and Safety Committee meetings or site meetings as appropriate.

### 8.8 Incident Management and Emergency Plans

The principal contractor shall create and Emergency Plan for the construction site. The plan shall be clearly laid out for all types of emergencies including responsibilities, evacuation routes, siren, emergency no's etc. The plan shall fully explain to all personnel during the induction training. All contractors will become completely familiar with the requirements of the plan and will participate in any evacuation drills that may take place.

### 8.8.1 First Aid [GSR 3]

The principal contractor shall be responsible to ensure compliance to this regulation as required. In particular, a first aid box with the minimum stock as specified in the regulation will be located at the site office and there will be signage to indicate the location of the box. Attention is drawn to GSR 3(4) for the requirement of trained first aiders. It is also suggested that a trained first aider be made responsible for the box in terms of the following:

- Security-the box should not be left open but it must be accessible in case of emergency(spare key availability)
- Injuries – a record of first aid box injuries treated and the stock issued.
- Stock- regular inspection to maintain stock levels and check expiry dates

In addition, the first aid requirement should be noted for high risk substances or hazardous chemical substances and if these are to be used, then it should be addressed in the HIRA and the need for eye wash facilities assessed.

**NOTE: It is strongly recommended and good practice to comply with the Draft Health and Safety Regulation 7**

### 8.8.2 Incidents and Injuries-Investigation and Reporting

The principal Contractor will ensure there is a management system to report and investigate all incidents. All incident including all near miss, first aid box treatment, and all other serious incidents involving any form of disabling injury or fatality are to be reported to the Client and the Clients H&S Agents telephonically immediately. This shall be confirmed in writing as soon as possible after the incident. Failure to comply with these provisions will be considered as serious offence. Recording and Investigation of Near Miss.

Incidents

The principal Contractor shall provide evidence by means of a procedure or chart that he is fully aware of the hierarchy of incidents that can occur e.g. unsafe situations, near miss first aid box injuries, medical cases, disabling injuries etc. He shall keep an incident register of all such incidents, investigate and apply corrective action where required. The client also reserves the right to request incident statistics from the principal contractor such as Di's DIFR and DISR and it is advised that these are maintained.

Injuries

First aid box injuries have been addressed under 8.7.1 above. More serious injuries requiring transport of the injured person to the nearest hospital or doctor or the calling of an ambulance and paramedic personnel will be the responsibility of the principal contractor's appointed personnel such as the Construction Supervisor,Fisrt Aider, and Safety Officer. It is advised that all required emergency numbers be on hand and prominently displayed.as all contractors are registered an in

Good Standing with the Compensation Commissioner, it will be the responsibility of the contractor whose employee has been injured; too make the necessary report and claims to the Commissioner.

### 8.8.3 Accident and Incident Reporting and Investigation [OHSA 24, GAR 8, 9(1) & (2)]

Should an incident or accident investigation need to be conducted, a competent person shall be appointed to conduct the said investigation. The procedure to be followed will be in accordance with Annexure 1 of GAR 9-"Recording and Investigation of incidents". Particular attention is also drawn to OHSA 24, reporting of certain incidents to an inspector of the department of labour. The principal contractor shall ensure that the investigations are kept for record purposes and he shall ensure that the outcome of the investigation is communicated to all affected parties as required i.e. the Client, Clients H& S Agent and contractors. The Client reserves the right to participate in all investigations into accidents or incidents and to conduct their own investigation if required.

### 8.9 Contractors and Suppliers

The client shall enter into an Agreement with Mandatory in terms of Section 37(2) of the OHS Act 85 of 1993, with all appointed principal contractors. Likewise all principal contractors shall enter in to a similar agreement with all contractors, sub-contracted to them for any period of the contract. Please note that if contractors hire any construction vehicle or mobile plant, the companies from which the equipment is hired must provide any maintenance and test certification as required. In addition, if operators are hired with the equipment, proof of competency and medical certification must be provided.

The principal Contractor shall ensure that all contractors are issued with this safety specification where *reasonable. The* principal contractor shall assist and ensure that contractors engaged comply with all of these requirements and adhere to the requirements set out OHSA .Contractors will be stopped from working in the event of unsafe conditions and activities being observed. All contractors shall be subject to the requirements specified in the HSP and will be issued with a copy of the plan. If the contractor is not able to comply with the requirements set out in the plan, he shall not be appointed as contractor.

### 8.10 Personal Protective equipment, Intoxication, Signage and Access Control [GSR 2]

**8.10.1**Personal Protective Equipment **(PPE)[GSR 2]**
The principal contractor shall through the Risk Assessment process identify the specific PPE needs per activity. Contractors, as employers, will be responsible for the issue of the required PPE. Should PPE be lost or stolen, then the employee will be issued with new PPE. Should PPE be worn out or damaged, the user shall return the worn or damaged PPE and will be issued with a replacement. Training in the use of this shall be provided. Visitors shall be informed of PPE requirements prior to their visit so that they may enter the site.

### 8.10.2 Intoxication [GSR 2A]

The principal contractor shall be responsible to ensure that no persons may enter or remain at the construction site if under or apparently under the influence of intoxicating liquor or drugs.

### 8.10.3 Display of signs [GSR 2B]

The principal contractor should make use of signage to assist in enforcing compliance to any requirement specified in this document or as required by law. Standard symbolic signs are acceptable for conveying these requirements where applicable.

### 8.10.4 Access control [GSR 2C]

The principal contractor shall be responsible to ensure control of access to all persons entering the construction site. The reason for this is as follows;

- The principal contractor is the employer on the site and all intents and purposes is responsible for section 8 of OHSA of employees and contractors and section 9 for any other person on site such as visitors and inspectors
- All persons entering the site must undergo induction training to inform them fo the hazards present on site. This includes contractors, visitors, inspectors etc.
- The construction supervisor will be aware of who is on site and their function
- The construction supervisor will be able to control tasks that may impact on other work being carried out on the site by a permit to work system.
- The number of people and their purpose on the site must be known in case of emergency and evacuation
- Security reasons

### 8.11 Ladders [GSR 13A]

**The following requirements shall be complied with regarding Ladders and Ladder Works:**

- A competent person shall be identified and appointed as ladder inspector
- Where aluminium ladders cannot be used, then wooden ladders shall be straight grained, unpainted to allow for proper inspection of the gran for cracking
- Ladders shall be secured at the top and choked at the base to prevent slipping.
- Where choking of the base is not possible, then the user shall ensure that the ladder is held in position by another employee when ascending the ladder.
- Ladders shall be inspected a minimum once per month by the person appointed as the ladder inspector.
- Proper storage shall be provided for all ladders when not in use.

### 8.12 Pressure Equipment Regulations, 2009(Gas Bottles) [PER 2009]

If gas bottle sets (Oxy-Acetylene for heating, cutting, welding) are used, these regulations, as required, shall be adhered to. Regular inspection of the sets shall be carried out. In particular;

- Only trained personnel shall operate such equipment.
- The construction Supervisor shall ensure operation of the equipment is in accordance with the HIRA requirements and Safe working Procedure (SWP) and /or method statement.
- All users shall undergo regular awareness training (toolbox) to ensure compliance.
- The Construction supervisor shall ensure the required PPE is used.

### 8.13 Portable Electric Tools [EMR 9]

This regulation shall be complied with as a minimum requirement. Regular inspections of all Portable Electric Tools such as drill, angle grinder's etc. shall are carried out. In particular:

- Only trained personnel shall operate such equipment.

- The Construction Supervisor shall ensure operation of the equipment is in accordance with the HIRA requirements and Safe working Procedure (SWP).
- All users shall undergo regular awareness training (toolbox talks) to ensure compliance.
- The Construction Supervisor shall ensure the required PPE is used.

### 8.14 Permit to work [including hot work]

**The principal contractor shall be responsible to ensure that:**

- All work being carried out on site has been approved through the necessary project control system.
- Permit require from third parties such as vetting for security clearance
- A permit system is operational so that work consisting of many tasks related to the construction on site, can be carried out without endangering he health and safety of personnel on site, neighbours and the public surrounding the site and or causing damage to property.
- In particular, attention is drawn to GSR 9, which details the requirements for welding, flame cutting, soldering and similar operations.

### 8.15 Environmental Rules

The contractor shall give effect to maintain all safeguards and standards and take such measures as may be necessary for the protection of the environment.

#### 8.15.1 Clearing

The contractor shall comply with the following conditions and requirements for clearing:

- Follow the Occupational health and Safety Act, the Environmental Regulations for workplaces and Project EMP.
- Areas to be cleared will have boundaries clearly marked by tape, pegs or other means and will conform to limits on design drawings.
- No clearing is to occur without a written permit from the Engineer.
- Clearing will not commence until drainage control works are in place.
- Cleared vegetation should be windrowed along the contour to assist with erosion control.
- Any area which is not to be disturbed under requirements of the Cultural Heritage management Plan will be clearly identified.
- Vegetation clearance will be restricted to that necessary for the works.
- The Engineer is to be notified immediately if contaminated soil is discovered.
- Traffic shall be confined to maintained tracks and roads.
- Particular care shall be taken to minimise disturbance to the bed and banks of watercourses.

#### 8.15.2 Noise and Vibration

The contractor shall ensure that each of its mobile and fixed plant and that of its subcontractor' are fitted with appropriate noise suppression equipment to ensure that noise levels from such plant are contained within the relevant limits prescribed by relevant industrial safety and environmental legislation, regulations and site standards. If there is a noise problem with electrical power generating equipment, compressors, or other facilities under the control of the contractor, additional noise suppression shall be erected by the Contractor at the Contractor's cost around the offending unit(s).Any deviation from the above listed practices is to be rectified at the Contractor's cost.

### 8.15.3 Transport, Storage and Handling of Hazardous Substances and Dangerous Goods

The contractor shall comply with the following conditions and requirements for storing and handling hazardous and dangerous goods:

- Comply with HCS Regulations 14. The storage and handling of flammable and combustible liquids.
- Provide a list of hazardous substances and corresponding MSDS prior to bringing substances on Site.
- Substances register to be held at each storage facility.
- Corrosive materials to be stored and handled in accordance with HCS Regulation 14.
- Fuels, oils and substances in containers of 200 litres or more shall be stored in a bunded area with capacity of at least 110% of largest container/tank.
- Fuel, oils and substances in less than 200 litre drums shall be stored as above or in a fenced and roofed compound.
- All fuels, oils and substances must be clearly labelled.
- Transfer of bulk fuel and handling of hazardous substances shall be conducted only by appropriately trained personnel
- Spill clean-up kits including absorbent materials shall be kept at each storage facility.

### 8.15.4 Erosion and Oil Traps

The Contractor shall comply with the following conditions and requirement for erosion, sedimentation, silt and oil traps:

- Land disturbance will be restricted to that necessary for the works.
- Topsoil will be salvaged for use in rehabilitation
- Storm water from upstream catchments will be diverted away from construction areas.
- Drains will be protected to prevent scouring if necessary.
- Sediment traps, silts fences or hay bales will be installed to control sediment where necessary and where directed by Engineer.
- Sediment traps will be cleaned periodically.

### 8.15.5 Dust Prevention

The contractor shall comply with the following conditions and requirements for air quality and dust:

- Dust generated by construction activities will be suppressed by water spraying, to levels that are safe for Site personnel.
- Speed limits on unsealed roads will be limited to a maximum speed consistent with the minimisation of dust generation.
- Earthworks Supervisors must pay particular attention to the management of topsoil stripping such that dust does not become a safety hazard or severe nuisance.
- All dust complaints will be investigated promptly and appropriate action initiated to reduce nuisance.

### 8.15.6 Waste Management

- The contractor shall provide suitable rubbish receptacles at the Site and shall ensure that all litter is collected in them and properly disposed of off Site in accordance with the requirements of the relevant statutory requirements
- The contractor shall ensure proper collection and off-site disposal of all industrial wastes in accordance with relevant statutory requirements.

- The contractor shall apply the principles of Waste Minimisation by reducing the amount of waste generated on Site by their operations and activities as much as possible. The contractor shall provide for cycling of glass, metals, plastics and papers.

### 8.15.7 Weed management

The contractor shall comply with the following conditions and requirements for weed management:

- Contractors shall ensure that all machinery, equipment and vehicles are washed down at a wash facility before the Site and again when leaving the site.
- Plants and soil shall not be removed from Site without authorisation.
- Soil or other material shall not be brought onto Site if it has originated from an area known to contain environmental weeds or declared weeds under the Rural land Protection act 1995.
- Areas disturbed or rehabilitated as part of a Contract will be inspected upon completion of the works. The Contractor shall eradicate any declared weeds found.
- Seeds used in rehabilitation shall be free of declared weeds
- Control measures (including use of herbicides) must be consistent with manufacture's recommendations, safe practice and recommendations in the Department of natural Resources Pest Fact series.
- Include information on the importance of weed control inductions.

**Any deviation from the above listed practices is to be rectified at Contractor's cost**

### 8.15.8 Found Object

All fossils, coins, articles, minerals of commercial value and objects of antiquity and structures and other remains and things of archaeological interest discovered at the Project site shall be deemed to be the absolute property of the Company. The Contractor shall take reasonable precautions to prevent the Contractor's employees, subcontractors and the employees of subcontractors and any other persons from removing and damaging any such article and thing and shall immediately upon discovery thereof acquaint the Engineer of such discovery and carry out, at the expense of the company and at the engineer's direction, the protection and or disposal of same,.

## 8.16 **Monitoring, Audit and Review**

- The Client's Agent/DPW Safety Manager shall have the right to conduct audits/inspections of the Contractor's operations, equipment and procedures at any time, and the Contractor shall fully co-operate with the client's agent during such audits/inspections.
- The client's agent rights under this clause shall not relieve the contractor of its obligations to conduct audits and reviews of its own safety and health performance.
- Where such Client's Agent/DPW Safety Manager audits reveal deficiency in the Contractor's procedure equipment, training, drills, etc. the contractor shall rectify such deficiencies as soon as practicable, and provide to the Client's agent a status report on all outstanding corrective actions. Where such deficiencies include an unsafe practice or breach of the Statutory or the Contract's requirements, the Client's Agents/DPW Safety Manager may in accordance with the general Conditions of Contract suspend the work associated with the unsafe practice or breach until the deficiency is rectified.

### 8.17 Penalties and Fines

Any contractor employees who is found not adhering to the ESH specification, Site Ground Rules ,ESH Plan or any other statutory requirement, or who is observed committing unsafe acts or contributing to unsafe conditions will be issued with a Non-Conformance Report and the relevant Contract will be issued a fine according to the scale of fines nominated below.

**Contractor employees will also be reprimanded as per the relevant company HR procedures:**

- First transgression constitutes a **verbal warning**.
- Second transgression constitutes **a written warning**.
- Third transgression constitutes **a full disciplinary hearing** according to the company' HR procedures
- Any life-threatening unsafe act or unsafe condition must be treated as a Gross Neglect of Company Environmental, safety and Health Rules and Procedures and Disciplinary hearing shall be conducted to determine the root cause of the incident and the appropriate action which must be taken to prevent the similar unsafe situation from occurring in the future.

  Copies of Non-Conformance Reports (NCR) and disciplinary hearings must be kept on record on the OHS File.

8.17.1 Offences and Penalties
All offences and penalties will be dealt according to CR (33)

**9 Applications of the Construction Regulations [CR]**
**[Please note; this is the complete list. Item 9.1 is compulsory and the rest are applicable if relevant to the work being carried out]**

**9.1 Hazard Identification, Risk assessment and Risk Control (HIRA) [CR 9]**

The contractor shall prior to the commencement of any construction work perform a HIRA exercise which will form part of the HSP and file for the project. A copy of HIRA shall be made available for viewing to the client's OHS agent and shall be kept in the Health and Safety File.

NB: The contractor shall ensure that the outcome of all HIRA exercises will be conveyed to all relevant employees with respect to the hazards and the related control measures before any work commences.

Below is the list of activities, which may be considered for HIRA if the activity is to be carried out on site. The list is not exhaustive but gives examples of activities for a construction site:

- Site security and access.
- Traffic management-restrictions etc.
- Activities that affect adjacent sites.
- Lifting operations such as offloading and moving equipment.
- Lifting equipment such as offloading and moving equipment
- Stacking, storage of equipment and materials, and good housekeeping.
- Use of hand tools
- Use of portable electric equipment(power tools)
- Use and storage of flammable and hazardous chemicals such as paint, adhesives, solvents, thinners, cement etc.

- Scaffolding.
- Painting.
- Welding.
- Electric installations.
- Mechanical installation.
- Waste management including removal of hazardous waste.
- Environmental restraints such as boundary noise and dust.
- Temporary site accommodation.
- General hazards to site personnel such as cleaning noise and dust.

**The control of several of these risks may be specified in the OHSA or the CR but this does not mean that the HIRA exercise does not have to be carried out.**

### 9.6 Construction vehicle and mobile plant [CR 23]

It will be the responsibility of each contractor on site to ensure compliance of their construction vehicles and mobile plant to these regulations.
This includes vehicles to be used for transporting personnel to and from site, which will be subject to relevant requirements such as licensing and roadworthiness checks. In addition the following will apply:

- Safe transport for personnel working on the project to and from the workplace, which shall include proper seating, side restraints and cover.
- Road safety principles shall be adhered to on and off site.

  If a mobile crane or other mobile plant is hired, only approved hire companies shall be contracted to provide such equipment. The Construction Supervisor shall ensure compliance of the provider to these regulations. In particular attention is drawn to the competence and fitness of the operator [section 1(d)] and the inspection of the equipment [section 1(j)].

### 9.7 Electrical Works [CR 24], including [EIR] and [EMR]

The requirement of these regulations shall be met as required by the appointed electrical contractor. Competent person will be appointed for inspection and control of all temporary electrical installations as per CR 24(d) and (e) respectively.

The person /Contractor who does electrical installation work as an electrical contractor shall be registered as an electrical contractor in terms of electrical Installations Regulations.

### 9.8 Use and storage of flammable liquids [CR 25], and hazardous chemical substances [HCSR]

All the requirements of CR 16 shall be met.
In terms of HCSR, contractors shall ensure that all hazardous chemicals brought to site have Material Safety Data Sheet (MSDS) and the users are made aware of the important sections of the MSDS such as:

- Hazards
- First aid measures
- Fire fighting measures
- Accidental release measure

- Handling storage
- Exposure control especially PPE
- Disposal

First aider shall be made aware of the MSDS and how to treat HCS incidents appropriately. Copies of MSDS's will be available on site and in the HSF.

### 9.9 Housekeeping [CR 27] including [ERW (6)]

All contractors shall ensure that housekeeping standards as per these regulations shall be maintained at all times.

### 9.10 Stacking and Storage of Materials [CR 28] including [GSR (8)]

All contractors shall ensure that materials are only stored in defined and allocated storage areas and that materials being stored are stacked in accordance with sound stacking principle as per these regulations.

### 9.11 Fire precautions [CR 29]

All contractors on site will comply fully with the requirements of this regulation. In particular, the principal contractor will be responsible for the evacuation plan (section (l) the details of which will be impaired to contractors, visitors etc. through the site induction.

### 9.12 Construction employee welfare facilities [CR 30]

The principal contractor shall be responsible for implementing this regulation and shall ensure that adequate facilities are provided for the personnel on site in terms of the following:

- Change room facilities
- Adequate toilets
- Hand wash facilities
- Drinkable water

No food preparation shall be conducted on site. Eating and drinking will only be permitted in the designated eating areas, which must be provided with adequate seating. Waste bins shall be strategically placed and cleared regularly.

## 10. Site Specific and Design Risks

**[Please note; this is not a complete or exhaustive list. The principal contractor is expected to assess all risks to which his employees may be exposed during the construction process, as well as the hazards identified and listed below].**

### 10.1 Hazard Identification and Risk Assessment Methodology

Once on site, every contractor shall perform task risk assessment, using the baseline risk assessment as a guide.

The Risk assessment should be reviewed once on site and thereafter after any incident, change in design or every one-year period, whichever occurs first. Additional hazards highlighted or change in the risk factor should have a separate risk assessment carried out and filed.

The risk assessment is based on the combination of the CONSEQUENCE and PROBABILITY associated with each hazards.

### 10.1.1 Definitions

| Term | Meaning |
|---|---|
| HAZARDS | Anything that can cause harm |
| RISK | The chance, great or small, that someone will be harmed by hazard |
| CONSEQUENCE | The possible outcome of an incident/ accident, e.g. broken leg, explosion. |
| PROBABILITY | The possibility of the accident/incident occurring |

### 10.1.2 Risk Assessment

The following evaluation must be used to determine risk:

Probability X Consequence= RISK

### Risk Matrix

**Calculating the risk**

1.Take the consequences rating(1-5) and select the correct column
2. Take the likelihood rating(A-E) and select the correct row
3. Select the risk rating where the two ratings cross on the matrix below.
**VH=Very, High=High, M= Medium, L=Low**

| | | CONSEQUENCES | | | | |
|---|---|---|---|---|---|---|
| Likelihood | 1 | 1 | 2 | 3 | 4 | 5 |
| | A | M | H | H | VH | VH |
| | B | M | M | H | H | VH |
| | C | L | M | H | H | VH |
| | D | L | L | M | M | H |
| | E | L | L | M | M | M |

### 10.2 Site Specific risks

The following site-specific risks have been identified for this project. These must be catered for in the contractor's health and safety plan (that which is applicable to their scope of work), and included in the site-specific risk assessment.

### 10.2.1 Traffic-restrictions, existing system, site traffic

Traffic accommodation must be arranged with the principal agent.

### 10.2.2 Site security and access-this is controlled by principal contractor.

### 10.3 Design risks

The following design risks have been identified by the designer for this project. These must be catered for in the contractor's health and safety plan (that which is applicable to their scope of work), and included in the site-specific risk assessment.

10.3.1 Electrical
10.3.2 Mechanical.
10.3.3 Civil Work

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Public Works and Infrastructure
REPUBLIC OF SOUTH AFRICA

EXPANDED PUBLIC WORKS PROGRAMME
CONTRIBUTING TO A NATION AT WORK

# EPWP IMPLEMENTATION FRAMEWORK ON NDPWI PROJECTS

***Kimberley Galeshewe Police Station: Replacement of air conditioners***

**In order to make tender / contract documents fully EPWP compliant (labour-intensive construction projects) the following clauses and / or additions need to be included in the documentation:**

## 1. Tender Document Cover

*The following* EPWP *Logo to be included on the bottom of the front cover*


## 2. Tender Notice and Invitation to Tender

*The following must be included in the notice and invitation to tender (for Contract Documentation for the Works):*

"Only tenderers who employ staff which satisfy EPWP requirements are eligible to submit tenders."

## 3. Contract Data

*The following must be included in the contract data in the contract with the Employer:*

### Linkage of payment for labour-intensive component of works to submission of project data

The Contractor's payment invoices shall be accompanied by labour information for the corresponding period in a format specified by the employer. If the contractors chooses to delay submitting payment invoices, labour returns shall still be submitted as per frequency and timeframe stipulated by the Employer. The contractor's invoices shall not be paid until all pending labour information has been submitted.

### Applicable labour laws

The current Ministerial Determination (also downloadable at www.epwp.gov.za), Expanded Public Works Programmes, issued in terms of the Basic Conditions of Employment Act of 1997 by the Minister of Labour in Government Notice , shall apply to works described in the scope of work as being labour intensive and which are undertaken by unskilled or semi-skilled workers.

## 4. Bill of Quantities

- Due to the nature of the works involved, this type of project is feasible as a labour Intensive project i.e. the construction activities will require skilled/unskilled labour.

- Noted that only few items were identified to be implemented LI on the BOQ. The QS is kindly requested to identify more activities that will be done LI in the BOQ.

- Below are some of the potential focus areas where employment creation can be optimized. The following activities must be marked in the bill of quantities with the letter (LI);

| LI Activities |
|---|
| All excavations works not exceeding 1.5 m |
| Masonry |
| Brickwork |
| Waterproofing ( requires skilled labour and semi-skilled labour) |
| Cleaning of roof |
| Carpentry and joinery (requires skilled and semi-skilled labour) |
| Shelving |
| Installation of handle doors, door closers, nameplates, bathroom fittings |
| Signage, |
| Installation of pinning boards , writing boards |
| Plastering ( Internal and External) |
| Tilling |
| Plumbing and Drainage & stormwater drainage |
| Paintwork |
| Installation of Fencing |
| Landscaping |
| Sewer connections |
| Water connections |
| Road signs |
| Paving to parking area |
| Fencing and installation of gate |

## 6. Employment Targets

The contractor needs to provide a realistic estimate on the number of jobs that the project has the potential to create throughout the project duration as the project will be implemented using Labour Intensive Construction methods on elements where it is economical and feasible for this construction method.

**Estimated no of jobs to be created:**
**NYS Beneficiaries = N/A**
**Local Labour = 2**

## 7. Employment requirements

Tenderers are advised that this contract will be subject to the Expanded Public Works Program (EPWP) aimed at alleviating and reducing unemployment.

Tenderers must allow for any costs for the following employment requirements of the EPWP
60% women
55% youth aged between 18 and 35 years
2% people with disability

100% unskilled labour utilized must reside within the boundaries of the Municipality ward where this contract is executed, with preference to the local community closest or at the walking distance to the contract site. Wherever possible local skilled tradesmen are to be employed on this contract with the view to maximize utilization of local resources.

## 8. Employment of Community Liaison Officer (CLO)

8.1. The Contractor shall allow for and pay any and all costs necessary for the engagement of the services of a Community Liaison Officer (CLO) for the full duration of a project.

8.2. A CLO will be identified by the local structures (Project Steering Committee) of the ward areas and appointed following a fair and transparent interviewing process, to be conducted in the presence of local structures and the contractor representative, in order to assist the Contractor in the procurement of any local labour, etc. required for this project.

8.3. The Contractor is to liaise with the CLO and afford him any assistance needed in ensuring sound working relations with the local community.

8.4. Key Responsibilities of the CLO are envisaged to include and not necessary be limited to:

a) Assisting local leadership in conducting skills and resources audit which facilitates sourcing labour from within the ward or targeted areas for employment, as required by contractor,
b) Assisting in the procurement of materials from local resources, as required by the contractor,
c) Assisting the contractor by identifying areas of potential conflict and or threats to the project or to stakeholders in the project and recommend appropriate action to the contractor.
d) Assisting contractor and stakeholders in the project in the resolution of any conflict which may arise.
e) Establishing and ensuring that sufficient and open communication channels between the contractor and the work force are maintained.
f) Establish and ensuring that efficient and open communication channels between the contractor and the community are maintained

g) Identifying and reporting to the Contractor regarding issues where communication between stakeholders is necessary, recommend courses of action and facilitate such communications
h) Assisting the Contractor and the work force in the establishment of grievance procedures and necessary recommendation to the Contractor regarding the grievances and solution thereto.
i) Attending to site meetings and project implementation meetings as required by the Contractor and prepare periodic reports as may be required by the Contractor from time to time.
j) Attending to such other duties which are consistent with the functions of a CLO, as may be required by the Contractor from time to time.

## 9. EPWP Branding

### 9.1. Signboard

EPWP Programme at the project level shall always be promoted through the projects signage board that embrace EPWP logo at the bottom, correct measurement for this signage board will be provided by the project leader during the site handing over meeting.

The Contractor is responsible for ensuring that the project board remains neatly and safely erected for the full duration including the maintenance period, after which the project board and posts are to be dismantled and handed to the client in good order

### 9.2. Personal Protective Equipment (PPE)

All local labourers including contractor & sub-contractors' shall be provided with EPWP branded Personal Protective Equipment (PPE), as per the branding specifications.

Overalls to be orange in colour as per EPWP Corporate image and requirements (Annexure E). Branding to be done in full colour. Specification with the exception of Correctional Services contracts where the participants top and bottom would be green.

## 10. Reporting

The Contractor's payment invoice shall be accompanied by labour information for the corresponding period in an EPWP reporting format (Annexure B). The completed EPWP reporting template should be accompanied by the following supporting documents:

- Contract of employment ( Individual and/or Entity) - once-off
- Certified South African ID copy ( certification date not older than 3 months)- once-off
- Attendance register of participants- periodically
- Proof of payment of participants- periodically
- Schedule of payment for SMMEs- periodically (N/A)

The Consultant shall, before certifying a contractor's payment certificate, ensure that contractor has submitted labour information in a format and timeframe specified by the employer.

If the information submitted by the contractor is inadequate the consultant shall not submit the payment certificate to the employer for payment. If the contractor chooses to delay submitting payment invoices, labour information shall still be submitted as per frequency and timeframe stipulated by the Employer. The contractors invoice shall not be paid until all pending labour information has been submitted.

**12.02 PROVISION OF PPE TO EACH LOCAL LABOUR.**

**DEPARTMENT OF PUBLIC WORKS AND INFRASTRUCTURE**

public works & infrastructure
Department:
Public Works and Infrastructure
REPUBLIC OF SOUTH AFRICA

# BILLS OF QUANTITIES

**Comprising of:**

Section 1 - Preliminaries and General

Section 2: Bill of Quantities - Mechanical Installations

Section 3: Final Summary

Department
Public Works and Infrastructure
REPUBLIC OF SOUTH AFRICA

**GALESHEWE SAPS REPLACEMENT OF AIR CONDITIONERS**
**ENGINEERING SERVICES**

| ITEM NO | DESCRIPTION | UNIT | QTY | RATE | AMOUNT |
|---|---|---|---|---|---|
| | | | | | |
| | **PART 1A: PRELIMINARY AND GENERAL** | | | | |
| | | | | | |
| | The agreement is to be the General Conditions of Contract (GCC 2010) (Second Edition), Published by the SA Institution of Civil Engineering. | | | | |
| | | | | | |
| | The preliminaries are to be the Construction and management requirements for works contracts - Part 1: General engineering and construction works (SANS 1921 -1: 2004 Edition 1) prepared by Standards South Africa and shall be deemed to be incorporated herein. | | | | |
| | | | | | |
| | Tenderers are referred to the abovementioned documents for the full intent and meaning of each clause thereof (hereinafter referred to by heading and clause number only) for which such allowance must be made as may be considered necessary. | | | | |
| | | | | | |
| | Where standard clauses or alternatives are not entirely applicable to this contract such modifications, corrections or supplements as will apply are given under each relevant clause heading. | | | | |
| | | | | | |
| | Where any item is not relevant to this specific contract such items is marked N/A (signifying "not applicable"). | | | | |
| | | | | | |
| | Adjustment of the preliminaries: each item priced, is to be allocated to one or more of the three categories, where "F" denotes a fixed amount (amount not to be varied), "V" denotes an amount variable in proportion to value and "T" denotes an amount in proportion to time. | | | | |
| | | | | | |
| | Time (T) related Preliminaries will only be adjusted for omissions or additions, issued by the Employer, or delays caused by the Employer, for which variation and extention of time has been granted. | | | | |
| | | | | | |
| | **SECTION A: GENERAL CONDITIONS OF CONTRACT** | | | | |
| | | | | | |
| **A1** | General (Clause 1) | | | | |
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| | F: ..... V: ..... T: ..... | Item | | | |
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| **A2** | Basis of Contract (Clause 2) | | | | |
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| | F: ..... V: ..... T: ..... | Item | | | |
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| **A3** | Engineer (Clause 3) | | | | |
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| | F: ..... V: ..... T: ..... | Item | | | |
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| | **CARRIED FORWARD** | | | | |

| ITEM NO | DESCRIPTION | UNIT | QTY | RATE | AMOUNT |
|---|---|---|---|---|---|
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| | BROUGHT FORWARD | | | | |
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| A4 | Contractor's General Obligation (Clause 4) | | | | |
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| | F: ..... V: ..... T: ..... | Item | | | |
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| | | | | | |
| A5 | Time and Related Matters (Clause 5) | | | | |
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| | F: ..... V: ..... T: ..... | Item | | | |
| | | | | | |
| A6 | Payment and Related Matters (Clause 6) | | | | |
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| | F: ..... V: ..... T: ..... | Item | | | |
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| A7 | Quality and Related Matters (Clause 7) | | | | |
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| | F: ..... V: ..... T: ..... | Item | | | |
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| A8 | Risk and Related Matters (Clause 8) | | | | |
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| | F: ..... V: ..... T: ..... | Item | | | |
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| A9 | Termination of Contract (Clause 9) | | | | |
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| | F: ..... V: ..... T: ..... | Item | | | |
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| A10 | Claims and Disputes (Clause 10) | | | | |
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| | F: ..... V: ..... T: ..... | Item | | | |
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| | SECTION B: SANS 1921-1:2004 (Edition 1): | | | | |
| | CONSTRUCTION AND MANAGEMENT | | | | |
| | REQUIREMENTS FOR WORKS CONTRACTS: PART 1 | | | | |
| | | | | | |
| B1 | Scope | | | | |
| | | | | | |
| | F: ..... V: ..... T: ..... | Item | | | |
| | | | | | |
| B2 | Normative references | | | | |
| | | | | | |
| | F: ..... V: ..... T: ..... | Item | | | |
| | | | | | |
| B3 | Definitions | | | | |
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| | F: ..... V: ..... T: ..... | Item | | | |
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| B4 | Requirements for construction and management | | | | |
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| | F: ..... V: ..... T: ..... | Item | | | |
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| B4.1 | General | | | | |
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| | F: ..... V: ..... T: ..... | Item | | | |
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| B4.2 | Responsibilities for design and construction | | | | |
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| | F: ..... V: ..... T: ..... | Item | | | |
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| | CARRIED FORWARD | | | | |

| ITEM NO | DESCRIPTION | UNIT | QTY | RATE | AMOUNT |
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| | BROUGHT FORWARD | | | | |
| B4.3 | Planning, programme and method statements | | | | |
| | F: ..... V: ..... T: ..... | Item | | | |
| B4.4 | Quality assurance | | | | |
| | F: ..... V: ..... T: ..... | Item | | | |
| B4.5 | Settling out | | | | |
| | F: ..... V: ..... T: ..... | Item | | | |
| B4.6 | Management and disposal of water | | | | |
| | F: ..... V: ..... T: ..... | Item | | | |
| B4.7 | Blasting | | | | |
| | F: ..... V: ..... T: ..... | Item | | | |
| B4.8 | Works adjacent to services and structures | | | | |
| | F: ..... V: ..... T: ..... | Item | | | |
| B4.9 | Management of the works and site | | | | |
| | F: ..... V: ..... T: ..... | Item | | | |
| B4.10 | Earthworks | | | | |
| | F: ..... V: ..... T: ..... | Item | | | |
| B4.11 | Testing | | | | |
| | F: ..... V: ..... T: ..... | Item | | | |
| B4.12 | Materials, samples and fabrication drawings | | | | |
| | F: ..... V: ..... T: ..... | Item | | | |
| B4.13 | Equipment | | | | |
| | F: ..... V: ..... T: ..... | Item | | | |
| B4.14 | Site establishment | | | | |
| | F: ..... V: ..... T: ..... | Item | | | |
| B4.15 | Survey control | | | | |
| | F: ..... V: ..... T: ..... | Item | | | |
| | CARRIED FORWARD | | | | |

| ITEM NO | DESCRIPTION | UNIT | QTY | RATE | AMOUNT |
|---|---|---|---|---|---|
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| | **BROUGHT FORWARD** | | | | |
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| **B4.16** | Temporary works | | | | |
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| | F: ..... V: ..... T: ..... | Item | | | |
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| **B4.17** | Existing services | | | | |
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| | F: ..... V: ..... T: ..... | Item | | | |
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| **B4.18** | Health and safety | | | | |
| | | | | | |
| | F: ..... V: ..... T: ..... | Item | | | |
| | | | | | |
| **B4.19** | Environmental requirements | | | | |
| | | | | | |
| | F: ..... V: ..... T: ..... | Item | | | |
| | | | | | |
| **B4.20** | Alterations, additions, extentions and modifications to existing works | | | | |
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| | F: ..... V: ..... T: ..... | Item | | | |
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| **B4.21** | Inspection of adjoining structures, services, buildings and property. | | | | |
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| | F: ..... V: ..... T: ..... | Item | | | |
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| **B4.22** | Attendance on nominated and selected subcontractors | | | | |
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| | F: ..... V: ..... T: ..... | Item | | | |
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| | **SECTION C: SCOPE OF WORK IN ACCORDANCE WITH SANS 10403** | | | | |
| | (The reference to clauses refer to table B.1 of SANS 1921-1:2004) | | | | |
| | | | | | |
| **C1** | Cerification by recognised bodies - (Clause 4.4) | | | | |
| | | | | | |
| | F: ..... V: ..... T: ..... | Item | | | |
| | | | | | |
| **C2** | Agrèment - (Clause 4.5) | | | | |
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| | F: ..... V: ..... T: ..... | Item | | | |
| | | | | | |
| **C3** | Other services and facilities - (Clause 4.8) | | | | |
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| | F: ..... V: ..... T: ..... | Item | | | |
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| | **CARRIED FORWARD** | | | | |

| ITEM NO | DESCRIPTION | UNIT | QTY | RATE | AMOUNT |
|---|---|---|---|---|---|
| | **BROUGHT FORWARD** | | | | |
| C4 | Recording of weather - (Clause 5.2) | | | | |
| | F: ..... V: ..... T: ..... | Item | | | |
| C5 | Management meetings - (Clause 5.3) | | | | |
| | F: ..... V: ..... T: ..... | Item | | | |
| C6 | Daily records - (Clause 5.6) | | | | |
| | F: ..... V: ..... T: ..... | Item | | | |
| C7 | Permits - (Clause 5.9) | | | | |
| | F: ..... V: ..... T: ..... | Item | | | |
| C8 | Proof of compliance with the law - (Clause 5.10) | | | | |
| | F: ..... V: ..... T: ..... | Item | | | |
| | **SECTION D: SPECIFICATION DATA ASSOCIATED WITH SANS 1921-1:2004 (Table A.1)** | | | | |
| D1 | Requirements for drawings, information and calculations for which the contractor is responsible - (Clause 4.1.7) | | | | |
| | F: ..... V: ..... T: ..... | Item | | | |
| D2 | The planning, programme and method statements- (Clause 4.3) | | | | |
| | F: ..... V: ..... T: ..... | Item | | | |
| D3 | Samples of materials. Workmanships and finishes - (Clause 4.12.1) | | | | |
| | F: ..... V: ..... T: ..... | Item | | | |
| D4 | Fabrication drawings that the contractor is to provide and deliver to the employer - (Clause 4.12.2) | | | | |
| | F: ..... V: ..... T: ..... | Item | | | |
| D5 | Office for the foreman - (Clause 4.14.3) | | | | |
| | F: ..... V: ..... T: ..... | Item | | | |
| | **CARRIED FORWARD** | | | | |

| ITEM NO | DESCRIPTION | UNIT | QTY | RATE | AMOUNT |
|---|---|---|---|---|---|
| | **BROUGHT FORWARD** | | | | |
| D6 | Telephone - (Clause 4.14.3) | | | | |
| | F: ..... V: ..... T: ..... | Item | | | |
| D7 | Office for inspector of works - (Clause 4.14.3) | | | | |
| | F: ..... V: ..... T: ..... | Item | | | N/A |
| D8 | Telephone in office for inspector of works - (Clause 4.14.3) | | | | |
| | F: ..... V: ..... T: ..... | Item | | | N/A |
| D9 | Provision and erection of signboards - (Clause 4.14.6) | | | | |
| | F: ..... V: ..... T: ..... | Item | | | |
| D10 | Termination, diversion or maintenance of existing services - (Clause 4.17.1) | | | | |
| | F: ..... V: ..... T: ..... | Item | | | |
| D11 | Services which are known to exist - (Clause 4.17.3) | | | | |
| | F: ..... V: ..... T: ..... | Item | | | |
| D12 | Detection apparatus - (Clause 4.17.4) | | | | |
| | F: ..... V: ..... T: ..... | Item | | | |
| D13 | Additional health and safety requirements - (Clause 4.18) | | | | |
| | F: ..... V: ..... T: ..... | Item | | | |
| | **SECTION E: SPECIFIC PRELIMINARIES** | | | | |
| | (Section E contains specific preliminaries items which apply to this contract except where "N/A" (Not applicable) appears against the item. | | | | |
| E1 | **WORKING OVER THE WEEKEND** | | | | |
| | Contractor to make allowance to work over the weekend in order to allow for the disconnection of utilities and the connection of the generator. The weekend to be used for disconnection and connection and must be communicated to the Department two weeks in advance. | | | | |
| | F: ..... V: ..... T: ..... | Item | | | |
| | **CARRIED FORWARD** | | | | |

| ITEM NO | DESCRIPTION | UNIT | QTY | RATE | AMOUNT |
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| **E2** | **SITE INSTRUCTIONS** | | | | |
| | Site instructions issued on site are to be recorded in | | | | |
| | triplicate in a Site Instruction book which is to be m | | | | |
| | maintained on site by the Contractor | | | | |
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| **E3** | **PLANT RECORD** | | | | |
| | At every site meeting, the Contractor shall provide the | | | | |
| | Engineer/Principal agent with a written record, in | | | | |
| | schedule form, reflecting the number, type and capacity | | | | |
| | of all plant, excluding hand tools, currently used on the | | | | |
| | works. | | | | |
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| **E4** | **SITE OFFICE** | | | | |
| | The Contractor is to allow for the provision and removal | | | | |
| | of a site office in accordance with the Principal Agent's | | | | |
| | requirements. To accommodate 6 persons. | | | | |
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| **E5** | **TRADE NAMES** | | | | |
| | Wherever a Trade Name for any product has been | | | | |
| | described in the Bill of Quantities, the Bidder's attention | | | | |
| | is drawn to the fact that any other product of equal quality | | | | |
| | may be used, subject to the written approval of the | | | | |
| | Principal Agent being obtained prior to the closing date | | | | |
| | for the submission of the Bids. | | | | |
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| **E6** | **INACCURATE AND DEFECTIVE WORK EXECUTED** | | | | |
| | **UNDER PREVIOUS CONTRACT** | | | | |
| | The contractor shall, after taking possession of the site | | | | |
| | and before commencing the work, check all levels, liners, | | | | |
| | profiles and the like and satisfy himself as to the | | | | |
| | dimensional accuracy of all work executed under the | | | | |
| | previous contract which may affect his work. | | | | |
| | | | | | |
| | Should any inaccurate or detecfive work be found, the | | | | |
| | contractor shall immediately notify the principal agent | | | | |
| | in writing requesting his instructions with regard thereto | | | | |
| | and afford every facility to those rectifying such | | | | |
| | inaccurate or defective work. | | | | |
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| **E7** | **VIEWING THE SITE IN SECURITY AREAS** | | | | |
| | If the site is situated in a security area and the bidder | | | | |
| | must arrange with the Authorities to obtain permission | | | | |
| | to enter the site for Bidding purposes. | | | | |
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| **E8** | **COMMENCEMENT OF WORKS IN SECURITY AREAS** | | | | |
| | If the works falls within a security area, the contractor | | | | |
| | must arrange with the Authorities and give the | | | | |
| | necessary notices before commencement of the works. | | | | |
| | Should the contractor fail to make such arrangements, | | | | |
| | admission to the site may be refused and any aditional | | | | |
| | costs will be for the contractor's account. | | | | |
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| **E9** | **ENTRANCE PERMITS TO SECURITY AREAS** | | | | |
| | If the works falls within a security area, the contractor | | | | |
| | shall obtain entrance permits for his personnel and | | | | |
| | workmen entering the area and shall comply with all | | | | |
| | regulations ans instructions which be issued from the | | | | |
| | time to time regarding the protection of persons and | | | | |
| | property under the control of the Authority. | | | | |
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| **E10** | **PROHIBITION ON TAKING PHOTOGRAPHS** | | | | |
| | In terms of article 119 of the Defence Act, 44 of 1957, | | | | |
| | it is prohibited to sketch or to take photographs of any | | | | |
| | military site or installation or any building or civil works | | | | |
| | thereon or to be in possession of a camera or other | | | | |
| | apparatus used for taking photographs, except when | | | | |
| | authorised thereto by or on behalf of the Minister | | | | |
| | | | | | |
| | The same prohibition is also applicable to all | | | | |
| | Correctional Institutions in terms of article 44.1 of the | | | | |
| | Correctional Services Act 8 of 1959. | | | | |
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| **E11** | **TOILET FACILITIES** | | | | |
| | Allow for the supply and removal of portable toilet | | | | |
| | facilities. The contractor is to maintain the cleanliness | | | | |
| | of the facilities throughout the contract period. The | | | | |
| | contractor must provide enough toilets for his/her entire | | | | |
| | workforce. | | | | |
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| **E12** | **MANAGEMENT OF WATER** | | | | |
| | Water for Construction puposes must be obtained from | | | | |
| | alternative water sources (i.e. supply other than water | | | | |
| | that is produced and distributed by a regulated water | | | | |
| | service authority from a licensed water treatment works | | | | |
| | for human consumption), e.g. dams, rivers, boreholes, | | | | |
| | springs, rainwater harvesting, recycled sewerage water, | | | | |
| | etc. The alternative water source shall not be of an | | | | |
| | inferior quality/ standard than that required for | | | | |
| | construction purposes. The client reserves the right | | | | |
| | through his agents to test such supplies or request | | | | |
| | certificates confirming the grade and nature of the water | | | | |
| | supply. Relevant knowledge of the respective area will | | | | |
| | be an advantage. | | | | |
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| **E13** | **OCCUPATIONAL HEALTH AND SAFETY ACT &** | | | | |
| | **CONSTRUCTION REGULATIONS** | | | | |
| | It is required of the Contractor to thoroughly study the | | | | |
| | Health and Safety specification that must be read | | | | |
| | together with and is deemed to be incorporated under | | | | |
| | this section of the Bill of Quantities. Provision for pricing | | | | |
| | thereof is made under items E12.1 to E12.15 hereafter | | | | |
| | and it is explicity pointed out that all requirements of the | | | | |
| | aforementioned specification are deemed to be priced | | | | |
| | hereunder, as the said items represent the only method | | | | |
| | of measurement and no additional items or extras to the | | | | |
| | contract in this regard shall be entertained. | | | | |
| | | | | | |
| | The contractor must take note that compliance with the | | | | |
| | Occupational Health and Safety Act, Construction | | | | |
| | Regulations and Health and Safety specification is | | | | |
| | compulsory. In the event of partial or total non- | | | | |
| | compliance, the Principal Agent , notwithstanding the | | | | |
| | provisions of Clause 6 of Section 1: Preliminaries | | | | |
| | (Part A) or any other clause to the contrary, reserves | | | | |
| | the right to delay issuing any progress payment | | | | |
| | certificate until the Contractor provides satisfactory | | | | |
| | proof of compliance. The Contractor shall not be entitled | | | | |
| | to any compensation of whatsoever nature, including | | | | |
| | interest, due to such delay of payment. | | | | |
| | All references hereafter are to Regulations of the | | | | |
| | Construction Regulations, 2003 issued under the | | | | |
| | Occupational Health and Safety Act, 1993 (Act No 85 of | | | | |
| | 1993). | | | | |
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| | The contractor shall, in submitting his bid, demonstrate | | | | |
| | that he has made provision for the cost of compliance | | | | |
| | with the specified health and safety requirements, the Act | | | | |
| | and the Construction Regulations. | | | | |
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| E13.1 | **NOTIFICATION OF CONSTRUCTION WORK** | | | | |
| | **(Construction Regulations 3)** | | | | |
| | The contractor shall, before commencing work, notify the | | | | |
| | Department of Labour of the intend construction work in | | | | |
| | terms o Regulation 3. The Contractor shall submit the | | | | |
| | notification in writing, on the appropriate form, prior to | | | | |
| | commencement of work. | | | | |
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| E13.2 | **HEALTH AND SAFETY PLAN (Construction** | | | | |
| | **regulations 5.4)** | | | | |
| | The Contractor shall provide and demonstrate to the | | | | |
| | Principal Agent a suitable and sufficiently documented | | | | |
| | health and safety plan based on the Act, Construction | | | | |
| | Regulations and the health and safety specification, | | | | |
| | which shall be applied from the date of commencement | | | | |
| | of and for the duration of the construction work. The | | | | |
| | Contractor shall ensure that a copy of the health and | | | | |
| | safety plan is available on request to an employee, | | | | |
| | inspector, sub contractor or principal agent all in terms | | | | |
| | of Regulation 5. | | | | |
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| E13.3 | **REGISTRATION WITH THE COMPENSATION FUND** | | | | |
| | **(Construction Regulations 5.3 f)** | | | | |
| | The Contractor shall provide proof of his registration and | | | | |
| | good standing with the Compensation Fund or a licensed | | | | |
| | compensation insurer prior to the commencement of | | | | |
| | work | | | | |
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| E13.4 | **HEALTH AND SAFETY FILE ( Construction** | | | | |
| | **Regulation 5.7)** | | | | |
| | The contractor shall ensure that a health and safety file, | | | | |
| | which shall include all documentation required in terms | | | | |
| | of health ans safety specification, the Act and the | | | | |
| | Construction Regulations, is opened and kept on site | | | | |
| | and made available to the Principal Agent or inspector | | | | |
| | upon request. Upon completion of the works, the | | | | |
| | contractor shall hand over a consolidated health and | | | | |
| | safety file to the principal agent. | | | | |
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| E13.5 | **SUPERVISION OF CONSTRUCTION WORK ( Safety** | | | | |
| | **officier) (Construction Regulation 6)** | | | | |
| | The Contractor shall appoint a full-time competent | | | | |
| | employee in writing as the construction supervisor, with | | | | |
| | the duty of supervising the construction work. | | | | |
| | | | | | |
| | The Contractor shall appoint a full-time or part-time | | | | |
| | construction safety officier in writing to assist in the | | | | |
| | control of all safety related aspects on the site. Such | | | | |
| | appointments are required to ensure that at all times the | | | | |
| | requirements of the Act and Construction Regulations | | | | |
| | are adhered to. Refer to Regulation 6. | | | | |
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| E13.6 | **RISK ASSESSMENT AND SAFETY POLICY** | | | | |
| | **( Construction Regulation 7)** | | | | |
| | Before commencing work the Contractor shall cause a | | | | |
| | risk assessment to be performed by a competent person | | | | |
| | appointed in writing and the risk assessment shall form | | | | |
| | part of the health and safety plan. A copy of the risk | | | | |
| | assessment shall be available on site at all times for | | | | |
| | inspection. | | | | |
| | The Contractor shall at all time carry out the works in a | | | | |
| | manner to avoid the risk of bodily harm to persons or | | | | |
| | risk of damage to any property. He shall take all | | | | |
| | precuations regarding training of employees in any | | | | |
| | hazards and the related work procedures, health and | | | | |
| | safety induction training of employees, visitors or any | | | | |
| | other persons entering the site and provide personal | | | | |
| | protective equipment to all employees and visitors to | | | | |
| | site which are necessary and adequate to eliminate any | | | | |
| | conditions which contribute to the risk of injury to | | | | |
| | persons or damage to property in terms of Regulation 7. | | | | |
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| E13.7 | **SIGNIFICANT HAZARD IDENTIFICATION RISK ASSESSMENT PREPARED BY THE DESIGN CONSULTANTS** | | | | |
| | The Contractor shall allow for additional finanical provision, if any , to take the necessary precauations regarding the significant hazards and risks identified and assessed by the design consultants. | | | | |
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| E13.8 | **ADDITIONAL FINANICAL PROVISION** | | | | |
| | The Contractor shall allow for additional finanicial provision, if any, to comply with the requirements of the Occupational Health and Safety Act ( Act No 85 of 1993) and the Construction Regulations issued there under which have not been specifically elsewhere. | | | | |
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| E13.9 | **FALL PROTECTION PLAN (Construction Regulation 8)** | | | | |
| | The Contractor shall, before commencing any construction work submit a fall protection plan identified all steps to be taken in order to ensure the continued adherence to the fall protection plan and shall include a risk assessment of all work carried out from a relevant position. The fall protection plan shall form part of the health and safety plan and file. | | | | |
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| E13.10 | **PHYSICAL AND PSYCHOLOGICAL FITNESS (Construction Regulation 8.2 (b))** | | | | |
| | The Contractor and sub-contractor shall before commencing any construction work submit proof of his employees that shall carried out work from an elevated position their physical and psychological fitness and shall be recorded in the health and safety file. | | | | |
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| **E13.11** | **CONSTRUCTION VEHICLES AND MOBILE PLANT** | | | | |
| | **(Construction Regulations 21)** | | | | |
| | The Contractor and sub-contractors shall ensure that all | | | | |
| | operated workers received training and been certified | | | | |
| | competent to operate such vehicles, and are physical | | | | |
| | and psychological fit to operate such construction | | | | |
| | vehicles and mobile plants and shall be recorded in the | | | | |
| | health and safety file. | | | | |
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| **E13.12** | **TRAINING (Construction Regulation 8 (c))** | | | | |
| | The Contractor and sub-contractor shall, before | | | | |
| | commencing any construction work, submit his training | | | | |
| | program of all his employees. This program shall form | | | | |
| | part of the health and safety plan. | | | | |
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| **E13.13** | **DEMOLITION WORK (Construction Regulations 12)** | | | | |
| | The Contractor shall, before any demolition work shall | | | | |
| | be carried out, submit all methods of demolition to be | | | | |
| | used. This method shall form part of the health and | | | | |
| | safety plan and file. | | | | |
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| **E13.14** | **REMOVAL AND DISPOSAL OF ASBESTOS** | | | | |
| | **MATERIAL (Asbestos Regulation)** | | | | |
| | The principle contractor shall appoint a contractor that | | | | |
| | is registered with the Department of Labour as an AIA. | | | | |
| | The contractor must allow for: | | | | |
| | | | | | |
| | NOTIFICATION OF ASBESTOS PROCESSING | | | | |
| | PERSONAL PROTECTIVE EQUIPMENT | | | | |
| | PACKAGING AND TRANSPORT AND STORAGE TO | | | | |
| | DISPOSAL SITE | | | | |
| | DEMOLITION WORK | | | | |
| | LABELLING, INFORMATION, ETC. | | | | |
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| E13.15 | **RISK COMPLIANCE AREAS (As Outlined** | | | | |
| | **In "Volume Three": Covid-19 Guidelines for** | | | | |
| | **Management of Risk on Construction Sites and** | | | | |
| | **Covid-19 addendum (Item 1-12) attached to** | | | | |
| | **Health and Safety specification)** | | | | |
| | | | | | |
| | · Disinfection of the workplace at regular intervals as | | | | |
| | outlined within the Guidelines "Annexure A" | | | | |
| | Workplace Preparation Procedure; | | | | |
| | · Ensure Staff and Security Staff have PPEs (i.e. | | | | |
| | masks,gloves, sanitisers, etc.) | | | | |
| | · Installed thermal scanners to check temperature of | | | | |
| | all staff and visitors. Ensure training of Security Staff | | | | |
| | for use of thermal scanners. Register to be | | | | |
| | implemented for staff and visitors to site with | | | | |
| | identification criteria "ID number, Name, Age, | | | | |
| | Health Status and Contact details"; | | | | |
| | · Isolation room identified/constructed on site; | | | | |
| | · Ensure sanitisers and soap are available in locker | | | | |
| | rooms for staff; | | | | |
| | · Ensure staff or visitors are wearing masks before | | | | |
| | entering; | | | | |
| | · Ensure social distance on site; | | | | |
| | · Notification about the restriction of the number of | | | | |
| | people allowed on site at one time; | | | | |
| | · Disinfection of rooms for meetings and strictly | | | | |
| | keeping to social distancing and wearing masks; | | | | |
| | · Plans to rotate work force on percentage allowable | | | | |
| | on site to comply with regulations; | | | | |
| | · Permits issued by Authorising Authority for Work | | | | |
| | Force and vehicles for Cross Provincial and District | | | | |
| | Boarders | | | | |
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| **E14** | **IMPLEMENTATION OF LABOUR-INTENSIVE** | | | | |
| | **INFRASTRUCTURE PROJECTS UNDER THE** | | | | |
| | **EXPANDED PUBLIC WORKS PROGRAMME (EPWP)** | | | | |
| | The contractor shall comply with all the requirements of | | | | |
| | the "Code of Good Practice for Employment and | | | | |
| | Conditions of Work for Special Public Works | | | | |
| | Programmes" issued in terms of the "Basic Conditions | | | | |
| | of Employment Act, 1997 (Act No 75 of 1997)" and the | | | | |
| | related "Ministerial Determination", for the employment | | | | |
| | of locally employed temporary workers on a labour | | | | |
| | intensive infrastructure project under the Expanded | | | | |
| | Public Works Programme (EPWP) | | | | |
| | The contractor shall maintain daily records with regard | | | | |
| | to the workers employed and shall, on a monthly basis, | | | | |
| | submit a report (Contract, ID Copy, Attendance register, | | | | |
| | Proof of payment) to the principal agent in the | | | | |
| | prescribed format. Compulsory indicators such as the | | | | |
| | project budget, actual project expenditure, number of job | | | | |
| | opportunities created, demographic characteristics of | | | | |
| | workers employed, minimum daily wage rate, number of | | | | |
| | person-days of employment created and number of | | | | |
| | training person-days, shall be included in said report, all | | | | |
| | as defined in the "Guidelines for the Implementation of | | | | |
| | Labour-Intensive Infrastructure Projects under the | | | | |
| | Expanded Public Works Programme (EPWP)" | | | | |
| | Provision for pricing of compliance with the | | | | |
| | aforementioned is made under this clause and it is | | | | |
| | explicitly pointed out that all that all requirements in | | | | |
| | respect of the aforementioned are deemed to be priced | | | | |
| | hereunder and no additional claims in this regard shall | | | | |
| | be entertained | | | | |
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| **E14.1** | **DECLARATION - EPWP PROGRAMME** | | | | |
| | The contractor must adhere to all rules, regulations and | | | | |
| | requirements regarding the EPWP programme, | | | | |
| | specifically but not limited to the following: | | | | |
| | **1. Labour intensive construction methods (LIC)** | | | | |
| | 1.1 Comply to implementation of LIC BOQ items | | | | |
| | specified elsewhere in the tender documents | | | | |
| | **2. Recruitment and placement of EPWP NYS** | | | | |
| | 2.1 Recruitment, placement and exposure training of | | | | |
| | ……..participants | | | | |
| | 2.2 Comply to EPWP BOQ specifications and code of | | | | |
| | good practice | | | | |
| | **3. Recruitment and placement of local labourers** | | | | |
| | 3.1 Recruitment and placement of minimum……. | | | | |
| | local labourers | | | | |
| | 3.2 Comply with applicable wage order/determination | | | | |
| | or agreement, in terms of labour relations act or | | | | |
| | wage act | | | | |
| | **4. Comply with EPWP monthly reporting** | | | | |
| | **requirements** | | | | |
| | Monthly prepare and submit below EPWP reports | | | | |
| | attached to monthly payments certificate | | | | |
| | 4.1 All employees and EPWP participants contracts | | | | |
| | 4.2 All employees and EPWP participants certified SA | | | | |
| | ID copies | | | | |
| | 4.3 All employees and EPWP attendance register | | | | |
| | 4.4 All employees and EPWP proof of payment | | | | |
| | 4.5 EPWP reports populated on standard templates | | | | |
| | **5. Penalties for non compliance** | | | | |
| | Acknowledge non compliance of R3000-00 (Three | | | | |
| | thousand rand) per month per participant | | | | |
| | | | | | |
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| | **CARRIED FORWARD** | | | | |

| ITEM NO | DESCRIPTION | UNIT | QTY | RATE | AMOUNT |
|---|---|---|---|---|---|
| | **BROUGHT FORWARD** | | | | |
| | | | | | |
| **E15** | **HIV/AIDS AWARENESS** | | | | |
| | It is required of the contractor to thoroughly study the | | | | |
| | HIV/AIDS Specification (PW 1544) of the Department | | | | |
| | that must be read together with and is deemed to be | | | | |
| | incorporated under this Section of the Bills of Quantities. | | | | |
| | Provision for pricing of HIV/AIDS awareness is made | | | | |
| | under items E14.1 to E14.5 hereafter and it is explicitly | | | | |
| | pointed out that all requirements of the aforementioned | | | | |
| | specification are deemed to be priced hereunder, as the | | | | |
| | said items represent the only method of measurement | | | | |
| | and no additional items or extras to the contract in this | | | | |
| | regard shall be entertained | | | | |
| | The contractor must take note that compliance with the | | | | |
| | HIV/AIDS Specification is compulsory. In the event of | | | | |
| | partial or total non-compliance, the principal agent, | | | | |
| | notwithstanding the provisions of Clause A 31.0 of | | | | |
| | Section A or any other clause to the contrary, reserves | | | | |
| | the right to delay issuing any progress payment | | | | |
| | certificate until the contractor provides satisfactory | | | | |
| | proof of compliance. The contractor shall not be | | | | |
| | entitled to any compensation of whatsoever nature, | | | | |
| | including interest, due to such delay of payment | | | | |
| | | | | | |
| **E15.1** | **AWARENESS CHAMPION** | | | | |
| | Selection, appointment, briefing and making available of | | | | |
| | an Awareness Champion including provision of all | | | | |
| | relevant services, all in accordance with the HIV/AIDS | | | | |
| | Specification | | | | |
| | | | | | |
| | F: ..... V: ..... T: ..... | Item | | | |
| | | | | | |
| **E15.2** | **AWARENESS WORKSHOPS** | | | | |
| | Selection and appointment of a competent Service | | | | |
| | Provider approved by the principal agent, provision of | | | | |
| | a Service Provider Workshop Plan and a suitable | | | | |
| | venue, conducting of awareness workshops by means | | | | |
| | of traditional and/or modern multimedia techniques, | | | | |
| | including follow-up courses, making available all tuition | | | | |
| | material and performing assessment procedures, all in | | | | |
| | accordance with the HIV/AIDS Specification | | | | |
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| | F: ..... V: ..... T: ..... | Item | | | |
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| | **CARRIED FORWARD** | | | | |

| ITEM NO | DESCRIPTION | UNIT | QTY | RATE | AMOUNT |
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| | **BROUGHT FORWARD** | | | | |
| | | | | | |
| **E15.3** | **POSTERS, BOOKLETS, VIDEOS, ETC.** | | | | |
| | Provision, displaying, maintaining and replacing when necessary of four plastic laminated posters, booklets and educational videos, etc. for the duration of the construction period, all in accordance with the HIV/AIDS Specification | | | | |
| | | | | | |
| | F: ..... V: ..... T: ..... | Item | | | |
| | | | | | |
| **E15.4** | **ACCESS TO CONDOMS** | | | | |
| | Provision and maintenance of condom dispensers fixed in position, including male and female condoms, replenishing male and female condoms on a daily basis as required for the duration of the construction period, all in accordance with the HIV/AIDS Specification | | | | |
| | | | | | |
| | F: ..... V: ..... T: ..... | Item | | | |
| | | | | | |
| **E15.5** | **MONITORING** | | | | |
| | Monitoring HIV/AIDS awareness of workers, providing the principal agent with access to information including making available all reports, thoroughly completed and reflecting the correct information, for the duration of the construction period and close out, all in accordance with the HIV/AIDS Specification | | | | |
| | | | | | |
| | F: ..... V: ..... T: ..... | Item | | | |
| | | | | | |
| **E16** | **CONSTRUCTION VEHICLES FOR DELIVERY OF EQUIPMENT** | | | | |
| | Allow for vehicles such as truck cranes, forklifts, etc for the moving of the generator into place and delivery of other necessary equipment for the project. | | | | |
| | | | | | |
| | F: ..... V: ..... T: ..... | Item | | | |
| | | | | | |
| **E17** | **ALTERNATE POWER SUPPLIES FOR CONSTRUCTION** | | | | |
| | Allow for the supply of portable generators and/or other alternate power supplies for construction equipment in the event of power failure on the premesis. | | | | |
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| | F: ..... V: ..... T: ..... | Item | | | |
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| | **CARRIED FORWARD TO SECTION 3 SUMMARY** | | | | R - |
| | | | | | |

**TENDER NUMBER:**

## Section 2 - MECHANICAL INSTALLATIONS FOR GALESHEWE SAPS

| ITEM No | DESCRIPTION | UNIT | QTY | RATE | AMOUNT |
|---|---|---|---|---|---|
| | | | | | |
| 2,1 | **EXISTING SYSTEM** | | | | |
| | **Decommission and remove from site existing Chilled Water Systems and Split AC Units, complete with all piping, insulation, cables, controllers, trays, brackets, trunking etc:** | | | | |
| 2,1,1 | Carrier chillers (on roof top of Block A, D, E and F) | item | 1 | | |
| 2,1,2 | Chilled water pumps | item | 1 | | |
| 2,1,3 | Water tanks and frames | item | 1 | | |
| 2,1,4 | Split units | item | 1 | | |
| 2,1,5 | Fan Coil Units (FCUs) | item | 1 | | |
| 2,1,6 | Redundant chilled water piping, valves, fittings, all other parts of the system - (from plant room on the roof to the AHUs and FCUs in the offices) | item | 1 | | |
| 2,1,7 | Redundant control panels and cables – (confirm with engineer) | item | 1 | | |
| 2,1,8 | Saving on scrap value of all removed equipment and piping, as well as accessories (taking account of transportation and municipal rates) | item | 1 | | |
| | | | | | |
| | **Inspect, test, basic repairs and servicing of existing installations. Basic repairs and service to include all cleaning, removal of redundant components, tightening of mountings, sealing, wiring. etc. Provide written report (content to include cost implications on proposed recommendations) on existing HVAC systems as follows:** | | | | |
| 2,1,9 | Supply air ducting and fresh air intake together with supply diffusers and louvres | item | 1 | | |
| 2,1,10 | Return air ducting together with grills | item | 1 | | |
| 2,1,11 | AHUs complete with connection points, fans, filters, coils, thermostats, valves, panels, piping, etc. | item | 1 | | |
| | | | | | |
| | **Repair and replacements allowances for existing HVAC system – To be instructed by engineer after reading the inspection and test reports:** | | | | |
| 2,1,12 | Repairs and replacements of all necessary parts on supply air ducting and fresh air intake together with supply diffusers and louvres | PC Sum | 1 | R50 000,00 | R 50 000,00 |
| 2,1,13 | Repairs and replacements of all necessary parts on return air ducting together with grills | PC Sum | 1 | R50 000,00 | R 50 000,00 |
| 2,1,14 | Repairs and replacements of all necessary parts on AHUs complete with connection points, fans, filters, coils, thermostats, valves, panels, piping, etc. | PC Sum | 1 | R150 000,00 | R 150 000,00 |
| | | | | | |
| | **CARRIED FORWARD** | | | | |

TENDER NUMBER:

## Section 2 - MECHANICAL INSTALLATIONS FOR GALESHEWE SAPS

| ITEM No | DESCRIPTION | UNIT | QTY | RATE | AMOUNT |
|---|---|---|---|---|---|
| | BROUGHT FORWARD | | | | |
| | Other: | | | | |
| 2,1,15 | Repairs to buildings and ceilings where old installations are decommisioned and also where ducting, AHU's, supply diffusers or grilles are removed, repaired, replaced - to match existing constructions | item | 1 | | |
| | | | | | |
| 2,2 | AIR CONDITIONING SYSTEMS | | | | |
| | **Supply, deliver and install 3-pipe heat exchanger VRF condenser units complete with hail guards, Anti-vibration mounting (AVMs) and support frames as per specifications:** | | | | |
| 2,2,1 | 45kW VRF heat recovery outdoor units | No | 15 | | |
| | | | | | |
| | **Supply, deliver and install VRF indoor units, all as per specifications:** | | | | |
| 2,2,2 | MW-01: VRF Inddor Midwall Type Unit: Cooling Capacity = 3,5kW | No | 37 | | |
| | | | | | |
| 2,2,3 | MW-02: VRF Inddor Midwall Type Unit: Cooling Capacity = 4,5kW | No | 54 | | |
| | | | | | |
| 2,2,4 | MW-03: VRF Inddor Midwall Type Unit: Cooling Capacity = 5kW | No | 2 | | |
| | | | | | |
| 2,2,5 | CSS-01: VRF Inddor Cassette Type Unit: Cooling Capacity = 5,3kW | No | 43 | | |
| | | | | | |
| 2,2,6 | CSS-02: VRF Inddor Cassette Type Unit: Cooling Capacity = 7,1kW | No | 2 | | |
| | | | | | |
| | CARRIED FORWARD | | | | |

TENDER NUMBER:

## Section 2 - MECHANICAL INSTALLATIONS FOR GALESHEWE SAPS

| ITEM No | DESCRIPTION | UNIT | QTY | RATE | AMOUNT |
|---|---|---|---|---|---|
| | **BROUGHT FORWARD** | | | | |
| | | | | | |
| | **Supply, deliver and install VRF refrigerant piping systems complete with all pipes (for the complete systems), insulation, fittings,junctions, BS boxes, trunking, hangers and special items required for each complete installation, as per drawings and specifications:** | | | | |
| | | | | | |
| 2,2,7 | All VRF systems | No | 15 | | |
| | | | | | |
| | **Supply, deliver and install all uPVC condensate piping systems for each VRF system, including brackets, rodding eyes and terminating in existing drain points:** | | | | |
| | | | | | |
| 2,2,8 | All VRF systems | No | 15 | | |
| | | | | | |
| | **Supply, deliver and install all VRF control equipment complete with cables, conduit, trunking and cable trays as specified:** | | | | |
| | | | | | |
| 2,2,9 | Hard-wired remote controllers for all units | No | 138 | | |
| | | | | | |
| 2,2,10 | Intelligent controller/BMS unit complete with lockable weather proof panel, interfaces, display monitors, testing, commisioning and all necessary accessories and training. | PC Sum | 1 | R355 000,00 | R 355 000,00 |
| | | | | | |
| 2,2,11 | Shielded communication cables for each system | No | 15 | | |
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| | **CARRIED FORWARD** | | | | |

TENDER NUMBER:

## Section 2 - MECHANICAL INSTALLATIONS FOR GALESHEWE SAPS

| ITEM No | DESCRIPTION | UNIT | QTY | RATE | AMOUNT |
|---|---|---|---|---|---|
| | BROUGHT FORWARD | | | | |
| | | | | | |
| | **Commission each completed VRF system, including Nitrogen purging, charging with refrigerant and sign-off by equipment supplier, all as per specifications:** | | | | |
| | | | | | |
| 2,2,12 | All VRF systems | No | 15 | | |
| | | | | | |
| | **Supply, deliver and install inverter type split air conditioning units complete with brackets, hangers and anti-vibration mounting (AVMs), hail guards, all as per specifications and drawings:** | | | | |
| | | | | | |
| 2,2,13 | AC-01: 3,5kW Midwall Type indoor unit complete with outdoor unit | No | 7 | | |
| | | | | | |
| 2,2,14 | AC-02: 4,5kW Midwall Type indoor unit complete with outdoor unit | No | 3 | | |
| | | | | | |
| 2,2,15 | AC-03: 5,3kW Cassette Type indoor unit complete with outdoor unit | No | 7 | | |
| | | | | | |
| 2,2,16 | AC-04: 5,3kW x 4 Cassette Type indoor units complete with industrial outdoor unit to meet the cooling capacity for the indoor units | No | 1 | | |
| | | | | | |
| | **Supply, deliver and install refrigerant piping systems for split units c/w all pipes, insulation, fittings, trays, brackets and trunking for a complete installation all as per specifications:** | | | | |
| | | | | | |
| 2,2,17 | For AC-01 | No | 7 | | |
| | | | | | |
| 2,2,18 | For AC-02 | No | 3 | | |
| | | | | | |
| 2,2,19 | For AC-03 | No | 7 | | |
| | | | | | |
| 2,2,20 | For AC-04 | No | 1 | | |
| | | | | | |
| | **Supply, deliver and install all uPVC condensate drain piping for split units, p-traps, rodding eyes, brackets, hangers etc for complete installation and terminating in building drain points or drip cups:** | | | | |
| | | | | | |
| 2,2,21 | For AC-01 | No | 7 | | |
| | | | | | |
| 2,2,22 | For AC-02 | No | 3 | | |
| | | | | | |
| 2,2,23 | For AC-03 | No | 7 | | |
| | | | | | |
| 2,2,24 | For AC-04 | No | 1 | | |
| | | | | | |
| | CARRIED FORWARD | | | | |

TENDER NUMBER:

## Section 2 - MECHANICAL INSTALLATIONS FOR GALESHEWE SAPS

| ITEM No | DESCRIPTION | UNIT | QTY | RATE | AMOUNT |
|---|---|---|---|---|---|
| | BROUGHT FORWARD | | | | |
| | **Supply, deliver and install hard wired controls and cabling for proper functioning of systems (and make good all building works):** | | | | |
| 2,2,25 | For AC-01 | No | 7 | | |
| 2,2,26 | For AC-02 | No | 3 | | |
| 2,2,27 | For AC-03 | No | 7 | | |
| 2,2,28 | For AC-04 | No | 1 | | |
| | **Commission each completed split unit system, including Nitrogen purging, charging with refrigerant, all as per specifications:** | | | | |
| 2,2,29 | For AC-01 | No | 7 | | |
| 2,2,30 | For AC-02 | No | 3 | | |
| 2,2,31 | For AC-03 | No | 7 | | |
| 2,2,32 | For AC-04 | No | 1 | | |
| | **Supply, deliver and install galvanised sheet metal ducting with insulation and cladding including, ancillaries, seals, plenum box, dampers, transformations, brackets, stop ends etc. all as per drawings and specified or as instructed by the engineer:** | | | | |
| 2,2,33 | Connections for AHUs and the existing ducting | PC Sum | 1 | R50 000,00 | R 50 000,00 |
| | **Other:** | | | | |
| 2,2,34 | Core drilling or making of hole's for A/C piping and cables, complete with sealing for all new installations | item | 1 | | |
| | **MISCELLANEOUS** | | | | |
| 2,2,35 | Cranage, rigging and all lifting for all equipment for the complete works of the project | item | 1 | | |
| 2,2,36 | Approved scaffolding and erection for all works | item | 1 | | |
| 2,2,37 | Transport and delivery of equipment | item | 1 | | |
| 2,2,38 | Waterproof duct penetrations into roof shafts or walls as well as repairs or water proof to slabs where old equipment are removed or new equipment installed | item | 1 | | |
| | **Section 2 - MECHANICAL INSTALLATIONS TOTAL CARRIED FORWARD TO SUMMARY PAGE:** | | | | |

Department:
Public Works and Infrastructure
REPUBLIC OF SOUTH AFRICA

**GALESHEWE SAPS REPLACEMENT OF AIR CONDITIONERS**
**MECHANICAL ENGINEERING SERVICES**

**SUMMARY OF BILL OF QUANTITIES**

| SECTION | DESCRIPTION | TOTALS AS PER BILL SECTIONS |
|---|---|---|
| 1 | Preliminaries & General | R - |
| 2 | Mechanical Installations | R - |
| | TOTAL: | R - |
| | TOTAL (EXCLUDING. VAT.) | R - |
| | 15% VAT | R - |
| | GRAND TOTAL | R - |

public works
& infrastructure

Department:
Public Works and Infrastructure
**REPUBLIC OF SOUTH AFRICA**

# TECHNICAL SPECIFCATIONS

# FOR THE

# MECHANICAL INSTALLATIONS

# OF

# HVAC SYSTEMS

# Contents

**GALESHEWE SAPS:**
**UPGRADING, RENOVATIONS AND INSTALLATIONS OF THE AIR CONDITIONING SYSTEMS**

**MECHANICAL PROJECT SPECIFICATIONS**

**HEATING, VENTILATION AND AIR CONDITIONING**

## 1. GENERAL

The project and standard specifications as well as drawings form part of the project specification and shall be read in conjunction with the project specification.

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

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

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

## 2. SITE AND SITE INSPECTION

The site is situated at Galeshewe, Kimberly in Northern Cape Province.

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

## 3. COMPLETION DATE

Completion dates are stipulated in the preliminaries included in this document. The Contractor will be required to keep up with the program and to complete the mechanical installation in the stipulated/negotiated contract period.

## 4. PROGRAM

Directly after acceptance of his tender, the Contractor shall submit time schedules and a program for each activity for which he is responsible. Please note the building will be in use during the contract period and allowance should be made for this.

A copy of the program (and revisions thereto) shall be submitted to the Engineer well within time and at regular intervals.

The following items shall be included in the programme:

- Working drawings
- Approval of working drawings
- Equipment detail submission for approval
- Ordering of material
- Piping and ducting installation
- Approval of first fix
- Plant equipment installation
- Second fix
- Commissioning and testing
- Final inspection

## 5. FINISHING AND TIDYING

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

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

## 6. SCAFFOLDING AND PLANT

All plant required for the execution of the contract shall be supplied by the Contractor under this contract.

The Contractor shall provide his own scaffolding. For installation purposes the Tenderer shall allow for his own lifting and rigging equipment, including cranes, trolleys etc. which may be necessary to complete the installation as none of these facilities will be available on site.

## 7. SUPERVISORY STAFF AND IDENTIFICATION

At all times while on the premises, all artisans and labour members of the mechanical contractor's and possible subcontractor's staff will wear clothing adequately marked with the relevant contractor's name.

The work shall be done by, or at all times be under the personal supervision of a qualified artisan (or qualified technician) in the respective trade. Details of this operation and prospective work shall be given at the time of tendering in a covering letter.

## 8. QUALITY OF MATERIALS AND WORKMANSHIP

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

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

Where applicable, all material shall be in accordance with the relevant standard specifications of the South African Bureau of Standards and the British Standard Specifications.

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

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

## 9. RATING OF EQUIPMENT

All equipment shall be selected to be operated well within the manufacturer's ratings. Equipment offered for use beyond these limits will not be considered.

The contractor shall supply a schedule of ALL equipment offered by him detailing the make, model, size/capacity/rating, electrical requirements and material of construction where applicable to the Engineer for approval before his installation commences or equipment is ordered. Any deviations from the specification shall be clearly highlighted.

## 10. SPACE REQUIREMENTS AND ACCESS

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

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

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

## 11. REGULATIONS AND STANDARDS

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

a) SANS 10400: The application of the National Building Regulations.

b) SANS 1125: Room air conditioners and heat pumps

c) SANS 10147: Code of Practice for Refrigeration systems, including plants associated with air conditioning systems

d) SANS 60335-2-40: Household and similar electrical appliances – Safety. Part 2 – 40: Particular requirements for electrical heat pumps, air conditioners and dehumidifiers

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

f) SABS 1453: Copper tubes for medical gas and vacuum services

g) SANS 1424-1987: Filters for use in air-conditioning and general ventilation

h) SANS 1238:2005: Air-conditioning ductwork

i) SANS 10173:2003: The installation, testing and balancing of air-conditioning ductwork

j) SANS 60335-2-80: Household and similar electrical appliances – Safety Part 2-80: Particular requirements for fans

k) SANS 10108: The classification of hazardous locations and the selection of apparatus for use in such locations

l) SABS 0147: Refrigerating systems including plants associated with air-conditioning systems

m) The Occupational Health and Safety Act, Act No. 85 of 1993

n) Mine and Industrial Regulations, Government notices

o) Local Municipal Regulations and Ordinances

p) Fire Department Regulations

q) All special conditions, specifications or codes of practice specified hereinafter.

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

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

The Contractor shall work strictly according to this specification and shall ensure that only the best quality material is used, and that the installation is handed over as a complete working system.

## 12. DRAWINGS

The dimensions and positions of equipment shown on the Engineer's drawings are schematic and for tender purposes only. The drawings are not suitable for manufacturing purposes. The responsibility for dimensional and layout accuracy remains with the Contractor. The exact positions will be pointed out on site where necessary.

The following drawings shall be submitted by the Contractor to the Engineer for approval, within four (4) weeks of acceptance of the tender:

a) **Builder's work drawings**

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

b) **Mechanical drawings**

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

c) **Electrical drawings**

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

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

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

The mechanical and electrical drawings shall be updated during the contract period and shall be included in the operation manual at the end of the contract period as "as built" drawings.

## 13. OPERATION MANUALS AND MAINTENANCE INSTRUCTIONS

The Mechanical Contractor shall submit one (1) draft hard copy and one (1) digital copy of the Operation and Maintenance Manuals and As-built drawings to the Engineer prior to commissioning or at an alternative agreed date, for checking, evaluation and comment purposes and shall allow at least ten (10) working days for the commenting process. The Mechanical Contractor shall incorporate all comments and re-submit the revised manuals. The Mechanical Contractor shall allow for temporary inserts and clearly list items such as commissioning data that are not yet available for inclusion in the manuals. Such information shall be submitted as soon as possible and no later than one (1) week before the planned practical completion date.

The Mechanical Contractor shall submit the commented, approved and finalized Operation and Maintenance Manuals and As-Built drawings at or prior to Practical completion.

Three (3) hard copies and three (3) digital copies shall be submitted. The comment and approval of the manuals shall be a pre-requisite for Practical Completion and no Practical Completion shall be given without fully approved Operating and Maintenance Manuals inclusive of all relevant drawings and other documentation as stated in this specification.

The operation manuals shall be sturdily bound in a strong hard cover. Material in the manual shall be clear, legible and well arranged and provided with an index.

- Documentation shall clearly record the arrangements of the various sections of the Works as actually installed and identify and locate all component parts.

- Documentation shall make it possible to comprehend the extent and purpose of the Works and the method of operation thereof.

- Documentation shall set out the extent to which maintenance and servicing is required and how, in detail, it should be executed.

- Documentation shall provide sufficient, readily accessible and proper information to enable spares and replacements to be ordered.

  Information in the documentation shall be correlated so that the terminology and the references used are consistent with those used in the physical identification of the component parts of the installations.

  The Mechanical Contractor shall show, as required, throughout the execution of the Works that complete and accurate records are being maintained and that the record documents are being progressively compiled as the work on site proceeds.

  Content:

  The operating and maintenance manuals shall include:

- A full description of each of the systems installed, written to ensure that the Employer's staff fully understand the scope and facilities provided.

- A description of the mode of operation of all systems including services capacity and restrictions.

- Diagrammatic drawings of each system indicating principal items of plant, equipment, valves etc.

- Details of how to re-commission so that complex plant services within the building can be re-commissioned by an engineer without any historic knowledge of the systems.

- Full size and reduced A3 copies of all drawings together with an index.

- Legend of all colour-coded services.

- Schedules (system by system) of plant, equipment, valves, etc., stating their locations, duties and performance figures. Each item must have a unique number cross-referenced to the record and diagrammatic drawings and schedules.

- The name, address and telephone number of the manufacturer of every item of plant and equipment together with catalogue list numbers.

- Manufacturer's technical literature for all items of plant and equipment, assembled specifically for the project, excluding irrelevant matter and including detailed drawings, electrical circuit details and operating and maintenance instructions.

- A copy of all Test Certificates, Inspection and Test Records, Commissioning and Performance Test Records (including, but not limited to, electrical circuit tests, corrosion

tests, type tests, start and commissioning tests) for the installations and plant, equipment, valves, etc., used in the installations.

- A copy of all manufacturers' guarantees or warranties, together with maintenance agreements offered by subcontractors and manufacturers.
- Copies of Insurance & Inspecting Authority Certificates and Reports.
- Starting up, operating and shutting down instructions for all equipment and systems installed.
- Control sequences for all systems installed.
- Schedules of all fixed and variable equipment settings established during commissioning.
- Procedures for seasonal change-overs and/or precautions necessary for the care of apparatus subject to seasonal disuse.
- Detailed recommendations for the preventative maintenance frequency and procedures which should be adopted by the Employer to ensure the most efficient operation of the systems.
- Details of lubrication systems and lubrication schedules for all lubricated items.
- Details of regular tests to be carried out (e.g. water cooling towers etc.)
- Details of procedures to maintain plant in safe working conditions.
- Details of the disposal requirements for all items in the works.
- A list of normal consumable items.
- A list of recommended spares to be kept in stock by the Employer, being those items subject to wear or deterioration and which may involve the Employer in extended deliveries when replacements are required at some future date.
- A list of any special tools needed for maintenance cross referenced to the particular item for which required.
- Procedures for fault finding.
- Emergency procedures, including telephone numbers for emergency services.
- Back-up copies of any system software.
- Documentation of the procedures for updating and/or modifying software operating systems and control programs.
- Instructions for the creation of control procedure routines and graphic diagrams.
- Details of the software revision for all programs provided.
- Two back-up copies of all software items, as commissioned.
- Contractual and legal information including but not limited to details of local and public authority consents; details of design team, engineers, installation contractors and associated subcontractors; start date for installation, date of practical completion and expiry date for the defects liability period; details of warranties for plant and systems including expiry dates, addresses and telephone numbers.

- The manuals must contain all commissioning datasheets and certification.
- Provide electronic copies of all Operating and Maintenance documentation in disk format, fully indexed.
- Provide a maintenance service log book that must be signed off after every maintenance visit.

## 14. MAINTENANCE AND GUARANTEE

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

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

The Contractor shall visit the installation uninterrupted and do the scheduled maintenance as prescribed in the operating instructions. On completion of the monthly visit a full report shall be prepared and submitted to the Engineer within seven (7) days from the visit.

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

## 15. PAYMENT CLAIMS

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

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

## 16. PAINTING

Where applicable the following painting specifications shall apply:

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

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

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

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

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

## 17. DAMAGE AND PROTECTION OF WORKS

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

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

Equipment delivered to site shall be stored in a well-protected area where it cannot be damaged by either the weather or other trades.

## 18. WELDING

Welding shall be carried out in accordance with the current edition of SANS 10044 Parts 1 to 2 where applicable. All welding shall be performed according to the latest technology and where exposed, it shall be smoothly finished off.

## 19. BUILDING WORK AND REMOVAL OF EQUIPMENT

The following work shall be carried out by the Mechanical Contractor.

a) Drilling and cutting of necessary holes in the concrete, brickwork, ceilings and wooden doors, including making good to match finish.

b) Concrete plinths for installation of equipment.

c) Waterproofing of roof penetrations and plinths.

d) Provide drain points where required.

## 20. TESTING AND COMMISSIONING

The mechanical contractor shall perform the following duties related to the testing and commissioning of services under this contract:

- The installation shall be commissioned in accordance with a recognised commissioning procedure or code.
- Agree the commissioning program with the client to include for pre-commissioning checks, setting to work, commissioning and performance testing, commissioning witnessing and allow for all costs incurred.
- Give duly notice and state any requirements for the attendance and co-operation of others. This notice shall be a period of no less than 10 working days.
- Provide all necessary facilities and access to enable tests to be witnessed and inspections to be carried out either on site or at manufacturer's works.
- Allow and arrange for the validation/data checking of all systems being commissioned to be witnessed and random checks to be performed. This shall include the checking of performance, duties and operation of all system components including water and air flow rates, temperature, pressure, etc. at all terminals and strategic points within the system. No acceptance of any commissioning data shall be given without the above checks having been performed. All commissioning data sheets and associated documentation required for the proper validation of the systems shall be made available at least 5 working days before requested site visits and commissioning witnessing dates.

- The mechanical contractor shall provide full method statements for all testing and commissioning and agree these prior to commencing any testing and pre-commissioning. These shall include all water and chemical treatment, pressure testing, flushing, chemical clean, setting to work, balancing, commissioning and acceptance procedures.

- Appoint an "approved and qualified representative", to supervise the whole of the testing, commissioning, performance testing and instruction of future maintenance staff.

- Provide all specialized personnel (including manufacturer's representatives) and co-ordinate their activities.

- Test all equipment, material and systems. If an inspection or test fails, repeat the procedure, until satisfactory results are obtained.

- Complete all tests before any paint, cladding or similar materials are applied or before services are concealed.

- Ensure all requirements such as cleanliness, protection from harmful external and internal elements, etc. are provided prior to commencement of commissioning.

- Following satisfactory completion of testing and when the installations are in a safe and satisfactory condition, set to work, regulate and adjust, as necessary, to meet the specified design requirements.

- Provide all necessary instruments and recorders to monitor systems during commissioning and performance testing.

- Provide test equipment that has been subject to a quality assurance procedure and complies with national and local standards.

- Do not start performance testing, including system demonstration, system proving or environmental and capacity testing, until commissioning of the system is completed.

- Maintain on site full records of all commissioning and performance testing, cross referenced to system components and on completion of the Works include a copy in each Operating and Maintenance Manual.

- Provide all certification documents for approval before any system is offered for final acceptance.

## 21. STAFF TRAINING

The Contractor shall be responsible for the training of the Client's site staff after the commissioning has been completed. The site staff shall receive enough instruction to ensure that they are fully conversant with the equipment concerned. The operating manuals shall be used during training. Upon completion of the training exercise the contractor is to obtain the client's representative's written acceptance of this handover tuition, thus acknowledging his complete understanding of the operational procedures for this installation. Site staff shall be instructed on:

- The general operating method of the plant;

- Starting and stopping instructions;

- Stopping the plant in an emergency and warning against restarting after an emergency;

- Positions and normal settings of control equipment;

- Safety measures;
- Operational checks on gauges, flow switches, indicator lights, etc.;
- Name, address and telephone number of competent person responsible for the maintenance of the plant.

## 22. SCOPE OF WORK

The specification covers the following:

a) Removal of existing chillers and associated installations including piping, FCUs in office spaces and AHUs feeding court rooms.

b) The supply, delivery and installation of new VR 3-pipe heat exchanger systems and piping systems.

c) The supply, delivery and installation of new indoor units, complete with all cables and controls.

d) The supply, delivery and installation of new individual split units.

e) Changes to and connection to existing ducting.

f) Servicing of existing air conditioning and ventilation equipment and systems.

g) Commissioning and testing of the complete HVAC systems.

h) Associated electrical and control services.

i) 12 month maintenance of the complete HVAC systems.

j) 12 month guarantee on new equipment.

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

The contractor shall submit, where possible, data sheet for at least three comparable makes of equipment before procurement. These submitted technical documentation shall meet the highest standard of quality as set out in the standards, specifications, drawings and shall be subject to approval by the engineer before proceeding with procurement of these equipment.

In certain cases the position of equipment is shown schematically on the drawings. In these instances the exact positions will be determined on site.

## 23. DESIGN CRITERIA

**Design Parameters:**

| | | |
|---|---|---|
| City Name | Kimberley | |
| Location | South Africa | |
| Latitude | -28,7 | Deg. |
| Longitude | 24,8 | Deg. |
| Elevation | 1184,0 | m |
| Summer Design Dry-Bulb | 33,9 | °C |
| Summer Coincident Wet-Bulb | 15,6 | °C |
| Summer Daily Range | 14,6 | K |
| Winter Design Dry-Bulb | -3,3 | °C |
| Winter Design Wet-Bulb | -5,9 | °C |
| Atmospheric Clearness Number | 1,00 | |
| Average Ground Reflectance | 0,20 | |
| Soil Conductivity | 1,385 | W/(m K) |
| Local Time Zone (GMT +/- N hours) | -2,0 | hours |
| Consider Daylight Savings Time | No | |
| Simulation Weather Data | N/A | |
| Current Data is | User Modified | |
| Design Cooling Months | January to December | |

## 24. VARIABLE REFRIGERANT SYSTEMS (VRF's)

### a. GENERAL

The variable refrigerant systems shall be of the inverter **heat recovery** type. The air conditioning systems shall comprise of a single outdoor unit and multiple split indoor units capable of operating continuously at ambient temperatures between –5 °C and 40 °C. Refrigerant piping shall be capable of being extended up to 150 m with level difference without oil traps of 50 m.

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

The air conditioning units and the installation of the VRS shall generally be in accordance with the supplier's recommendations. Any discrepancies between this specification and the supplier's recommendations that may influence the unit's performance or guarantee shall be clarified with the Engineer.

The electrical power requirements to all indoor and outdoor units shall be:

- Single phase when the cooling capacity of the unit is less than 10 kW.
- Three phase when the cooling capacity of the unit is more or equal to 10 kW.

The indoor- and outdoor units shall be interconnected with refrigerant piping, control cabling, the relevant REFNET Joints and headers. The pipe and cable connections shall be made in accordance with the unit supplier's recommendations. The refrigerant shall be of the R410A type.

All indoor and outdoor units shall be of reputable make with a proven track record and dependable dealership located in South Africa.

## b. INDOOR UNITS

All indoor units shall be of the heat pump type to allow the VRS to operate in heat recovery mode when required.

All indoor units shall have electronic control valves that shall control refrigerant flow in response to the load requirements. All fans installed in the indoor units shall be statically and dynamically balanced to ensure low noise and vibration.

Indoor unit casings and finish shall be the manufacturer's standard, with adequate access to filters, fans and motors. Room side fan motors shall be centrifugal with a direct coupled motor.

Each indoor unit will have a heat exchanger which shall be constructed from copper tubing with aluminium fins. The flow of refrigerant through the heat exchanger will be controlled by a linear expansion valve. This valve will be controlled by two pipe thermistors and a return air thermistor and shall be capable of controlling the variable capacity of the indoor unit between 25% and 100%.

The units shall have factory fitted, electrically operated condensate pumps with a drain pipe connection. Integral safety switches shall be provided to prevent the pump from running dry, and to prevent the unit from operating when the condensate pump has failed.

The units shall be provided with synthetic fibre washable long-life filters.

Access through demountable ceiling tiles or dedicated ceiling access panel shall be provided for ceiling concealed units to allow access for maintenance. The mechanical contractor shall inform the architect/design engineer if any additional ceiling access measures or panels are required, based on the final selection, size and accurate location of equipment.

Ceiling mounted cassette type units shall be of the 4-way blow type discharging air in the directions as indicated on the project drawings. The mechanical contractor shall fix the sealing material to the air outlets in accordance with the discharge requirements.

All cassette units shall be complete with a decoration panel.

All ceiling mounted built-in units shall be equipped with long-life primary filters.

All indoor units shall be provided with an individual zone controller. The zone controller shall be of the hard wired/wall mounted remote control type.

## c. BRANCH SELECTOR (BS) UNITS

BS units shall be of the same make as the indoor and outdoor units and shall be installed where indicated by the manufacture. BS units shall be installed to the supplier's recommendation.

Each indoor unit must be individually controlled for heating and cooling.

Branch selector units / distribution controllers shall be provided to link indoor and outdoor units. Spare connections for 2 No indoor units shall be included. The selector units shall be insulated as per the manufacturer's standard and shall be installed to the manufacturer's stipulations and recommendations. The selector units shall be complete with cover panels and no exposed wiring or piping shall be accepted.

## d. OUTDOOR UNITS

The outdoor unit/s shall be of the heat recovery type running on R410A refrigerant and shall have sufficient capacity to meet the cooling/heating requirements of the indoor units. The outdoor unit shall be equipped with inverter control capable of changing the speed of the compressors in accordance with the cooling and heating load requirements.

Outdoor unit casing and finish shall be the manufacturer's standard.

The outdoor unit/s shall be equipped with a drain pan kit for operation in the reverse (heat pump) cycle.

Units shall be installed as per the manufacturer's recommendations and installation criteria.

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

Outdoor condensing units shall be installed on wall mounted brackets and / or a concrete slab as relevant to the project / installation scenario.

Where installed on wall mounted brackets, the condensing unit shall be properly bolted to the mounting bracket with adequately sized fasteners.

Where installed on a concrete slab or steel structure, the condensing unit shall be fitted on top of neoprene vibration isolating pads and 450mm square concrete paving slabs or builder's plinth.

Outdoor condensing units shall be installed complete with hail guards to protect fins against damage by hail.

## e. PERFORMANCE SPECIFICATIONS

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

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

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

All units shall be capable of meeting sensible cooling and sensible heating requirements. All capacities specified are to be achievable at medium evaporator fan speed.

## f. CONTROLS

All conditioned spaces should be provided with individual zone controllers. The zone controllers should be of the hard-wired remote controller type. Where there are more than one unit in a room the units should be controlled by a single interlinked controller.

All controllers should have heating, cooling and automatic functions.

In addition to the individual zone remote controllers for indoor units, the VRS shall be controlled by a central intelligent controller. The contractor shall allow for the complete setting up, reprogramming and commissioning, including warrantees related to the intelligent controller.

Control wiring to individual unit controllers shall be different in colour to the colour of the control wiring that interconnects air conditioning units and the central system controller.

## g. REFRIGERANT CIRCUITS

Refrigerant piping shall be in accordance with the following standards:

- SANS 1453: Copper tubes for medical gas and vacuum services

- SANS 10147: Refrigerating systems including plants associated with air conditioning systems

Refrigerant piping shall be seamless copper. Fittings shall be copper based capillary solder fittings.

All soldered joints on proprietary manufactured units shall be carefully checked and remade if found damaged in transit.

Pipe size selections shall be to the supplier's recommendation and shall be such as to produce moderately low velocities whilst:

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

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

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

All "REFNET" joints shall be installed according to the supplier's recommendations.

Where soft drawn material is used, bends shall be with a long radius formed with the proper tools. Where hard drawn material is used only long radius brazed bends shall be used. All refrigerant piping shall be properly sealed against moisture and dirt at all times.

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

All refrigeration pipes shall be sized to the supplier's method. The refrigerant charge shall be accurately calculated by the same method. The recommended maximum pipe lengths and routes as set out by the manufacturer shall be strictly adhered to.

Only synthetic oil compatible with the refrigerant shall be used to lubricate any cutting, reaming and flaring tools.

Only phosphor copper brazing rods shall be used without any flux on the piping joints. The pipework shall be continuously purged with low pressure nitrogen during all brazing operations.

Simple purging of the refrigerant pipes between the indoor and outdoor units shall not be acceptable. Refrigerant pipes shall be correctly pressure tested with nitrogen and a small amount of refrigerant to 3.8 MPa for R410A and left for 24 hours to ensure that the pressure does not drop. A vacuum pump shall then be used to purge the piping for longer than 2 hours to -100kPa. The system shall be capable of holding this vacuum for 1 hour or to the satisfaction of the design engineer.

The system shall then be charged in the liquid state with the calculated amount of additional refrigerant by using an accurate charging scale (charging cylinder shall not be used). Only once the system is correctly charged shall the refrigerant valves on the outdoor units be opened.

The mechanical contractor shall make use of colour coding (insulation type straps) to differentiate between refrigerant pipes running from refrigerant risers to different thermal zones.

Refrigerant pipes for multiple outdoor units shall be correctly arranged to meet manufacturer's requirements. Where multiple outdoor units are used, insulated oil equalisation line shall be installed between the units.

Support all pipework and controls cabling throughout their length using cable tray, firmly fixed to the building fabric - refer to section regarding trunking for further details. The installation of trunking and trays shall form part of this mechanical contract.

Arrange all exposed pipe runs to present and neat appearance, parallel with other pipe or service runs and building structure.

Ensure all vertical pipes are plumb or follow building line. Provide lifting loops where called for by system manufacturer.

Space pipe runs in relation to one another, other services runs and building structure, allow for specified thickness of thermal insulation and ensure adequate space for access to pipe joints, etc.

Take precautions to prevent the discharge of refrigerant gases to atmosphere.

Longest possible lengths of copper pipe should be utilised to minimise joints on site.

Appropriate refrigeration installation tools must be utilised. Dry nitrogen must be utilised at all times in the system during brazing.

Refrigerant (R410A) charge weight must be calculated, based on the actual installed length of pipework in accordance to manufacturer's recommendations.

All joints installed horizontally shall be mounted with branch piping in a horizontal plane.

Refrigerant piping in ceiling voids and mounted internally against walls shall be installed in galvanised steel light duty cable trays of adequate size to cope with the pipe load. Pipes shall be strapped over insulation to cable trays at 500mm intervals. Where drain pipes run together with refrigerant pipes, cable trays shall be to a size of 30% excess capacity of the condensate and refrigerant piping the tray carries.

Externally mounted refrigeration pipes and drain pipes shall be mounted in cable trunking. Cable trunking shall be complete with clip-on covers. Pipes and cables shall be strapped together every 500mm and loosely fitted in the trunking. The trunking shall be manufactured from galvanised steel and epoxy powder coated in a colour to match the building or as identified by the Engineer.

Any insulation material not covered by the trunking and exposed to the elements shall be neatly strapped to minimise the possibility of dirt and water entering between the insulation and refrigeration pipes.

### h. PROTECTION DEVICES

Thermal protection shall be provided for the compressor and indoor and outdoor fan motors. Over current relay shall be provided for the compressor and indoor and outdoor fan motors to ensure over current protection. Reverse phase, three phase overload, overload during startup, phase imbalance, phase loss and low voltage protection shall be provided for all three phase motor.

The compressor shall have high and low refrigerant pressure protection.

Protection fuses shall be provided for all control circuits.

The indoor and outdoor units shall comply with the safety requirements as set out in SANS 60335-2-40.

## i. INSTALLATION OF CONDENSATE DRAIN PIPE

Outdoor units shall be provided with a galvanised drain tray with suitable drain pipe connection. Drain pipes that run from the drain tray to the nearest drainage point shall be installed to ensure positive drainage of condensate. Piping shall be galvanised steel where exposed to weather elements.

Where possible, the condensate drain pipes from indoor units shall be run together with refrigerant pipes and be installed in the same trunking and on the same cable trays for as far as the installation permits.

uPVC pipes shall be used for drain piping from indoor units. Drain pipes shall run and connect via a suitable U-type trap to waste water pipes as indicated on the project drawings. The connection between the drain pipe and waste water pipe shall be an airtight sealed connection that allows positive drainage of condensate.

In ceiling voids, drain pipes shall be installed in galvanised cable trays. Where drain piping does not run with refrigeration piping in the same cable trays, galvanised "Cabstrut" light duty cable tray shall be used. Drain piping shall be fixed to the cable tray with suitably sized cable ties installed at 500mm intervals.

Horizontally mounted drain pipes shall be installed at a slope of 20mm per 1000mm ensuring positive drainage.

Surface mounted drain piping shall be secured to the wall by means of galvanised steel saddles at no more than 1m intervals to prevent sagging.

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

## j. PIPE INSULATION

The entire length of refrigerant pipework is insulated for thermal insulation and to avoid contact between copper and galvanising of tray.

The mechanical contractor shall apply "Armaflex" type, lightweight, elastomeric nitrile rubber tube insulation on all refrigerant piping in such a manner as not to cause leaking. The wall thickness of the insulation shall be min 13mm and as per the following table:

| Refrigerant Pipe Diameter (mm) | Wall Thickness (mm) |
|---|---|
| 6.34 | 13 |
| 9.53 | 13 |
| 13.70 | 13 |
| 15.88 | 19 |
| 19.05 | 19 |

All internally routed condensate drain piping shall be insulated with "Armaflex" type, lightweight, elastomeric nitrile rubber tube insulation. Insulation thickness shall be 13mm.

### k. PRELIMINARY TESTING

The equipment manufacturer's authorized representative shall inspect and perform preliminary commissioning on the VR system and shall supply the Engineer with a certificate indicating that the system has been installed according to their specifications.

The Contractor shall switch the electrical power on to all indoor and outdoor units after the system has been charged with refrigerant. Power shall be supplied to all units for duration of 9 hours before initial testing shall commence.

The equipment test sequence shall be run and the errors displayed on the controller shall be rectified.

The system as a whole as well as individual equipment shall be adjusted to give the specified performance. Control systems shall be adjusted and placed in operation.

## 25. SPLIT TYPE UNITS

### a. GENERAL

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

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

The electrical power requirements to the condensing units shall be:

- Single phase when the cooling capacity of the unit is less than 10 kW.
- Three phase when the cooling capacity of the unit is more or equal to 10 kW.

The indoor unit and condensing unit shall be interconnected with refrigerant piping, electrical wiring and interlocking control cabling. The pipe and cable connections shall be made in accordance with the unit supplier's recommendations. The refrigerant shall be of the R410 type.

Each condensing unit with connected evaporator unit shall be clearly labelled to identify different split units.

The outdoor unit coil shall be treated for corrosion with blygold, techni-coat, corium or any other method as approved by the Engineer.

Units shall consist of a direct expansion, indoor fan coil evaporator unit and a separate, remote and externally located, air-cooled, condensing unit.

Heating shall be by means of heat pump action by the reversal of the cooling cycle. All the necessary control equipment, valves and piping required to perform this function shall be supplied as part of this work.

A defrosting system shall be provided that will defrost the condensing coil during the winter months when heating is required. The defrosting system shall be a proven system that functions automatically without affecting the room temperature.

The evaporator unit shall be equipped with an easy accessible washable filter, a 3 speed adjustable cross flow fan driven by an induction motor and evaporator coils manufactured from seamless copper tubing mechanically bonded to aluminium.

Indoor units shall have integral condensate drain tray with drain hose connections.

The compressor unit shall be of the hermetic reciprocating / rotary or scroll type, powered by an induction motor, and installed with anti-vibration mounts such as rubber or spring isolators. The compressor shall be equipped with crankcase heater.

The condenser cooling fan shall be of the direct driven multi-wing, dynamically balanced propeller type axial flow fans. The outdoor unit shall be of the horizontal blow type.

The outdoor unit casing shall be manufactured from mild steel plate and shall be corrosion protected as follows or to a method as approved by the Engineer:

- Galvanised
- Electro plated

The outdoor unit shall be colour coated as follows or to a method as approved by the Engineer:

- Acrylic resin powder coated
- Polyester powder coated

For reverse cycle units, a proper galvanised steel drip pan with drainage piping or drain piping connected to the integral drain pan shall be provided for the condensing units.

The unit shall have an auto swing vane function that allows the vane to swing up and down automatically. An auto-flap shutter shall close automatically when the unit is turned off.

The control system shall be such that the unit will automatically change from heating to cooling and vice versa. A time delay relay shall prevent the compressor from restarting immediately when changing from heating to cooling and vice versa.

The "auto restart after power failure" option shall be available on all units' settings. The units shall also be able to operate in a "fan only" mode.

Electrical interlocking shall be provided to ensure that:

- Compressor cannot run without both evaporator and condenser fans running.
- It shall not be possible to switch cooling and heating on simultaneously.

**b. REFRIGERANT CIRCUITS**

Refrigerant piping shall be in accordance with the following standards:

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

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

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

- Ensuring proper oil return to the compressor and minimizing lubricating oil being trapped in the system.

- Ensuring practical lines without excessive pressure drops and with proper feed to evaporators.

- Preventing liquid refrigerant from entering the compressor during operation and at shutdown.

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

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

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

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

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

Refrigerant piping in ceiling voids and mounted internally against walls shall be installed in 101 mm wide galvanised steel light duty cable trays (per unit). Pipes shall be strapped over insulation to cable trays at 500 mm intervals with suitably sized cable ties. Cable trays shall be 152 mm wide where drain pipes run together with refrigerant piping (per unit).

Externally mounted refrigeration pipes and drain pipes shall be mounted in cable trunking (127 mm x 76.2 mm). Cable trunking shall be complete with clip on covers. Pipes and cables shall be strapped together every 500 mm with suitably sized cable ties and loosely fitted in the trunking. The trunking shall be manufactured from galvanised steel and epoxy powder coated to a colour as specified by the Engineer.

Any insulation material not covered by the trunking and exposed to the elements shall be neatly strapped with cable ties to minimise the possibility of dirt and water entering between the insulation and refrigeration pipes.

### c. INSTALLATION OF INDOOR & OUTDOOR UNITS

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

Outdoor condensing units shall be installed on wall mounted brackets where indicated on the project drawings.

Where installed on wall-mounted brackets, the condensing unit shall be properly bolted to the mounting bracket with adequately sized fasteners, neoprene vibration isolating pads and bracket end caps.

Where installed on a slab, the condensing unit shall be properly bolted to mounting bracket installed in a cross formation with adequately sized fasteners, neoprene vibration isolating pads and bracket end caps.

Mounting brackets shall be powder coated to match the unit casing colour.

### d. INSTALLATION OF CONDENSATE DRAIN PIPES

If an outdoor unit (heat pump type) is mounted against a wall more than 1 m above ground / floor level, the unit shall be fitted with an uPVC drain pipe neatly saddled to the wall. Drain pipe sizes for outdoor units shall be to the supplier's recommendation.

Condensate drain pipes shall always run together with refrigerant pipes and shall always be installed in the same trunking and on the same cable trays for as far as the installation permits. Surface mounted drain piping shall only be allowed where condensate drain pipes run in a different direction to either a service duct, waste water pipe or any other location as indicated on the project drawings. Surface mounted drain piping shall be secured to the wall by means of galvanised steel saddles at no more than 1 m intervals.

Drain pipes shall run together with the refrigerant pipes to the outside unit where the condensate shall be drained.

All condensate pipes running from indoor units to waste water pipes, outlet gullies or open waste water points shall be fitted with a U-trap.

uPVC pipes shall be used for drain piping from indoor units. Drain pipe sizes for indoor units shall be ∅ 32 mm for all unit sizes.

The first 5 m of drain piping shall be insulated with "Armaflex" type, lightweight, elastomeric nitrile rubber tube insulation. Insulation thickness shall be 13 mm.

In ceiling voids, drain pipes shall be installed in galvanized cable trays. Where drain piping does not run with refrigeration piping in the same cable trays, 76 mm galvanised light duty cable tray shall be used. Drain piping shall be fixed to the cable tray with suitably sized cable ties installed at 500 mm intervals.

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

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

Drain pipes shall run and connect to wastewater pipes where indicated on the project drawings. The connection between the drain pipe and waste water pipe shall be an airtight sealed connection that allows positive drainage of condensate.

Where no wastewater pipe is available a 400mm long 110mm PVC sleeve shall be planted into the ground and filled with gravel to act as a drip cup.

## e. PERFORMANCE SPECIFICATIONS

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

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

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

All units shall be capable of meeting total and sensible cooling requirements. All capacities specified are to be achievable at medium evaporator fan speed.

## f. PROTECTION AND CONTROLS

All units shall be rated for a power supply of 220V/1ph or 400V/3ph with a 10% fluctuation.

Thermal protection shall be provided for the compressor, indoor and outdoor fan motors. Overcurrent relay shall be provided for the compressor, indoor and outdoor fan motors to ensure over current protection.

Reverse phase, three phase overload, overload during startup, phase imbalance, phase loss and low voltage protection shall be provided for all three phase motors.

Protection fuses shall be provided for all control and operating circuits.

The compressor shall have high and low refrigerant pressure switches for protection.

The indoor and outdoor units shall comply with the safety requirements as set out in SANS 60335-2-40: Household and similar electrical appliances – Safety. Part 2-40: Particular requirements for electrical heat pumps, air-conditioners and dehumidifiers

The Controllers shall be of the same manufacture as the air conditioning units and shall display the following:

- Operation mode
- A checking display when abnormality occurs in the unit
- Setpoint temperature
- Operational lights
- Room temperature display
- Fan speed indication
- Key lock function
- The controller shall allow the following operational functions:
- Manual ON/OFF.
- ON/OFF by seven day timer.
- Room temperature adjustment.
- Scheduled weekly timer
- Cooling / heating / ventilation selection.
- Automatic change-over between cooling and heating.

Where room controllers are required the controller shall be of the hard-wired remote controller type, installed over an electrical draw box (where available) at the positions indicated on the drawings. Temperature set point control shall be on the space air temperature measured with at least two averaging temperature sensors situated in the cooling space. An adjustable timer shall be provided for the units and shall be installed in the control panel to enable the user to programme the units to run during office hours.

The control system shall be such that the units will automatically change from heating to cooling and vice versa. The units shall also be able to operate in a "fan only" mode.

Electrical interlocking shall be provided to ensure that:

- Compressors cannot run without both evaporator and condenser fans running.
- It shall not be possible to switch cooling and heating on simultaneously.

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

## 26. VENTILATION FANS

### a. GENERAL

The combination of fan and attenuators shall be such that the specified noise levels are achieved.

Where no pressure requirements are indicated, the Contractor shall estimate the fan static pressure requirements for the system lay-out and tender accordingly. Where filters are included in the system, the static pressure losses through filters shall be estimated at ***150*** Pa through each stage of filtration.

Ventilation and extraction fan duties as specified on the tender drawings shall be checked against the respective system's design resistance once all information on the selected system is available. Where fan duties are found inadequate, the contractor shall notify the Engineer before ordering the equipment.

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

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

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

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

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

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

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

Bearings shall be of the ball or roller type and shall be quiet in operation. They shall be sized to give a long life (not less than 100 000 hours) at the loads imposed by the application.

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

The construction and design of electrical apparatus for ventilation equipment in hazardous environments shall comply with the relevant SANS specification, e.g. SANS 10108. The electrical installation shall comply with SANS 60335-2-80: Household and similar electrical appliances – Safety Part 2-80 Particular requirements for fans.

### b. IN-LINE DUCT FANS

In line duct fans shall be suitable for duct installation as indicated on the project drawings for the relevant ventilation and/or extraction system(s). In line duct fans shall be manufactured from a self-extinguishing material, be IP54 protected and be equipped with fan motor overload protection. Fans shall have compact overall dimensions with the overall diameter only slightly larger than the ventilation duct.

In-line duct fans shall have two speed settings and shall be sized and selected so as to meet the required fan duty at the lower speed setting. In line duct fans with their adjoining attenuators shall not exceed the NC level as set out under the section, Sound Control.

To minimise the transmission of vibration of fan noise, fans shall be resiliently mounted on rubber cushions or anti-vibration hanger rods.

Fans shall be installed with sound attenuators as specified in sound control section of this specification.

### c. CONTROL

The fresh air ventilation fans shall be switched on/off by a seven day 24h timer and or wall mounted speed controller as shown on the project drawings. Toilet and kitchen extract fans shall be switched on/off with a motion sensor that comes with a delay timer as shown on the project drawings. The mechanical contractor shall be responsible for the supply and wiring of the necessary equipment.

All ventilation fans shall, upon receiving a signal from the fire detection system, switch-off. The contractor shall allow for this function in the interlocking control DB boards.

## 27. DUCTING

### a. GENERAL

Sheet metal ductwork shall be manufactured in accordance with SANS 1238, and installed balanced and tested as set out in SANS 10173. The installation and manufacture of ductwork shall strictly be in accordance with SANS standard specifications with specific attention given to the following:

- Changes in size and shape of ducting: refer to SANS 1238, section 6.3. Particular requirements are given on the standard drawings.
- Access openings, doors and covers: refer to SANS 1238, Section 5.3.
- Sealant requirements: refer to SANS 1238, Section 5.6.
- External ducting insulation: refer to SANS 10173, Section 5.4.
- Material thickness and duct stiffening for low pressure ductwork: refer to SANS 1238, Section 6 for rectangular ductwork and SANS 1238, Section 7 for circular ductwork.
- Radius and square bends as well as turning vanes: refer to SANS 1238, section 6.4. Typical bend layouts as set out in SANS 1238 are given on the standard drawings.
- Unless the sheet-metal ductwork is inherently corrosion protected, all sheet-metal shall be protected against corrosion as outlined in SANS 1238, Section 8.
- It shall be the responsibility of the installing contractor to ensure proper assembly and sealing of sheet-metal ductwork and insulation strictly in accordance with SANS specifications.
- The air duct system shall be of the low pressure type and the ductwork shall be manufactured of galvanised mild with general material requirements as set in section 5.1 & 5.2 of SANS 1238. The ductwork shall either be circular or rectangular in cross-section as indicated on the project drawings.
- The first dimension given on the drawings for rectangular ductwork shall be read as the width on plan and the depth on section, and the second dimension shall be read as the depth on plan and the width on section.
- The duct dimensions shown on the drawings are sheet metal dimensions. All final dimensions shall be checked on site, or verified by means of architect's working drawings and structural drawings, before the fabrication of the ducting.
- Sealing membranes and adhesives for affixing insulation shall meet the indexes for surface spread of flame, heat contribution and smoke production as set out in section 4 of SANS 1238.

- The inner surfaces of ducting shall be smooth and no internal insulation shall be used. Dampers, sound attenuators, duct splitters and turning vanes shall be installed where indicated on the drawings.

- Flexible connections shall be provided between all fans, sound attenuators, air-handling units, and ducting. Flexible connections exposed to weather shall be provided with protecting galvanised sheet steel cover strips. The material used for flexible joints shall comply with the requirements as set out in SANS 1238, section 5.5. Flexible connections shall be provided on both sides of the equipment with a fixing method as indicated on the standard drawings.

- Ducting shall always be installed in such a way, that, especially in plant rooms, maximum height between the floor and the underside of ducting is achieved.

- The installation and testing of hangers shall comply with the requirements as set out in SANS 10173. All hangers shall be treated against rust and shall be painted.

- The galvanised surface of the ducting shall not be damaged or marked in any way. The internal surface of plenums and ducting shall also be painted black where necessary, to prevent the visibility of the inside surface of the duct or plenum.

- Exterior supply and return air ducting and cladding that is exposed to sunlight shall be painted with an approved solar heat reflective paint

- Where ducting required painting, all galvanised ducting shall be prepared, coated and painted to the following method. All galvanized surfaces requiring painting shall be thoroughly cleaned with galvanised iron cleaner, rinsed and dried. It shall then be painted with one coat galvanised iron primer or self etch primer. Finally, the surface shall be given two coats of high gloss enamel paint to a colour as specified by the architect.

- Reinforcement, duct stiffening and fastening accessories shall be galvanised and installed where required. Only duct accessories manufactured from compatible materials, which comply with SANS 10173, shall be installed with the ductwork. Tie rods shall be manufactured from galvanised steel. Rivets, screws, bolts and other fastening equipment shall be corrosion proof.

### b. LONGITUDINAL SEAMS AND TRANSVERSE JOINTS

Pieces of ductwork shall be joined with the necessary sealants, as applicable, as set out in SANS 10173, Section 5.

Longitudinal seams and Transverse joints for rectangular ductwork shall be in accordance with SANS 1238, Section 6. The types of seams and joints outlined in the SANS standard are depicted on the standard drawings for clarity.

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

Longitudinal Seams and Transverse Joints for circular ductwork shall be according to SANS 1238, Section 7. Particular details on the seams and joints are outlined on the standard drawings.

### c. HANGING AND SUPPORTING OF DUCTWORK

Hangers and supports for rectangular and circular ductwork shall comply with SANS 10173, section 5.3 *"Ductwork with a vapour barrier"*. The hanger and support types are depicted in the standard drawings.

Hangers and supports for rectangular and circular ductwork with no insulation shall comply with SANS 10173, section 5.3 *"Ductwork with no vapour barrier"*. The hanger and support types used for ducting with insulation may be used. In addition to these types, the types depicted in the standard drawing may also be used.

### d. DUCTING INSULATION

All air ducts carrying heated or cooled air, except where ducting run in conditioned spaces or specifically stated to the contrary shall be externally thermally insulated. Internal insulation shall not be acceptable. All joints and valves, dampers etc. shall also be adequately insulated. All ducting insulation material and installation shall comply with the requirements as set out in SANS 10173, section 5.4.2.1.

External duct insulation shall be highly resistant, organic glass fibre blanket bonded with resin, faced and vapour protected with an aluminium foil cover laminate. The external insulation shall be of properties as given in the table below.

| Type | Thickness (mm) | Volumetric Mass ($kg/m^3$) | Thermal Conductivity ($W/m°C$) | Temperature Limits | Fire Rating |
|---|---|---|---|---|---|
| Duct Wrap 25 | 25 | 18 | 0.040 @ 35 °C | 120 °C | Class 1 |
| Duct Wrap 50 | 50 | 16 | 0.040 @ 35 °C | 120 °C | Class 1 |

Insulating material shall be fixed to the duct with adhesive and strapped or clamped at intervals not exceeding 300 mm. Mechanical fastener pins may also be used on the bottom and sides of the duct. The Contractor shall reinstate the integrity of the vapour barrier after the pins have been fixed. Joints in the insulation shall be taped by means of an aluminium type of the same quality as the foil facing with a minimum overlap 50 mm. No vapour seal shall be left punctured.

All insulated ductwork shall be provided with a vapour barrier to the requirements as set out in SANS 10173, section 5.4.2.3. The vapour barrier material shall comply with the requirements for flammability of sealing membranes of SANS 1238.

Ducting running in areas exposed to the weather elements shall be provided with an additional protective layer applied over the existing vapour barrier.

Galvanised sheet metal shall cover the insulated ductwork to shed water and provide protection against physical damage. The galvanised sheet metal cladding shall at least be 0.6 mm in thickness and secured tightly to the insulation.

In the case of a vapour barrier, care shall be taken to ensure that the vapour barrier is not damaged in any way. If the vapour barrier is damaged in the process of installing the cladding then the contractor shall repair, seal and reinstate the integrity of the vapour barrier as needed.

### e. FLEXIBLE DUCTING

Flexible ducting shall comply with the requirements as set out in SANS 10173, section 5.7. Flexible ducting shall be proprietary manufactured with a fire rating to SABS 0177 Part 3 Class 1. The flexible ducting shall have an adequate working pressure and temperature range to suit the application of the installation.

Flexible ducting shall at all times be kept to a length not exceeding 1.5m. Flexible ducting shall not have more than the equivalent of one 90° bend and bends shall be of maximum possible radius. Flexible ducting shall be supported with sufficient and correct brackets that will ensure maintenance of shape.

Flexible ducting shall be provided between air terminals, diffusers and all locations as indicated on the project drawings.

Uninsulated flexible ducting shall be manufactured from aluminium laminate with a heavy-duty steel helix core.

For insulated flexible ducting the inner core shall be of aluminium laminate with a heavy duty steel helix core. The flexible ducting shall be insulated with 25/40/50 mm fibreglass insulation and provide with reinforced multiple layer aluminium laminated outer vapour barrier.

### f. TESTING OF DUCTWORK

All ducting shall be leak tested in accordance with SANS 10173, section 4.3. No ducting shall have leakage rates in excess of 5 % of the required air flow rate in any section of ductwork or in excess of the SANS permissible leakage rates, whichever is the smallest.

## 28. AIR TERMINALS AND DAMPER

### a. GENERAL

Where selected by the contractor, air diffusion equipment shall be selected in accordance with the manufacturer's recommendations, capable of passing the specified air quantity at the appropriate throw without creating excessive resistance, noise or local draughts. All air diffusing equipment shall be capable of meeting NC level requirements for the space environment where the equipment is installed.

In all instances where spigot boxes (plenums) are used for the connection of air diffusion equipment, the inside surfaces shall be painted black to prevent visibility of the internal surface from ground level.

During commissioning of the system, each grille, diffuser, valve etc. shall be set to deliver the specified air quantity. It is the Contractor's responsibility to check regenerated noise levels of grilles offered against the overall acoustic performance of the system required. Noisy grilles and diffusers that exceed the NC level requirements of the given space shall be replaced at the Contractor's expense with more suitable types.

### b. RETURN, TRANSFER AND DOOR GRILLES

Return air grilles shall be manufactured from extruded type anodised aluminium, naturally anodised or epoxy powder coated to a colour as specified by the Engineer. Return air grilles shall in all instances have fixed blades with a curved blade profile.

Return air grilles shall be capable of meeting the airflow requirements, as set out on the project drawings, with a face velocity not exceeding 2 m/s.

Transfer air grilles shall be complete with fixed curved blades and outer frame on both sides of the wall or partition. Transfer air grilles shall be of aluminium extruded type, naturally anodised or epoxy powder coated to a colour as specified by the Engineer. Openings in walls where transfer grilles are to be installed shall be provided by the Building Contractor.

Door air grilles shall be installed in wooden doors only. In cases where steel and glass doors are used, transfer grilles or transfer ducting as an alternative shall be installed. Door air grilles shall be of the chevron-blade type. Door air grilles shall be manufactured from extruded type anodised aluminium naturally anodised or epoxy powder coated to a colour as specified by the Engineer.

Transfer ducting shall comprise of galvanised sheet metal ducting and aluminium curved blade intake and outlet transfer grilles. Flexible ducting shall not be used as transfer ducting.

Return, transfer and door air grilles shall be provided where indicated on the project drawings and shall be installed to the supplier's recommendation.

Return air grilles shall be installed directly on the ducting where indicated on the project drawings unless specified otherwise. The connection between return air grilles and ducting shall be airtight and sufficiently strong to handle the duct pressure.

## c. WEATHER LOUVERS

Weather louvers shall have standard blade spacing of 50 mm.

Weather louvers shall be manufactured of extruded aluminium, naturally anodised or epoxy powder coated to a colour as specified by the engineer. Weather louvers shall be constructed with drip edges to blades and rigid frames to enable building in. The top and bottom blade of each weather louver shall be fitted flush with the frame and shall be smooth without grooves, channels or recesses where dirt or water can accumulate. Weather louvers shall be watertight and shall prevent the entrainment of raindrops at a face velocity of up to 3 m/s. Plastic bird mesh screens shall be fitted behind the blades. Galvanised expanded metal or wire mesh screens with 12 mm opening sizes shall also be accepted.

Weather louvers smaller than 450 x 300 mm, shall have 19 mm spacing between blades. Grilles shall be installed horizontally at the location where indicated on the project drawings.

## d. FIXING OF WALL-MOUNTED GRILLES AND LOUVRES

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

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

## e. SUPPLY AIR DIFFUSERS AND SUPPLY AIR GRILLES

Where supply air grilles are specified on the project drawings, the supply air grilles shall be manufactured of extruded type anodising grade aluminium and shall be provided with opposed blade volume control dampers, unless specified otherwise on the project drawings. Volume control dampers fitted with supply air grilles shall conform to SANS 1238, section 6.5 requirements. The blades shall be adjustable from the front of the grille.

Where aluminium ceiling diffusers are specified on the project drawings, diffusers shall be manufactured from extruded type 5OS aluminium, naturally anodised or epoxy powder coated to a colour as specified by the Engineer. Ceiling diffusers shall be complete with an opposed blade damper, plenum box with spigot and ceiling plate. Ceiling type diffusers shall have a standard flat frame with blade spacing and distribution pattern as indicated on the standard drawings.

Where steel diffusers are specified on the project drawings, diffusers shall be manufactured from steel and powder coated to a colour as specified by the Engineer. Diffusers shall be equipped with a locking bracket to lock the adjustable radial disc once the system has been balanced. Alternatively diffusers shall be manufactured from steel and finished in a chip resistant baked epoxy powder coating to a colour as specified by the Engineer. The control disc shall be adjustable to vary airflow for balancing purposes. The diffuser shall be equipped with a locknut on the control shaft to lock the volume control disc in position after the system has been balanced.

Diffusers shall be installed at the locations where indicated on the project drawings. The Contractor shall install insulated flexible ducting of length not exceeding 1.5m and of the same diameter as the diffuser, extending from the supply duct to the diffuser. Spigots shall be attached to the ducting and sealed with silicon sealer around the outer perimeter of the joint. Flexible ducting shall be strapped to the diffuser and spigots with steel straps to form an airtight connection.

Alternatively, where indicated on the project drawings, diffusers shall be "hard" connected to ducting with rivets or taper screws and sealed with silicone sealer to form an airtight connection. All diffusers shall be capable of meeting the discharge pattern and throw requirement as set out on the project drawings.

### f. EXHAUST DISC VALVES

Disc valves shall be supplied and installed in the ceilings of the ablution areas and connected to the extract ducts by means of sheet metal spigots and flexible ducting.

The disc valves shall consist of a ring and central disc, which when rotated shall adjust the volume through the outlet. During commissioning of the system, each disc valve shall be set to exhaust the specified air quantity.

Disc valves in ceilings shall be of the polypropylene type, in a finish to match the ceiling colour.

### g. VOLUME CONTROL DAMPERS

Volume control dampers shall be of the opposed multi-blade damper (OBD) type or alternatively be of the butterfly-valve type suitable for use in circular ducting.

Volume control dampers shall be installed in ducting where indicated on the project drawings. The Contractor shall balance the ducting system after installation and set the required flow rates to the various air terminals as specified on the project drawings. The Contractor shall test, balance and adjust the duct system to the requirements of SANS 10173: 2003, Section 8.

All dampers, whether it is an OBD or a butterfly valve, shall in all cases comply with requirements of SANS 1238, Section 6.5. The damper frames and blades shall be constructed of galvanised mild steel, assembled with galvanised bolts, nuts and washers. Extruded aluminium blades shall also be acceptable. Blades shall have a mill, anodized or epoxy powder finish. All volume control dampers shall have manually quadrant operation. Dampers shall be gear operated.

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

## 29. NOISE AND SOUND ATTENUATION

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

| Environment | NC Level |
|---|---|
| Court Rooms | 25 |
| Offices | 35 |
| Other | 35 |

Noise generating equipment such as fans, motors etc. shall be selected to operate as close to the point of maximum efficiency as possible. It is the responsibility of the mechanical contractor to check operating noise levels of equipment before bidding. Contractors offering equipment with low noise ratings may receive preference.

Background noise levels shall be measured separately with the plant switched off and shall be deducted from the total measured sound pressure levels.

Contractors are advised to calculate sound levels on the system offered before bidding. Where it is not possible to meet the specified sound levels due to the noise generated by the equipment, or due to inadequacies in the building structure, or the design of the plant, such deficiencies shall be stated in the bid together with the contractor's recommendations and cost implications.

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

Noise levels on the outside of buildings due to ventilation equipment shall not exceed the following values when measured at a distance of 10 m directly in front of the noise source (fan outlet, air grille, etc.) unless more stringent levels are called for in any bye-laws by local authorities such as municipalities etc.

| Environment | NC Level |
|---|---|
| Buildings in city centres adjacent to or across roads to flats, hostels. hotels etc with 24 hour plant operation: | 35 |

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

If the noise levels exceed the NC values specified above, the contractor shall be responsible to carry out all the necessary rectifications at his own expense. Noise readings outside the building shall preferably be taken at night when the background noise levels are low.

All fans shall be fitted with attenuators to reduce room noise levels.

Where attenuators are selected by the contractor, the attenuator shall be selected such that the pressure drop on both suction and discharge attenuators are minimized whilst meeting the noise level attenuation performance levels as required.

Where in-line axial flow fans are used, attenuators shall have casings constructed from pre-galvanised steel sheet, glass fibre absorbing material and a 1.6 mm thick pre-galvanised wire mesh to retain the acoustic material. Where Silax-P attenuators are used, actuators shall have an acoustic pod constructed from pre-galvanised wire mesh and filled with fibre glass acoustic material.

## 30. AIR FILTERS

### a. GENERAL

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

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

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

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

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

### b. FILTER MEDIA

Washable filter media shall be fitted behind hinged return air grilles where indicated on the project drawings. The filter media shall be of the Peter McLeod PM 100 type or equally approved, 100 grams / $m^2$ density and 5 mm thick. The filter media shall be of the synthetic type and shall be capable of arresting lint of the return air. The filter media shall fit and extend past the outer perimeter of the wire mesh in the return air grille such that the bypass of unfiltered air is avoided. The filter media shall be fire proof. Glass fibre filter media type shall not be acceptable

## c. FILTERS

All units shall be fitted with a primary pleated filter, mounted at the location where indicated on the project drawings.

Frames and filters shall be constructed in such a manner that the passage of unfiltered air is prevented. Gaskets shall be provided between filters and filter holding frames to prevent the bypass of unfiltered air. Primary filters shall slide into the filter holding frame and shall easily be removed without the need to destruct the ductwork to which the filter holding frame is fixed.

Each filter bank shall be supplied with an identification label stating type of filters, quantity of filter elements, model numbers and all other information necessary for re-ordering filter material.

Filters shall be adequately protected against dirt during construction and shall not be operated until the system is thoroughly cleaned.

## d. PRIMARY PLEATED FILTERS

Primary filters shall be of the 50 mm pleated washable panel type. The media shall be synthetic and shall be of the self-supporting type. The media shall fit into and extend to seal all round in the panel frame to ensure that no air bypasses the media. The filter outer panel frame shall be of galvanised steel.

All filter accessories including the channel filter holding frames and clips shall be standard products of the filter manufacturer. Filter holding frames shall be manufactured from galvanised steel. Filter holding frames shall be bolted or riveted together, where necessary, and shall be suitably reinforced in larger arrangements to withstand all possible operating conditions. An airtight seal shall be provided where filter holding frames are joined together. All metal parts shall be sufficiently protected against corrosion.

Primary filter panels shall fit into channel holding frames with sealing gaskets located between filter panel and channel holding frame. Where the channel holding frames are located on the downstream side of the filter, at least two spring loaded clips shall be used to ensure a positive seal against the edge gaskets and to keep filter panel in place. Where the channel holding frames are located at the upstream side of the filter, at least four spring loaded clips shall be used. All clips shall be from stainless steel.

The primary filter shall be of filtration class G3 / G4 have an average ASHRAE arrestance of 90 %, SABS tested. The dust holding capacity shall not be less than 150 g per square meter. The initial (clean) and final (dirty) resistance of the filter shall be 65 Pa and 250 Pa respectively. The above-mentioned features shall be based on a rated face velocity of 2.5 m/s.

Primary filters shall be of the 50 mm pleated washable panel type and be of the Peter McLeod Manufacture. The media shall be synthetic and shall be of the self-supporting type. The media shall fit into and extend to seal all round in the panel frame to ensure that no air bypasses the media. The filter outer panel frame shall be of galvanised steel.

All filter accessories including the channel filter holding frames and clips shall be standard products of the filter manufacturer. Filter holding frames shall be manufactured from galvanised steel. Filter holding frames shall be bolted or riveted together, where necessary, and shall be suitably reinforced in larger arrangements to withstand all possible operating conditions. An airtight seal shall be provided where filter holding frames are joined together. All metal parts shall be sufficiently protected against corrosion.

Primary filter panels shall fit into channel holding frames with sealing gaskets located between filter panel and channel holding frame. Where the channel holding frames are located on the downstream side of the filter, at least two spring loaded clips shall be used to ensure a positive seal against the edge gaskets and to keep filter panel in place. Where the channel holding frames are located at the upstream side of the filter, at least four spring loaded clips shall be used. All clips shall be from stainless steel.

### e. FILTER HOLDING RAMES AND HOUSING BOXES

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

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

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

Filter boxes shall be constructed and installed such that under no circumstances may any un-filtered air by-pass the filters. Boxes shall be sealed with silicone sealer at installation and filters shall be fitted with approved seals.

## 31. ELECTRICAL INSTALLATION

### a. GENERAL

The services of qualified electrician shall be employed by the mechanical contractor. The mechanical contractor shall be responsible for the design, documentation, supply, installation and commissioning of the electrical system for the air conditioning installation. The electrical system shall be designed, installed and tested in accordance with the criteria laid down in the Standard Regulations for the wiring of premises, SANS 10142-1 latest Edition. An electrical certificate of compliance shall be issued by the mechanical contractor after completion of the installation.

Power provision responsibilities shall be as described on the HVAC drawings and equipment schedules, as well as described here-in where relevant. Power to indoor units should be provided in an isolator mounted within 1 m of the unit. The mechanical contractor shall perform the full electrical installation from the DB to the isolator and connection to the equipment. Plant that is located in plant rooms shall be fed from a motor control centre/panel at the plant room. Power and fire signals to the distribution boards shall be existing.

The board itself with all switch gear and controls gear and all cabling to equipment shall be by the mechanical contractor.

Where applicable, the mechanical contractor shall supply and install dedicated motor control centre(s)/panel(s) related to the mechanical works and shall be responsible for the complete electrical installation extending from the distribution boards to the isolators and mechanical equipment.

The panel(s) shall have all the necessary main switchgear, safeties and instrumentation and other mechanical equipment where indicated on the drawings fully wired and connected. It is the mechanical contractor's responsibility to determine the correct fault level of the main distribution boards before manufacturing of the HVAC distribution boards.

Labelling of the electrical system shall be of engraved laminated plastic with 4mm high white lettering on black background. Labels shall be securely fitted with brass bolts, and labels glued or pop riveted into position shall not be acceptable.

The following local control panels will be installed:

- Plant Room – VRS & Hide away units

### b. CONTROL PANELS

Local control panels shall be of the wall-mounted type, robustly fabricated of 16 S.W.G. galvanised mild steel sheet, with fascia plates behind lockable doors.

All metalwork shall be suitably treated against corrosion and shall be coated with a self-etching primer, two coats of metal primer, and finished, internally one coat, externally two coats, with a good quality hard gloss enamel of an approved colour. The final coat colour shall be a standard B.S. colour readily matchable. No hammer tone or similar.

All control equipment is to be chassis mounted behind a hinged fascia plate through which only circuit breaker toggles, reset buttons, etc., protrude. Equipment shall not be fixed to the fascia plate. Alarm pilot lights, timing units and ammeters shall be mounted on the doors, all other equipment being behind the doors. The control panels shall be complete with main isolator/s that can be operated without opening the doors. Access to equipment and wiring shall not be possible without switching off the main isolator.

The cable boxes to terminate the incoming cable will be mounted by others, but supports for this box are to be provided. Where PVC insulated cable is indicated, a gland plate only is required.

Internal busbars, wiring, and terminals, shall be of suitable size and rating. Terminals shall be of brass and comply with sections 5.14.2 and 5.14.4 of SABS 152-1951. Wiring shall be neatly bunched and run in PVC wiring channels.

The electrical equipment to be provided on the switchboard shall comply with the detailed requirements.

Each control panel shall have red alarm pilot lights to indicate any malfunction or operation of any safety device. Normal running conditions of fans etc., shall be indicated with green pilot lights. All pilot lights shall have a "lamp test" facility. This can be done either collectively or singly by means of a push button switch.

All exposed equipment and pilot lights are to be clearly labelled by means of plastic engraved labels, mounted on the fascia panels by means of screws or channelling. Each item of equipment in the board is to be labelled to correspond to its reference number on the wiring diagram. All wiring connections to equipment are to carry numbered ferrules corresponding to the connection number on the wiring diagram. All wiring to external equipment is to terminate in a numbered terminal block, to which the external wiring is to be connected. The terminals are to be of suitable rating for each circuit. No deviation from these requirements will be permitted.

The grouping of equipment on panels will be logical and neat and shall be done on the following basis:-

i) Main incoming breaker, main metering, and incoming cable access;

ii) Each motor circuit with sub-main breakers, starters, and Contactors;

iii) Plant room auxiliaries and general control circuits.

A detailed drawing of the control panels, as well as an electrical component and connection diagram shall be submitted for approval before manufacture commences. A wiring diagram of each control panel is to be laminated and installed inside the panel with clips or hooks.

The following shall be typically provided as part of the control panels:

| | |
|---|---|
| One ampere meter with phase selector switch | YES |
| One voltmeter with phase selector switch | YES |
| ON/OFF/AUTOMATIC selector switch | YES |
| Fault indication lights | YES |
| Run indication lights | YES |
| Lamp test pushbutton | YES |

| | |
|---|---|
| Circuit Breakers | YES |
| Main Incoming isolators | YES |

The HVAC control panels shall have all the necessary switchgear and instrumentation and other mechanical equipment where indicated on the drawings fully wired and connected.

Before commencing manufacture of the control panels, shop drawings shall be submitted to the Engineer for approval. The panels shall be thoroughly tested before leaving the factory and copies of the manufacturers test certificate shall be submitted to the Engineer for approval before installation.

The electrical contractor shall supply main supply cables to the position of the HVAC control panels. The supply cables shall be terminated in a weatherproof isolator at each fan of AC unit. Connection to the control panel and equipment will be by the mechanical contractor.

The mechanical contractor shall supply and install all cables and galvanised conduit from the isolators and control panels to all the fans or AC units. The connecting of cables in the control panel shall be executed by the mechanical contractor.

Labelling of the electrical system shall be of engraved laminated plastic with 4 mm high white lettering on black background or equal. Labels shall be securely fitted, and labels glued into position shall not be acceptable.

### c. MOTOR CONTROL CENTRES (MCC's)

General:

The mechanical contractor shall ascertain the positions of the existing distribution board(s) timeously and ensure that provision is made for cabling, trays and trunking etc. as required.

The mechanical contractor shall supply and install all cables and galvanised conduit from the HVAC MCCs to all relevant HVAC equipment as detailed on the drawings and equipment schedules. The connecting of cables in the distribution boards shall be executed by the mechanical contractor.

MCCs (low voltage assemblies) must be provided as detailed below and conform to the requirements of the OHS Act in terms of SANS 10142-1 in general and specifically in terms of SANS 1973 (latest editions). Note that the following interpretation serves as a guideline only and all associated contractors must acquaint themselves fully with the relevant SANS requirements.

MCCs rated at 10 kA and less must comply with SANS 1973-3.

- MCCs rated at more than 10 kA, must comply with SANS 1973-1 and the MCC must be certified to comply with the relevant type provided for within SANS 1973-1.

- On completion the MCC manufacturer must certify that the MCC complies with the OHS Act in terms of the relevant SANS certification, before delivery will be taken. SABS permit holders must apply the mark to the MCCs. This certification, as well as a routine test report, must be provided to the installation electrician for purposes of the COC.

- In the case where the MCC populator is not the steelwork and busbar manufacturer, the steelwork and busbar manufacturer must inspect the populated switchboard and certify that the populated switchboard has not compromised his certification and that the populated switchboard complies with the relevant code.

Switchgear:

Circuit breakers must provide short-circuit and overcurrent protection, suitable for motor starting.

The main and motor starter circuit breakers must have panel door mounted, door interlock padlockable handles. Circuit breaker handle extended shafts coupling to the circuit breaker must be an integral part of the circuit breaker body, or screw fixed into a threaded receptacle in the body. A clip or clamp-on adaptor will not be acceptable. Rear access MCCs, rear panel doors, must be fitted with square key locks and padlockable handle.

Starter General Requirements:

Comprehensive motor protection shall include, overload, underload, phase fail/under-voltage and phase rotation.

Note: That all drives, including ancillary equipment e.g. motor driven grease pumps etc. associated with the relevant equipment, must have a separate starter included in the MCC.

Ratings:

The MCC and all switchgear must be rated for the specified fault level as specified in the project specification under the relevant MCC. Single pole circuit breakers on MCCs with a fault level in excess of 10 kA, may be rated at 10 kA with suitable HRC backup fuses.

Fault levels given at the relevant MCCs, are based on the position of MCCs as shown on the tender drawings and cable sizes in the schedule of cables. Should there be any deviation, the fault levels must be re-evaluated.

MCCs shall be rated to a protection degree of IP54 for external use and IP44 for use inside buildings

Ratings given for equipment are based on the estimated power requirements of new driven equipment, but must be determined according to the specific motors as installed. Starters may not be rated at less than the motor rating.

General Construction:

The MCC must be floor or wall-mounted and be manufactured from 3CR-12 sheet steel not less than 1.6 mm thick. The MCC shall be arranged for front access to live parts if placed against the wall and front and rear access for MCCs not placed against a wall.

Rear access doors must be padlockable. Floor standing MCCs must be provided with a 50 mm x 100 mm hot dipped galvanised U-channel base.

The MCC must be constructed in tiers, subdivided in separate panels, one each per individual drive and control section, each with own door. All equipment related to a specific panel/drive must be directly accessible by opening the related panel door and not via adjacent doors. For MCCs with a fault level of 10 kA and more, the panels must be fully compartmentalized and for less than 10 kA, open construction may be used, subject to the requirements of SANS 1973-3.

A push lock twist unlock emergency stop which will stop all running equipment (via auxiliary relays in each panel) must be provided on the incoming section door, with corresponding indication light if the E-stop is operated. In the case where individual motors and / or panels are fitted with E-stops, each E-stop must have an indication light and the active status must be wired to the Terminal/Marshalling enclosure for remote monitoring.

All interactive equipment must be installed on doors. Doors must be hinged and fitted with rubber door seals. MCCs for external use must have outside weather-proof doors and both the internal and external doors must be fitted with rubber gaskets, to prevent ingress of dust and sand. The door construction must provide a continuous sealing edge against the gasket. Cut

outs for overlapping doors or locks will not be permitted. Quarter turn square key locking devices shall be used for securing the front panels and doors must be removable.

The grouping of equipment on panels must be logical and neat and shall be done on the following basis:

- Incoming section with main incoming breaker, metering and incoming cable access.
- Outgoing sections for each motor circuit with sub-main breaker, starter, dedicated control, ancillary equipment and status indication.
- Separate control panel, for each group of related equipment operating together such as a duty and standby pump and all common controls and indication lights.
- Outgoing section for plant room auxiliaries and general control circuits, power and lighting.
- The lowest operator interface (operating facility, status indication etc.) may not be less than 500mm from floor level.

All the equipment referred to above must comply with the relevant clauses in this specification.

All connections, including motor connections must be extended to terminals above the gland plate, within dedicated terminal compartments with own doors. Connections to starter panels situated at the bottom of a tier may be accommodated within that starter panel, but no others.

Tiers with enclosed starter compartments must be provided with separate full length vertical wiring compartments of minimum width 250 mm between tiers, for wiring to terminals in the terminal compartments. Terminals to power and control cabling may be installed within such tiers. Terminals for power conductors of 6mm² and more must be mounted horizontally, in staggered group configuration. I.e. conductors must enter the terminal without an offset. All other terminals may be installed vertically. All conductors must be secured to a tie rail or equivalent, to eliminate any strain on the terminal.

Hot air from electronic starters, unless fitted with a bypass contactor, must be ducted to the top or back of the switchboard with aid of extraction fans at the point of exit. Starters with a combined rating of 100 kW or more, must be vented to the outside of the building. Air entry openings must be fitted with filters in a removable frame for easy removal for cleaning. Screens must be fitted to air exits to prevent ingress of foreign bodies.

Sufficient space must be provided between the base of the panel, the gland plate and the main circuit breaker to allow easy connection of the supply cable. In the case of free-standing MCCs, there must be at least 300 mm clearance between the base and gland plate with additional space below in a trench, to allow for the cable bending radii. In absence of a trench, the additional height must be provided by means of a raised platform from angle iron.

Painting must be in accordance with section 3 on painting and the final coat must be electric orange or light grey baked enamel baked or powder epoxy. Outdoor MCCs for pump stations must be olive green.

The electrical equipment to be provided in the MCC must comply with the requirements of the project specification and other relevant sections hereafter.

The MCC must have a totally enclosed air insulated busbar chamber running the length of the main panel. If the MCC is fitted with a distribution section feeding other MCCs or distribution boards (such as a local DB for power and lighting), the MCC section busbars must be separated from the main supply busbars. The MCC section must be fed from the distribution section by means of a distribution circuit breaker fitted with external locking facilities, to provide the facility to isolate the MCC section from the distribution section, without affecting the other distribution feeds.

Internal busbars, shall be of solid copper for each phase and neutral. Wiring and terminals shall be of suitable size and rating and terminals shall be of brass and comply with SANS

60947 3. Busbars must be solidly mounted on insulated supports with bolted lug connections to conductors. Screw type connections with clamps shall be acceptable for conductors up to and including 10 mm2. Neutral and earth busbar of solid brass with one way for each circuit and for each conductor, must be provided. Flexible conductor may not be used in parallel to increase current carrying capacity. The maximum size for flexible conductor is 95mm² after which solid copper bar must be use.

Wiring to equipment must be installed in PVC trunking (maximum utilization 80%), or within dedicated wire-ways by means of neatly arranged vertical and horizontal runs and laced together in circular looms by means of PVC cable ties. Wire looms not in trunking must be strapped to rails, secured to the steelwork. Self- adhesive type securing material shall not be accepted. Wire ends must be fitted with suitable crimped lugs to suit the connection type. All control wiring and terminals shall be numbered with approved wire and terminal markers.

Openings in steelwork for wiring passing through must be provided with suitable edge protection (bushing/ rubber grommet or similar) to prevent wiring insulation damage. Wiring at panel breaks for transport must be fitted with a suitable fixed plug and socket arrangement (terminal strips with jumpers are not acceptable) with positive connection locking facility. The MCC sections must be fitted with lifting lugs and the surrounding steelwork must be suitably reinforced to prevent metal distortion.

All equipment must be clearly labelled by means of plastic engraved labels in legible position.

External door mounted labels must be fixed to the boards immediately below the equipment by means of screws. A label must be provided at the incomer and outgoing circuit breakers depicting the point of supply / equipment served and cable size.

Note: That all supporting structures for freestanding switchboards, such as over cable trenches, must be provided under this contract and included in the switchboard price.

Outdoor type MCCs:

The following additional requirements are applicable to outdoor (kiosk) type MCCs.

Outdoor MCCS must be of the weather-proof type rated at IP 54 and manufactured from 3CR12 sheet steel. MCC within residential areas must be green and outside residential areas, off-white, to be confirmed with the design engineer, before manufacture.

MCCs must have a double slope roof with a minimum of 50 mm overhang and be of the hinged double door construction. The inner doors must be hinged with square key locks utilised for the mounting of indication and control equipment and the outer door as total weather protection, hinged, with padlockable rotary handles operating a stainless steel sliding locking rod. The outer doors must be fitted with hold-open stays. All locks, hinges and handles must be stainless steel.

Refer to General Construction i.r.o. door seals.

MCCs must be installed on a hot dipped galvanised angle iron framework bolted to a concrete plinth, provided as part of the contract. The bottom end of the kiosk may not be less than 600 mm from ground level (including the plinth height above ground). The operating side must face south.

Shade canopies manufactured from 1,6 mm 3CR12 sheet steel (unfolded) must be provided for MMCs, if so specified in the project specifications. The canopy must have a double slope and overhang the MCC by 200 mm on all sides. Full length side panels must be provided. The canopy must be fixed to the MCC stand.

The framework and canopy detail drawing must be submitted to the design engineer for approval before manufacture, as well as a drawing of the concrete plinth detail.

Where specified in the project specification, the MCC must be provided with a back to back section with own padlockable hinged door, as for the front door. This section is for use by

other parties specified in the project specification and the dimensions must be liaised with such parties.

The incoming size of the cable by the electrical supply authority must be established before construction of the board starts, if not supplied as part of this contract. Suitable terminals must be provided for the incoming cable if the main circuit breaker terminals are inadequate.

Ancillary and Control Equipment:

Control relays must be of the type indicating switched status and have an external manual switching facility. Connection pins must be sturdy in construction and of ample dimension. Thin pin type, prone to bending and misalignment, will not be acceptable.

Rotary switches must be of the wafer type with through fixing bolts and not of the multiple in-line switch block type.

Surge and Other Protection:

Surge protection on the incoming supply must be provided in accordance with SANS 10142-1. Both Class 1 and Class 2 coordinated protection must be provided, directly adjacent to each other, with curve C backup protection circuit breakers, rated in accordance with the manufacturer's recommendation.

The surge arrestors must be of the clip in type, having both end of life and safety reserve visual indication, as well as provision for operational status remote monitoring installed in a vented polycarbonate enclosure in the MCC incoming section.

Electronic equipment must in addition be provided with suitable equipment specific coordinated surge protection on an individual basis, in the relevant equipment section.

The following surge protection is in use elsewhere in the same building:

a) Circuit breaker (CB) larger than 250A:

- Type 1+2 Class1 Combined Arrestor
- DEHNvenci DVCI 1 255 **961 200** on all live conductors
- DEHNgap Maxi DGPM 1 255 **961 180 on Neutral**

b) CB smaller than 250A:

- Type 1+2 Class 1+2 DEHNventil **951 310**

Motor and other Equipment Protection:

Unless stated to the contrary, motor protection devices must be of the following type:

- Overload: Thermal overload relay.
- Overheat: Motor winding embedded thermal protection device. For motors up to and including 5 kW Klixons may be used. For motors rated more than 5kW thermistors must be used
- Phase fail: Phase fail relay with AUTO reset (300 s time delayed, adjustable) for protection against phase loss, phase rotation and undervoltage. (This protection must include control equipment such as contactor coils).

- Over/under voltage protection: a Sollatek 3 phase automatic voltage switcher (AVS- 3) per outdoor VRS unit.

Where comprehensive motor protection is specified as a separate electronic protection relay, it must have at least the above facilities. Soft starter and variable frequency controllers must have integral comprehensive protection. The specific fault must be identified on the unit by means of a LED or LCD display and a single trip contact must also be provided for a common TRIP indication light on the external panel door. Comprehensive motor protection relays may be offered, even if not specifically specified.

All protection/alarm devices must have manual resets, unless specified to the contrary elsewhere in the project specification. Electrically latched alarms, must be reset by a manually operated pushbutton on the relevant MCC, or remotely via a telemetry system, if so specified in the project specification. It must be possible to reset an alarm as soon as the alarm detection unit is in the normal state again. An equipment drive motor may only restart once the protection device has been reset.

Alarm and Status Indication:

The plant status and fault/alarm conditions must be identified on the panel as described for each switchboard, by means of indication (pilot) lights of the cluster LED type.

Fault/alarm lights must stay on until the alarm/fault condition has been rectified and the protection/alarm device reset operated.

Indication light colours reflect the plant status and must be provided in accordance with the following general guideline:

- GREEN : Healthy/active (such as RUN, START DEMAND)
- RED : Fault / alarm (such as TRIP, HI LEVEL)
- AMBER : Neutral (such as OPEN/CLOSED)
- BLUE : Special status

All equipment fitted with an emergency stop must have an associated indication light on the relevant control panel, which will switch on if the E- stop is activated and off when the E-stop is deactivated.

An alarm generated at a specific MCC and relayed to another MCC by means of a telemetry/cable system, must be reset at the MCC of origin, resulting in an automatic reset at the secondary MCC, due to absence of the alarm.

A lamp test pushbutton must be provided to switch on all indicating lights simultaneously. MCCs comprising more than three tiers, must have a test pushbutton for each panel.

A continuous duty audible and flashing strobe type alarm must be provided at each MCC. The flasher must be in a clearly visible position. All alarm and fault (protection) conditions derived from equipment served by the MCC, must activate this alarm. An ALARM ACCEPT pushbutton must be provided on the control panel of the MCC, to cancel this alarm. Note this is separate from any alarm/fault reset pushbutton.

In the case of indoor MCCs, the alarm light must be installed on the building outside wall and in the case of outdoor MCCs, the alarm must be fitted to a bracket attached to the side of the roof canopy, that ingress of water into the MCC at this point is not possible. Alarm lights must be protected against vandalism with a stainless steel wire grid enclosure.

Power Factor Correction:

Power factor correction equipment must comprise a suitable circuit breaker or fused on load isolator, switching contactor and capacitors to provide correction to 0.95 lagging. Discharge

resistors must be provided to discharge the capacitors to less than 10 % of the system voltage within 30 seconds of disconnection.

In the case of free-standing rear access MCCs, the PFC capacitors must be installed at the back of the associated starter panel. In the case of front access only MCCs, the capacitors must be installed in the motor starter compartment, but separated from the starter and control equipment by means of a solid barrier plate.

PFC capacitors used in conjunction with soft starters, must be arranged that the capacitors are not switched to the starter outgoing terminals, by means of a suitable contactor arrangement, isolating the soft starter during running (including start up and stopping).

Spatial Requirements:

MCCs sizes must be verified against spatial provision on the tender drawings. Any constraints must be qualified in the offer.

After appointment, prior to submission of drawings for comment, the MCCs sizes must be verified against the spatial provision for construction. Failure to do so resulting in additional cost for special measures required to overcome such constraints, will be for the responsible contractor's account.

MCC Drawings:

All MCC drawings must be submitted for review. Once the design engineer has commented on a drawing, construction can proceed, unless there are unresolved issues. A copy of the updated drawings must be issued to the design engineer for record. All revisions must be listed on drawings.

**d. STARTERS**

The starters or switches for starting the electric motors shall be so designed to limit the amount of current when starting and accelerating, to the current values set out below:

- 1.5 kW to 3.7 kW four times full load current.
- 4.5 kW to 11.0 kW twice full load current.
- 11.5 kW to 18.5 kW one and three quarters full load current.
- over 18.6 kW one and a half times full load current.

Starters are to be of the same manufacture.

Starters shall be rated for not less than 15 starts per hour and consist of the following:

- Circuit breaker with padlockable handle;
- CT operated ampere meter;
- 6-digit running hour meter;
- Controllers/contactors and current limiting devices in accordance with the motor starting and control requirements;

  Protection devices shall be provided as follows:

- Earth leakage relays shall be purpose made, similar to the E.P.C. manufacture;

- Any other protection for specific application such as bearing over temperature, vibration, etc. shall be stated in the Project specification.

All protection devices must trip the associated motor and individual fault indication must be given by means of a red pilot lights. Flush mounted push buttons must be provided for resetting electrically latched protection equipment.

Automatic restarting must be provided in accordance with the project specification requirements.

The motor circuit breaker (with auxiliary switches as required) shall disconnect all power and control connections to the motor served. It shall however be possible to test the control circuit (applicable to motors 15 kW and higher only) without switching the motor (i.e. the motor circuit breaker off) by means of a selector switch inside the panel marked normal/test.

The control circuit voltage must be taken from the load side of the motor circuit breaker (normal position) and from the live side (test position), via this changeover switch. The test position must be interlocked with an auxiliary switch on the motor circuit breaker, that the test line will be disconnected when the motor is on. For example, it shall not be possible to start the motor with the motor circuit breaker on and the C/O facility in test.

The starters shall be fitted with approved terminals of ample dimensions to suit the cables to be supplied from this equipment. The terminals must be installed directly above the gland plate for the outgoing cables.

An approved earth terminal shall be provided on the frame of each starter housing gear and provision shall be made for earthing each starter.

Soft Starters:

Soft starters must provide smooth acceleration during run up, reducing voltage drop, current and torque peaks, by means of reduced voltage at start-up, which is increased to full value on an adjustable time ramp, with an adjustable maximum motor current limit.

The motor and starter combination must be carefully selected to ensure compatibility of the torque requirements and motor insulation class for the operating cycle and starter to prevent thermal tripping of the starter due to overheating of the motor (prolonged starting times).

Soft starters will in general be specified for purposes of torque control rather than current limit. The reduced voltage at start-up and degree of current limit (if specified) may reduce starting torque considerably. All starters shall be suitable for the conditions specified and the associated driven machinery.

The starter unit must consist of a microprocessor controlled control unit and a power unit with 3 banks of 2 thyristor modules back to back with protection devices and gamma firing angle control.

Climatic operating range shall be 0 °C to 40 °C and 93 % RH at 40 °C without condensation.

Vibration resistance shall comply with IEC 60068-2-6.

Shock resistance shall comply with to IEC 60068-2-27.

The starter must be suitable for the continuous rated motor connected load plus 10% and 12 starts per hour, for single motors (refer to 6.0 for multiple motor starting).

Control functions shall include the following:

a) Starting

- Voltage ramp (starting acceleration) : Adjustable 1-30 seconds from a fixed threshold of 0.33 rated voltage.

- Current limit: Adjustable form 2-5 times motor rated current.
- Start voltage boost facility: Switch selectable full voltage starting for 100 ms.

b) Stopping (switch selectable)

- Controlled stop with voltage ramp (deceleration) : Adjustable 2-60 seconds.

c) Simultaneous starting/stopping - Where more than one drive can operate together, they must start and stop in succession and not simultaneously.

d) Switch selectable automatic and manual fault reset.

e) Motor thermal protection by adjustment of the motor current setting.

Protective features shall include:

a) Starter short circuit protection by means of fast acting fuses or other approved (by manufacturer) method.

b) Self diagnostic internal fault check before starting.

c) Thermal protection of the starter against over-load and over-temperature shutting the unit down. Units fitted with a cooling fan must have a fan fail alarm.

d) Protection of the motor against overload (slow, medium and fast overheating exceeding the motor thermal capacity) by setting the motor operating current. It must incorporate a thermal memory, taking into account previous starts, which will prevent a restart once the thermal capacity has been exceeded until the motor has cooled down sufficiently. This facility must remain operational even if the starter is bypassed once the motor is up to speed.

e) Voltage Phase failure and phase imbalance must stop the motor.

Status display (LED) shall include:

a) Starting/stopping

b) Normal operation

c) Cooling down

d) Internal fault (starter)

e) Thermal fault (starter)

f) Overload (motor)

g) Phase failure

The status indication must be visible without opening the panel door (in case of panels with an inner and outer door such as weatherproof panels, this applies to the inner door only).

When installed in a general purpose enclosure protection degree IP23, sufficient space must be provided around the starters to ensure adequate air flow in accordance with the manufacturer's requirements. If sufficient cooling cannot be obtained by natural ventilation fan(s) must be fitted. In case of IP54 enclosures an internal cooling fan must be fitted and adequate heat exchanging surfaces must be provided (calculation to be provided on request).

If power factor equipment forms part of the project, steps must be taken that the power factor correction equipment is never connected to the starter output terminals. I.e. in the case of

individual motor correction, the motor must be directly connected to the main supply after run up and the starter output disconnected, by means of interlocked contactors, before the power factor equipment is switched into the motor circuit. In these cases motors must be provided with separate overload relays since the starter overload protection is then out of circuit. Note the starter thermal memory must be retained when the motor is disconnected, to be functional if the motor is restarted.

### e. CONTACTORS

All contactors shall have easily removable coils and contacts, the contacts rated at AC3 for normal motor starting.

All contactors shall have adequately rated coils and continuously rated coils with a drop-off value of not more than 80 % of rated voltage.

### f. SWITCHGEAR

All switchgear shall be rated for the anticipated load and the maximum rupturing capacity of the particular system.

Main isolators:

All control panels shall be provided with a suitably rated main Isolator, which is to be of the "on-load" type, and can be operated without opening the door. This isolator shall be mechanically interlocked so that no live components are exposed without the isolator being in the off position.

Circuit breakers:

All circuit breakers shall be of the moulded case type, unless otherwise specified in the project specification, conforming to SANS 156 and carry the SABS mark. They shall be equipped with thermal or hydraulic devices for tripping on over currents and magnetic devices for instantaneous tripping on fault currents. The minimum voltage rating for single and double pole circuit breakers shall be 240 V and 400 V for three-pole. The ampere rating and fault rupturing capacity shall be as specified or shown on the drawings.

Miniature isolators:

Miniature isolators shall be micro-gap type manually operated air break switches suitable for flush mounting and shall be to SANS 60947. Where individually mounted they shall be in galvanised steel boxes with brass dished cover plates finished to match switch cover plates.

Fused switches:

The fuse-switch units shall be of the three phase and neutral arrangement having double break moving contacts supporting high rupture capacity fuses, all housed in a robust metal toggle mechanism. Interlocks shall be provided to ensure that the cover cannot be opened when the switch is in the closed position.

The fuses shall be of the high rupture capacity type and shall comply fully with BS 88-2 category AC4.

One set of spare fuses of each rating used in the switchboards shall be supplied and handed to the representative at the site.

## g. CABLE

Cables shall be 600 volt grade polyvinyl chloride (PVC) insulated steel wire armoured to SABS 150 - 1957 general purpose grade.

Tenderers are required to state in the schedule of prices the size of the cable between the various units to be supplied under this contract. The current ratings of PVC cables shall be in accordance with the standard wiring regulations.

The Contractor will be responsible for measuring on his final layout plan for the plant room, the lengths of the different cables required. The tender price must include for the supply and installations of all the necessary cables.

No cable joints will be permissible within any plant room.

## h. EARTHING

All starters, motors, pumps and associated equipment must be earthed by means of a separate bare copper stranded earth conductor, connected to the earth bar of the relevant switchboard serving that equipment. The earth conductors shall be properly laid and connected between the motors, starters, switchboards and the earth mat.

Earth conductors must be run alongside and strapped to its associated cable, equal in size to the cable conductors, with a minimum of 6 $mm^2$ and maximum of 70 $mm^2$ at the ends it must be fitted with sweated or crimped lugs, solidly bolted to the equipment to be earthed and the earth bar.

If there is a spare core in a cable, this may be used as an earth conductor instead of the separate bare copper earth conductor, as specified above.

Wire armouring of cables shall not be used as an earth conductor, but must nevertheless be earthed.

A suitable earth mat must be supplied at each switchboard, connected with a 70 $mm^2$ earth conductor, marked "earth mat" to the switchboard earth bar. If possible the earthing system must be bonded to the water reticulation system at least once, preferably at the main switchboard. All motors, starters, switchboards and cable armouring are to be connected to earth by means of separate PVC covered stranded copper conductor the same size as the cable conductors, run alongside cables and strapped thereto. Earthing conductors shall be fitted with sweated lugs at ends and are to be solidly bonded to each other, to the electrical plant and equipment and to earth.

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

## i. RADIO AND TV INTERFERENCE

An electrical installation shall comply with Government and Local Government Laws and Regulations in respect of radio and television interference suppression. Interference suppression components shall not be used in any part of the circuit in such a way that their failure might cause an unsafe condition.

## j. EARTH LEAKAGE PROTECTION

All general purpose power outlets and switched socket outlets shall be protected by an earth leakage unit. Earth leakage protection shall be of the current-balance type. A static tripping arrangement, either a magnetic or a solid-state amplifier of simple design, shall be used.

The relay shall have sensitivity, such that immediate tripping will result from a total leakage of between 15 m A and 20 m A.

The relay shall have an integral tripping facility and shall also be temperature-compensated.

The relay shall stand up to high values of earth-fault current without damage to the tripping arrangement.

The relay shall be of an approved type to SANS 767 and shall bear the SABS mark.

## k. TESTING

The following tests will be carried out on the installation in the presence of the design engineer or his representative.

- Insulation resistance test using 500 volt insulation tester (Megohm-meter);
- Earth continuity test;
- Test for correct direction applied to every motor;
- Earth resistance test;
- Prove the correct connection and rotation of any energy meters;
- Settings of all overload and other adjustable protective devices shall be set to the requirements of the equipment.

## l. DRAWINGS AND INSTRUCTION BOOKS

The mechanical contractor shall supply the following information:

- Plant room layout drawings showing the main items of equipment as well as all cable and wiring runs;
- Switchboard and control board outline and equipment layout drawings and details of manufacturing;
- Single line and wiring diagrams detailing all control, metering and indication circuits;
- Instruction and maintenance books for all major items or equipment.

## m. ELECTRICAL SUPPLY

The electricity supply to VRS outdoor units shall be 400V, 50 Hertz, 3 phase plus neutral.

The electricity supply to VR indoor units shall be 220V, 50 Hertz, 1 phase. All equipment

The electricity supply is existing installed by others terminating in existing isolators or the distribution board for the plant room.