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**PROJECT DESCRIPTION: IZIKO MUSEUMS AIR COMPRESSOR SERVICE  
AND REPAIR**

**IZIKO MUSEUMS OF SOUTH AFRICA – SOUTH AFRICAN MUSEUM**

**2x AIR COMPRESSOR SERVICE & ALTERATIONS**

**RFQ SCOPE OF WORK, SPECIFICATIONS**

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## GENERAL NOTES TO TENDERERS

### INTRODUCTION

The Client, Iziko Museums of South Africa, hereon referred to as the Employer, requires a full major service and repair to the existing compressed air installation installed at their premises in the South African Museums. An option is allowed to either replace one compressor (if existing one is faulty) or add another one. The existing electrical distribution board to be replaced entirely.

### TERMS AND DEFINITIONS

In interpreting this specification, the following words shall have the meaning herein assigned to them unless there is something in the subject matter or context inconsistent with such construction.

**“Shall”** is mandatory.

**“Should”** is strongly recommended.

**“TIP”** or **“Tie-In Point”** is a connection to an existing system that should not require a plant shutdown or significant isolation to make the connection.

## GENERAL INFORMATION

The contractor shall service, test, and commission the Air Compressor Plant, described herein.

## SCOPE OF WORK AND SUMMARY OF THE REQUIREMENTS OF THE CONTRACT

### GENERAL

The Contract consists of the repair, modification, testing, commissioning, maintenance, and guarantee for the specified period, of the complete air compressor installation as described in this specification.

### Scope of Work: Air Compressor System Maintenance and Re-Commissioning

The scope of work encompasses the comprehensive servicing, testing, and re-commissioning of the existing air compressors and auxiliary equipment. The specific details are outlined below:

#### Existing System:

##### **Compressors:**

- 2 x CECCATO CSA15/8 G2 compressors (2019)

##### **Receiver:**

- 1 x Ingersoll Rand 504m<sup>3</sup> receiver (1985)

##### **Aftercooler:**

- 1 x Hiross aftercooler (1984)

##### **Air Dryer:**

- 1 x Quincy air dryer qpn21 9 (2019)

##### **Electrical DB**

- 1 x existing DB (to be replaced)

### Phase 1: Scope of Works

#### **a) Major Service Compressor 1:**

- Perform a major service according to OEM specifications for the CECCATO CSA15/8 G2 compressor.
- Test and recommission.

#### **b) Major Service Compressor 2:**

- Conduct a major service according to OEM specifications for the nonoperational CECCATO CSA15/8 G2 compressor.
  - Service provider to provide repair cost estimation post-service.
- c) Receiver:**
- Test the air receiver and associated safety equipment in compliance with SANS 347.
- d) Aftercooler:**
- Perform major services and repairs as per OEM specifications for the Hiross aftercooler.
- e) Air Dryer:**
- Conduct major services and repairs as per OEM specifications for the Quincy air dryer qp21 9.
- f) Electrical DB:**
- Disconnect and remove existing DB and replace with complete new and modern one.

## Phase 2: Scope of Works

- a) Major Service Compressor 2:**
- Repair compressor as per detailed quote approved from phase 1
  - Test and recommission.
- b) Controller:**
- Configure the controller to alternate between compressors 1 and 2 with a lead-lag configuration.

## Phase 3: Scope of Works

- a) Supply and install.**
- 1 x CECCATO CSA15/8 G2 compressor.
    - Including stand
    - Connections
    - Controls
    - Safety valves
  - Dia 800mm header with
    - 2 x connections to the receiver
    - 3 x connections to the compressors
    - 1 x 100mm analog pressure gauge
    - 1 x safety valve
    - 1 x drain point.
    - 5 x Isolation valves
    - 1 x 80mm ball valve
    - Brackets and fittings
    - 2 x 15mm testing points.
  - Test and recommission.
- b) Controller:**
- Configure the controller to alternate between compressors 1, 2 and 3 with a lead-lag configuration.
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## SCOPE INCLUSIONS

Included in the above Scope of Work are the following:

- a) Supply of “as built” drawings.
- b) Supply of all necessary certifications.
- c) Packing and shipping of all equipment to site.
- d) Submission of procurement, manufacturing, and delivery program.
- e) All inspection and testing as required including all necessary testing equipment such as bolts, gaskets, hoses, flanges, plugs, test pumps and gauges etc.
- f) Painting of equipment in accordance with the Specifications.
- g) All safety equipment (guards and locking facilities etc as applicable).
- h) Supply of 3<sup>rd</sup> party inspection and non-destructive testing as required; and
- i) Hot and Cold Commissioning.

## SCOPE EXCLUSIONS

Excluded from this scope of work are the following:

- a) Civil works.

## TERMINAL POINTS

- a) Existing Distribution board (to be replaced).
- b) Existing Air Receiver.

## VISIT TO SITE

Tenderers must acquaint themselves with local site conditions such as access to the building, area available on site, type of ground, space available for on-site fabrication, storage, transport, loading and unloading facilities, scaffolding, tackles, and tools needed, as no claims by the Contractor, which may arise from ignorance of the site conditions, will be considered.

## MATERIAL AND WORKMANSHIP

The Contract works shall be executed in accordance with the specified standards and level of workmanship, to the satisfaction of the Engineer.

All materials shall be of the quality specified and the Contractor shall, upon request of the Engineer, furnish him with proof to his satisfaction that the materials are of the specified quality.

All materials and equipment used for the Installations shall be new and undamaged.

The Contractor shall, if requested by the Engineer, provide samples of material and equipment for approval. If judged necessary by the Engineer, such samples, may only be returned after the completion of the Installation, to ensure that the quality of the installed product is the same as that of the approved sample.

## REFERENCE SPECIFICATIONS AND STANDARDS

The latest revision of any Specification referred to in this Specification will be applicable.

Where a Specification or standard is not specifically referred to, it will be assumed that the relevant SANS, ISO, BS, DIN or equivalent American standard, listed in order of preference will apply.

The SI ("Le Systeme International d' Unites") - Metric System of Units will apply. Refer to SABS - M33A: The International Metric System: Guide to the use of the SI in South Africa.

### Applicable Standards

- a) SANS 10142: The wiring of premises
- b) The Occupational Health and Safety Act of 1993 (OHS Act).
- c) SANS 10103: The measurement and rating of environmental noise with respect to annoyance and to speech communication.
- d) SANS 121: Hot dip galvanized coatings on fabricated iron and steel articles: Specifications and test methods.
- e) SANS 1473-1: Low-voltage switchgear and control gear assemblies.
- f) Relevant by-laws of local or other authorities.

The following will generally apply where particularly pertinent:

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<b>Standard</b>	<b>Abbreviation</b>
American National Standards Institute	ANSI
American Petroleum Institute	API
American Society of Mechanical Engineers	ASME
British Standards	BS
European Standards	EN
German Institute for Standardization	DIN
International Standards Organisation	ISO
International Electrotechnical Commission	IEC
Eurocodes	EC
International Organization for Standardization	ISO

Note: National and International Standards must be adhered to as a minimum requirement. The Supplier may propose equivalent acceptable standards however these must be specified.

## **VARIATION TO STANDARDISED SPECIFICATIONS**

Should any requirements of the project specifications conflict with any requirements of the standardized specification, the requirements of the standardized specifications shall prevail.

## **SCHEDULE OF RATES**

Rates indicated in the Schedule of Quantities shall, where applicable, include material, cutting and waste, patterns, models and templates, labour, supervision, duty and taxes, marking, transport, delivery, unloading, storing, unpacking, hoisting, labour, setting and fixing in position, temporary works, return of packings, tools, provision of Contractor's equipment and consumables necessary for the complete installation.

## **DRAWINGS**

### **Contractor's Drawings**

The Contractor shall supply to the Engineer four (4) copies of marked up structural or other drawings showing any changes and/or additional requirements to be made in the structure in order to meet the dimensional requirements of the equipment and materials to be installed by him. These builder's work drawings shall be supplied to the Engineer within four (4) weeks after notification by the Engineer that his tender was successful.

The Contractor shall supply four (4) copies of each detail design drawing for approval. The Contractor shall allow the Engineer three (3) weeks for drawing approval. After a marked up copy with all the Engineer's' comments have been returned, the Contractor shall update the original which shall then be submitted to the Engineer for signature. This will ensure that all prints used for construction will be certified as approved.

Four (4) copies of the certified drawing shall be issued to the Engineer for distribution.

The Contractor will be required to produce the following detail design drawings:

- a) Builder's Work Drawings
- b) Mechanical Drawings
  - i. These are all Workshop and Equipment Layout Drawings required for the manufacture and erection of the Installations.
- c) Instrumentation Drawings, such as:
  - i. Schematic Control Diagrams.
  - ii. Pneumatic Pipe Layout Drawings giving all terminal numbers.
  - iii. General Arrangement Drawing of Control Board,
  - iv. Alarm panels.
  - v. Manifold details.
- d) Electrical Power Drawings, such as:
  - i. General Arrangement Drawing of Switchboard.
  - ii. Circuit Diagrams and interconnecting diagram giving cable schedules with numbers and sizes corresponding with the circuit diagrams and interconnection diagram.

Unless otherwise specified, cable routes shall be superimposed on the Mechanical Layout Drawings, showing the runs and fixing details.

Any work done by the Contractor without an approved signed drawing, will be at the risk of the Contractor.

The Contractor shall update all drawings ("as built drawings") once the Installation has been completed. Four (4) sets of paper prints and one (1) set of sepia copies shall be supplied to the Engineer as part of the O & M Manual. An additional electronic copy of O & M Manuals and as built drawings shall be provided to the Engineer.

## Progress Drawings

The Contractor shall arrange for a full set of white prints of installation drawings to be kept on the site showing the progress of all work in connection with this Contract. Such prints shall be kept up to date.

The progress drawings shall be available for inspection at any time by the Client or Engineer or any other authorized person.

The Contractor shall include for his representative to keep a diary recording the progress of the works and details of all instructions received. The diary shall be at the disposal of the Engineer as and when required.

## Equipment Drawings

The Contractor shall provide the Engineer with working drawings of all items of equipment, with a detail technical specification of the equipment, for approval, before placing an order for the equipment.

## Health And Safety

The Contractor shall comply with the Health and Safety Regulations as issued by Iziko Museums.



## OPERATING AND MAINTENANCE MANUAL

The Contractor shall, at his cost, prepare and supply manuals for the successful operation and maintenance of the Installation.

Six weeks prior to the commencement of commissioning, the Contractor shall supply a draft of the manual to the Engineer for approval.

Two weeks after commissioning, the Contractor shall supply four (4) additional manuals that have been updated and include all commissioning data, CoC's, and "as built" drawings.

The Contractor shall supply an electronic copy of all O & Manuals, as built drawings, commissioning data, and CoC's.

These manuals shall contain the following information:

### **INDEX OF CONTENTS**

#### **SECTION 1: SYSTEM DESCRIPTION**

A comprehensive description of the Installation

#### **SECTION 2: OPERATING INSTRUCTIONS**

- 2.1 Starting and stopping instructions.
- 2.2 Prestart checks.
- 2.3 Equipment running checks.

#### **SECTION 3: MECHANICAL EQUIPMENT**

The following information shall be provided in full for each item of equipment:

- 3.1 General information  
Description, Make, Model Number, Name, and Address of Supplier, Manufacturer, etc.
- 3.2 Design information  
Design Data Sheet containing all design and selection parameters, calculations, selection curves, etc.
- 3.3 Settings and values recorded during commissioning.
- 3.4 Manufacturer's Brochures and Pamphlets.
- 3.5 Maintenance data and Schedules

The lapse of time between services and the description of the service required for each part, lubrication requirements, etc.

### 3.6 Schedule of Spares

## **SECTION 4: ELECTRICAL EQUIPMENT**

The following information shall be provided for all electrical equipment whether in a switchboard or field mounted.

4.1 A complete Electrical Equipment Schedule  
Description, Make, Model Number, Rating and other Design Criteria, Commissioned Setting, Name, and address of Supplier.

4.2 Maintenance information.

4.3 Manufacturers Brochures and Pamphlets.

## **SECTION 5: INSTRUMENTATION AND CONTROL**

5.1 Detail description of the operation of the electrical and control systems.

5.2 Design information.

5.3 Manufacturers Brochures and Pamphlets.

5.4 Settings and values recorded during commissioning.

5.5 Maintenance data and schedules.

## **SECTION 6: DRAWINGS**

Paper prints or reduced size prints and electronic copies of all Contractor's drawings (Clause 8.4) updated to "as built" drawings.

## **INSPECTIONS AND TESTING**

### **Inspections (Part III, SAACE - 1978)**

The Engineer shall have general supervision and direction of the Contract Works. Supervision shall comprise such periodic visits as the Engineer may consider necessary to inspect the Contract Works for conformity with the Contract documentation and to provide clarification and further information as necessary.

The Engineer shall have the power at any time to inspect and examine any part of the Contract Works or any materials intended for use in or on the Contract Works, either on the site or at any factory, workshop or other place where such parts or materials are being constructed or manufactured or at any place where same are lying or from where they are being obtained, and the Contractor shall give all such facilities as the Engineer may reasonably require to be given for such inspection and examination.

The Contractor shall not be liable for the cost of inspecting materials at the place of manufacture, construction or storage nor be responsible for any travelling or accommodation costs arising out of the execution of such inspection etc.

## Testing

The Contractor shall supply all test equipment, test facilities and everything necessary, at his cost, to perform these tests. The minimum testing and commissioning equipment that is required, is as follows:

- a) Pitot tube and manometer.
- b) Hot wire anemometer.
- c) Crane type manometer for balancing valves.
- d) Thermometer for insertion into pipe and duct pockets alongside temperature detectors.
- e) Noise meter with octave band analyser.
- f) Sling psychrometer.  
Revolution counter suitable for measuring fan and motor shaft rotation.
- g) Megger equipment.
- h) Clamp on ammeter.
- i) Voltmeter.
- j) Power factor meter.
- k) Ohmmeter suitable for continuity testing.
- l) LED type ON/OFF test lamp.
- m) Maximum indicating ammeter suitable for measuring peak motor starting currents.

The Contractor shall record all measurements taken during testing and shall do the necessary adjustments until the Engineer is satisfied with the results.

The Engineer shall be notified one (1) week in advance of any tests so that he may witness such tests.

Unless otherwise specified, the Contractor will be required to perform the following tests:

### Electrical Switchboards

- a) The existing distribution board to be replaced and be tested in the factory to ensure the correct operation of equipment, controls, interlocks and measuring circuits.
- b) A Certificate of Compliance to be issued after completion of the works.

### Piping

Pressure test of all piping at a test pressure of 1,5 times the maximum working pressure at the lowest point in the system, but not less than 700kPa. All instrumentation or other equipment which could be damaged during the pressure test, shall be removed from the pipe systems. The relevant system shall be filled with water and all high points shall be vented at least 24 hours before the test. The duration of the pressure test shall be 24 hours, after which no water leaks shall be visible, and no pressure drop shall occur after corrections have been made for changes in ambient temperature during the test period.

Pressure tests shall be completed in sections, which adhere to the schedule as specified in this specification, prior to insulating or covering piping.

If leaks are found, welded connections shall be cut out and re-welded and screwed joints shall be dismantled, cleaned, and reconnected. Rectified piping shall be retested.

### Pressure Vessels

Refer to the requirements set out in the Occupational Health and Safety Act of 1993.

## COMMISSIONING AND HANDING OVER

### Procedure

#### Physical Completion

After physical completion of the erection phase of the Installations, the Engineer will issue a Snags List certifying that commissioning can proceed. Items which would not influence the commissioning process could, at the discretion of the Engineer, be attended to during commissioning stage.

### Commissioning Stage

After commissioning the Engineer will issue a second Snags List (the Commissioning Snags List). Any outstanding work will be recorded on this List.

### Engineer's Certificate

After completion of all outstanding items and receipt of all manuals and drawings as recorded on the Commissioning Snags List, the Engineer will issue an Engineer's Certificate. This certificate will accompany a certificate of acceptance by the Client's representative. The one-year maintenance and guarantee period will commence on the date of the Engineer's Certificate.

## Commissioning

The Contractor shall commission the Installation in terms of the following codes, or any other code approved by the Engineer:

Air Distribution Systems:

SABS 0173 - 1980: Code of Practice for the Installation, Testing and Balancing of Air Conditioning Ductwork.

Refrigeration Systems:

CIBS: Commissioning Code: Series R: Refrigeration Systems.

Control System:

CIBS: Commissioning Code: Series C: Automatic Controls.

Water Distribution Systems:

CIBS: Commissioning Code: Series W: Water Distribution Systems.

The Contractor shall submit a commissioning programme to the Engineer, at least four (4) weeks prior to the commencement of commissioning.

The power connections to the various installed equipment must be energized to facilitate commissioning of the installation. The Contractor is to liaise timeously, with the Electrical Contractor responsible for the new installation, to ensure that power will be available when required to avoid delays to the Mechanical Installation Programme.

To enable this switch-on to take place the Mechanical installation must be substantially complete.

The Contractor shall inform the Engineer within (4) weeks of his appointment, what time allocation has been allowed for commissioning purposes. This must be reflected on the Critical Path Schedule to be submitted by the Contractor.

## Handing over Procedures

The Contractor shall provide a suitably qualified and trained person to train the Employer's staff in the correct operation and maintenance of the Installation. The Contractor shall allow for this person to be full time on site for a period of three (3) days immediately after the handover date.

## MAINTENANCE DURING THE GUARANTEE PERIOD

During the guarantee period the Contractor shall be fully responsible for complete maintenance of the Installation. The guarantee period on material, equipment and labour performed commences on the date when the Engineer's Certificate and the Clients Certificate of Acceptance is issued and expires one calendar year later.

Maintenance of the Installation shall mean the regular servicing, lubrication, repairing, cleaning and adjustment of the Installation as well as the free of charge replacement of any defective components during the guarantee period.

A suitably qualified and trained person shall check and ensure the correct and proper operation of the plant once a month and shall also perform all necessary maintenance tasks to ensure smooth and faultless operation. Emergency calls shall be immediately attended to.

A Logbook shall be kept in the Chiller Plantroom. Details of each service and all repairs shall be recorded in this Logbook with meticulous care. The Logbook shall at all times be put at the disposal of the Engineer.

## STATUTORY AND REGULATORY REQUIREMENTS

The Installations shall be designed, erected, commissioned, and maintained in compliance with the following appropriate regulations as specified in the Standard Technical Specification.

In addition, the Contractor shall exempt the Employer from all losses, costs or expenditures which may arise as a result of the Contractor's

negligence to comply with the requirements of the regulations enumerated in this Clause.

It shall be assumed that the Contractor is conversant with the abovementioned requirements. Should any requirement, by-law or regulation, which contradicts the requirements of this Document, apply or become applicable during erection of the Installation, such requirements, by-law or regulation shall overrule this Document and the Contractor shall immediately inform the Engineer of such a contradiction.

Under no circumstances shall the Contractor carry out any variations to the Installations in terms of such contradictions without obtaining the written permission to do so from the Engineer.

## Arrangements with the Supply Authority

It shall be the responsibility of the Contractor to make the necessary arrangements at his own cost with any Statutory Authority, and to supply the labour, equipment, and means to inspect, test, commission, and hand over the Installation.

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

## Layout of Plant

The various plant shall comply in capacity and general layout with the details given in the specification and drawings. Should the Contractor offer equipment at variance with these requirements, full details and calculations and the supporting reasons therefore shall be given.

The general layout may be altered or modified to suit the Contractor's equipment, but a sketch showing the intended layout submitted to the Engineer before the tender is awarded.

Dimensions shown on the Drawings are sufficiently accurate for tendering purposes, but before construction of the plant is commenced, these dimensions together with all structural members etc., must be verified on site and the plant constructed accordingly. If the Contractor requires alterations to the structure these must be described timeously so as not to affect the construction programme. Minor structural alterations which might facilitate the work can be arranged with the Engineer and/or Architect as the work progresses, but no claims will be entertained for alterations to plant, etc.

constructed before the necessary dimensions and details had been verified.

The Contractor must ensure that his plant selection is suitable for the plantroom dimensions.

## ALTERNATIVE EQUIPMENT

The words "similar or equal to", are implied wherever specific descriptions of equipment is provided.

In the case of specific product names being provided in schedules, implies that such equipment was selected for design purposes only.

Tenderers may offer alternative equipment with the understanding that such alternative offers are "similar and equal to" the selected equipment (in quality and performance) on which the design was based.

The Engineer shall reserve the right, on behalf of the client, to decide whether such equipment is acceptable or not. Subject to a tender being accepted with such alternatives, approval must be obtained from the Engineer for such alternatives prior to the Contractor placing orders for the equipment.

## REQUEST BY ENGINEER FOR CHANGES

When a variation becomes necessary, the Engineer shall notify the Contractor in writing, setting out the scope and nature of the proposed variation.

The Contractor shall then determine what cost variation, if any, is involved, giving due consideration to any material already prepared or work already done which would require alterations.

Variation in cost shall be in accordance with rates set out in the Contract where these are applicable. A price breakdown is to accompany the variation quotation submitted.

Within seven (7) days of receipt of the Engineer's request for variation, the Contractor shall inform him of the price adjustment attributable to the proposed variation. If it is decided that the work shall proceed, the Engineer will then issue a Variation Order to the Contractor, authorizing him to carry out the variation.

If the Contractor should fail to notify the Engineer within seven (7) days that there will be a cost increment associated with the proposed



variation, it will be assumed in default that no cost variation is applicable.

If the carrying out of any variation instructed by the Engineer would, in the opinion of the Contractor, prevent him from fulfilling any of his obligations under the Contract, including the timely completion of the Contract, he shall notify the Engineer in writing without delay, and shall submit computations or other evidence in support of his opinion.

The Engineer should then decide whether or not the variation is to be carried out. If the Engineer confirms his instructions to carry out the variation, the Contractor shall be held relieved of his obligation under the Contract insofar as they are affected by the required variation. The Engineer's decision as to the validity of the Contractor's claim is however final.

## PAINTING

### General

Unless otherwise specified the Contractor will be responsible for the painting of the complete Installation.

The metal fan enclosures may be provided pre-painted in terms of the required stated specifications of manufacturers and/or supplies of such equipment.

The Contractor shall be responsible for the painting of all pipework, ductwork, and hangers in accordance with this specification.

### Identification Colour Marking (Where applicable)

The installation shall be painted in accordance with the following colour coding unless the Engineer issues an instruction to deviate from the specified coding.

Before commencing with painting, the Contractor shall obtain confirmation from the Engineer that the given coding is applicable to the specific Installation.

Services which are not listed in the schedule below, shall be identified in accordance with SANS 10140: Identification Colour Marking: Part I - General: Part III - Contents of Pipelines.

Identification Colour Marking shall be in accordance with SANS 10140.

Colours referred to are in terms of SANS 1091: National Colour Standard for Paint.

## Application

All surface to be painted shall be clean and dry and shall be free from oil or grease.

The cleaning and preparation of surfaces, the application and type of undercoats and paints, shall be in accordance with the prescriptions and specifications, applicable to the specific material and surface, of an approved paint manufacturer and of this section of the specification which shall take priority.

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

ITEM	BASIC COLOUR	COLOUR NO. TO SANS 1091	COLOUR CODE INDICATOR	COLOUR NO. TO SANS 1091	COMMENTS
1. <b>PIPING</b>					Colours and Colour Marking shall generally be in accordance with SABS 0140: Part III 1978
1.1 <b>Water Pipes</b>					
1.1.1 <u>Domestic</u>					
Cold Water	Brilliant Green	H10	Cornflower	F29	
Hot Water	Brilliant Green	H10	Crimson + Cornflower	A03 F29	
1.1.2 Distilled Water	Brilliant Green	H10	Crimson + White + Crimson	A03 A03	
1.1.3 Demineralized Water	Brilliant Green	H10	White		
1.1.4 Chilled Water	Brilliant Green	H10	Golden Yellow + Ultramarine	B49 F09	
1.1.5 Condenser Water	Brilliant Green	H10	Golden Yellow + Golden Brown	B49 B13	Galvanised piping shall remain unpainted unless the external zinc layer has, according to Engineer, been damaged.
1.1.6 Hot Water	Brilliant Green	H10	Golden Yellow + Crimson	B49 A03	
1.1.7 Drain Water	Black	-	-	-	
1.1.8 Hose Reel and Hydrant Water	Signal Red	All	Canary Yellow	C61	
1.1.9 Sprinkler Water	Signal Red	All	Numbers of Control valves on distribution	C61	Numbers shall be marked every 6 metres
1.2 <u>Air Pipes</u>					
1.2.1 Compressed	Arctic Blue	F28	-	-	Copper pipes shall not be painted
1.2.2 Instrument	Arctic Blue	F28	Salmon Pink	A40	
1.2.3 Vacuum	Arctic Blue	F28	Primrose	C67	
1.3 <u>Steam Pipes</u>					

ITEM		BASIC COLOUR	COLOUR NO. TO SANS 1091	COLOUR CODE INDICATOR	COLOUR NO. TO SANS 1091	COMMENTS
1.3.1	Diesel Fuel	Golden Brown	B13	White	-	Stainless Steel, Aluminium or Galvanised insulation covering shall not be painted
1.3.2	Hydraulic Power	Golden Brown	B13	Salmon Pink	A40	
1.3.3	Lubricating	Golden Brown	B13	Verdigris Green	E22	
1.3.4	Transformer	Golden Brown	B13	Crimson	A03	
1.4	<u>Steam Pipes</u>					
1.4.1	Steam	Pastel Grey	G54	-	-	
1.4.2	Condensate	Brilliant Green	H10	Pastel Grey	G54	
2. AIR HANDLING EQUIPMENT						
2.1	Fans	Cornflower	F29	-	-	Only the external surface of plenums manufactured from galvanised sheet metal, need to be painted
2.2	Air handling units and plenums	Cornflower	F29	-	-	
2.3	Air Ducts			Identification and coding shall be in terms of SABS 0173-1980		
2.3.1	Internally insulated galvanised Sheetmetal ducts	-	-	-	-	To architects' specification
2.3.2	Externally insulated ducts	-	-	-	-	To architects' specification
2.3.3	Aluminium ducts	-	-	-	-	To architects' specification
2.3.4	Stainless Steel	-	-	-	-	To architects' specification
2.3.5	P.V.C.	-	-	-	-	To architects' specification
3. ELECTRICAL EQUIPMENT						
3.1	Switchboards		B20	-	-	SABS 074 – 1961

ITEM	BASIC COLOUR	COLOUR NO. TO SANS 1091	COLOUR CODE INDICATOR	COLOUR NO. TO SANS 1091	COMMENTS
	Black Frame with Flag Orange Panels				
3.2 Electrical Heater Boxes	Flag Orange	B20	-	-	
3.3 Cable Trays and Cable Channels	Flag Orange	B20	-	-	Galvanised sheet metal trays and channels shall be painted
4. <b>GENERAL</b>					
4.1 Bases and plinths	Black	-	-	-	Approval of standard colours of equipment shall be obtained from Engineer prior to ordering. If the painting is found to be damaged during the final inspection, the sub-contractor shall repaint the equipment in accordance with the prescriptions of the Manufacturer and to the approval of the Engineer
4.2 Equipment	-	-	-	-	
4.3 Safety Guards	Flag Orange	B20	-	-	To NOSA requirements
4.4 Refrigeration Piping (Copper)	Unpainted	-	-	-	

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

The Contractor shall adequately protect the painted surfaces of all equipment which have been pre-painted in the factory since such equipment will have to be repainted in total if the Engineer is not satisfied with the paint surfaces during the final inspection.

Before any painting is applied, the surfaces shall be prepared according to SANS 10064 Code for Preparation of Steel Surfaces for Painting.

All galvanised surfaces shall be thoroughly degreased. In the case where detergent is used, the surface shall be well rinsed and dried. It shall then be painted with one coat of wash primer (self-etch primer) to SANS 996. When dry, the surface shall be painted with one undercoat to SANS 681, Type 11 and one coat high gloss enamel paint to SABS 630m, Grade 1 as topcoat.

Exposed and unlagged galvanised piping shall be painted with one coat wash primer (self-etch primer) to SANS 996 followed by one undercoat to SANS 681, Type 11 and one coat high gloss enamel paint to SANS 630, Grade 1 as topcoat.

Unlagged black piping, flat iron, angle iron, rods etc. for supports, brackets, frames, duct stiffeners etc., shall be painted on all sides with a zinc chromate primer to SANS 679 type 1, followed by two coats of enamel paint to SANS 630, Grade 1.

## NOISE AND VIBRATION

### Vibration Isolation

#### General

All equipment creating vibrations shall be installed on vibration damping mountings to prevent transmission of vibrations to the surrounding structure.

The method of installation and the number of mountings required shall be strictly in accordance with the manufacturer's instructions.

Mechanical equipment, piping, etc. shall be mounted on or suspended from approved and specified foundations or supports. Floor mounted equipment shall be erected on a 100mm high reinforced concrete base or as detailed on the drawings. Where vibration isolation equipment is used, the bases shall be extended to support the isolation system.

All vibration isolation systems exposed to a corrosive environment shall be weatherproofed all steel parts shall be hot-dip galvanised, and olts shall be cadmium plated and all springs shall be cadmium plated and NEOPRENE - coated.

#### Double deflection "Neoprene"-in-Shear Mountings

Double deflection NEOPRENE- in shear mountings shall have a minimum static deflection of 10mm. The mountings shall each consist of a steel top plate and base plate completely embedded in coded NEOPRENE for easy identification of rated load capacity. The mountings shall be moulded with a non- skid ribbed construction on the top plate and base plate. All mountings shall be equipped with bolt holes in the base plate and tapped holes in the top plate so that may be bolted to the floor and the equipment.

#### Steel Spring Mountings

Steel spring vibration mountings shall consist of cast telescopic housing containing one or more steel springs of 50mm minimum diameter as the isolation medium. They shall have built-in levelling

bolts, resilient inserts to act as guides for the upper and lower housings and shall incorporate 6mm thick ribbed NEOPRENE - acoustical pads bonded to the top and bottom. All mountings shall have bolt holes in the base plate. Horizontal and vertical spring constants shall be equal to ensure mounting stability. All mountings shall have an additional 50% capacity beyond the rated load. Mountings used on equipment likely to undergo mass changes (i.e., cooling towers or boilers when being drained) shall incorporate a resilient vertical limit stop to prevent spring extension. A minimum clearance of 12mm shall be maintained between the steel springs and the limit stop housings, and around the restraining bolts so as not to interfere with normal spring performance.

### Steel Spring Hangers

Steel spring hangers shall consist of a steel spring in combination with a NEOPRENE-in-shear element.

The minimum total deflection shall be 32mm.

### Double Deflection "NEOPRENE"-in-Shear Hangers

Double deflection NEOPRENE-in-shear hangers shall have a minimum static deflection of 10mm. The elements shall be of moulded 'neoprene' and shall be coded for easy identification of rated load capacity.

### Type of mountings for various types of equipment

The following types of vibration mountings shall be used for various types of equipment. For each mounting the static deflection shall be based on the equipment and its location in the building and shall be in accordance with the manufacturer's instructions.

EQUIPMENT	VIBRATION MOUNTING
Close coupled pumps of less than 7,5 kW located in the basement.	Double deflection >neoprene= - in-shear mountings.
All pumps larger than 7,5 kW in the plant rooms and all pumps in locations other than the plant rooms.	Framed concrete base with steel spring mountings under concrete base. Minimum static deflection 20mm.
Floor mounted packaged air handling units.	Double deflection >neoprene= - in-shear mountings.
Air Compressors	Structural steel rails with steel spring mountings and limit stops. Minimum static deflection 25mm.

Flexible connectors shall be installed at the suction and discharge sides of all pumps or other equipment that may generate vibrations.



# Detailed Specification

## AIR CONDITIONING AND VENTILATION DUCTING

### Air Compressor

Each new compressor shall achieve the following design parameters.

Compressor System Operating Conditions	
Design Parameters	Design Values
Maximum pressure required	10 bar (g)
Total Air Demand(For each compressor)	107.4 m <sup>3</sup> /hr (Free Air Delivery)
Inlet compressor temperature for design	35°C.

The Supplier shall design and provide a complete system capable of achieving the required capacity at the specified design parameters.

The air compressor shall be an air-cooled, oil-free rotary screw air compressor. The compressor shall be supplied with the following features, as a minimum:

- a. Integrated Electronic Controller to manage, control and regulate all operations of the compressor;
- b. Cleanable air inlet filter/s;
- c. Air intake valve;
- d. Pre-mounted electrical cubicles;
- e. Integrated Compressed air aftercooler;
- f. Integrated oil separator(3 phase system- Centrifugal, Gravitational and coalescent);
- g. Integrated safety valve/s;
- h. Integrated water separator;
- i. Vibration dampers;
- j. Seals such as lip seal;
- k. Fittings;
- l. Compressors to be arranged/set-up in a lead and lag operational arrangement;
- m. Holding down bolts, anchors, studs or any other retaining devices;
- n. A control system;
- o. Full load and No-load regulation system;
- p. Complete air circuit piping.

## PIPING

### General

Water piping systems shall follow the routes indicated on the relevant Drawings. Piping shall be arranged to maintain sufficient headroom, keep access ways unobstructed and not interfere with maintenance and adjustment of valves and equipment.

Automatically operated air release valves will be installed at the top end of all risers as well as other high points to release any air in the system to prevent air locks.

Where pipe sizes are not indicated on drawings or specifications, the following maximum velocities shall be used:

- 7-10 m/s for all piping

All pipe work shall be routed and installed to consider expansion and contraction. All the pipe systems will be properly flushed, cleaned, pressure tested and sterilised on completion of the installation.

Steel piping shall have a minimum thickness equal to heavy grade to SANS 62-1:2003 and SANS 61-2:2009.

Piping for closed circuit water systems shall, be of galvanised type with threaded joints.

Threaded fittings shall be malleable iron to B.S.S. 143 or SANS 14:1994/ISO 49:1994, or wrought steel to B.S.S. 1740:1 971, as relevant. Welded fittings shall be genuine butt-weld fittings, to ASTM A234 GR.WPB Dimensions to BS1640 or ASA B16.9. Welding of threaded fittings is not permitted.

Copper earthing straps shall be fitted over all flexible connections and shall be carried out in accordance with the standard wiring regulations.

Pipe joints shall be neatly made, all pipe cuts properly cleaned and reamed. At all connections to equipment use flanged joints to conical face unions for smaller pipe sizes up to 40 mm nominal bore. Incorporate sufficient flanged joints or unions to allow dismantling of sections of pipework to facilitate access to plant items for maintenance purposes. Use screwed joints on galvanised pipework up to, and including, 100 mm nominal size. Where galvanised piping is called for above 100 mm diameter, use black piping with welded joints, all hot-dip galvanised after welding.

Screwed joints on piping up to 25 mm diameter shall utilise P.T.F.E. jointing tape equal to 3-M manufacture. For larger joints use Hemp

and Stag, or equivalent jointing compound. Flanged joints shall include Klingerite gaskets or equivalent. Caulking of joints will not be permitted.

Plug open ends of piping, drains, fittings and equipment connections during installation to keep systems free of rubble, dirt and other foreign matter.

Maximum support spacing for pipework shall be:

- 50 mm diameter and smaller - 3 m
- 65 to 100 mm diameter - 4.5 m
- Above 100 mm diameter - 6 m

All piping systems shall be flushed out properly to ensure cleansing, prior to the operation of the plant.

Piping systems shall be tested by means of a hydraulic pump to twice the operating pressure of the system, or, where it is not permissible due to the maximum allowable piping working pressure, the piping shall be tested to the limit set by such maximum allowable working pressure.

## PAINTING AND CORROSION PROTECTION - SURFACE PREPARATION

### Mixing

The Bidder/Contractor shall ensure that all paints are mixed in accordance with the manufacturer's instructions.

In the case of two pack materials, the splitting of kits as supplied from the factory is not permitted. The Bidder/Contractor either has to make use of smaller kits or needs to plan the work in such a way that any unnecessary wastage of paint is avoided.

During application, containers shall be agitated often enough to keep pigments in suspension.

### Coating

All surfaces shall be coated as specified. Surfaces which do not require coating shall be suitably protected.

The primer coat shall be applied as soon as possible after the surface preparation operation and at least during the same shift as the blast

cleaning operation, but under no circumstances may the primer be applied over rust bloom or over surfaces that have changed colour due to humidity or other contamination.

Coating application and cleaning shall not take place when site conditions are likely to negatively affect these operations. The Bidder/Contractor shall ensure that the necessary protective equipment is used to prevent contamination of the coatings and to minimise delays due to such site conditions.

Successive coats shall be of distinctly different colour to the previous coat to ensure correct intercoat coverage. However, two finishing coats of the same colour may be applied to achieve complete colour uniformity. If required, zinc rich primers shall be tinted to provide a colour that contrasts with the abrasive blast cleaned substrate. Special attention shall be given to cracks, crevices and edges to ensure complete coverage and paint thickness. All finishing colours shall be as specified.

On pre-coated surfaces all traces of soluble salts and other corrosive airborne contaminants shall be removed with potable water and surfaces shall be allowed to dry prior to further paint application.

Concealed surfaces shall be completely coated. Suitable sponges may be used for application of coating to concealed surfaces or back to back angles. In the case where it is impractical to coat the concealed surface, the opening shall be sealed utilizing an approved mastic material.

All edges, corners, bolt holes, mouse holes, cut ends and weld beads shall be stripe coated by brush application, prior to the application of the intermediate coat. The stripe coating shall be an additional coat of the specified intermediate coat.

In order to assist in its identification, the stripe coat shall be a different colour to both the specified intermediate coat and finishing coat. Under no circumstances shall stripe coating be carried out by roller or spray-application.

The stripe coat is not intended to increase the overall specified dry film thickness of the system but to ensure that the minimum thicknesses required are actually achieved at edges.

## Application

Unless otherwise specified, all coatings applied in the shops or on Site shall be applied by airless spray techniques.

In instances where spray application is considered not to be possible, practical or feasible, this must be brought to the attention of the Engineer at the time of tendering.

The Bidder/Contractor should note that many of the high build coatings specified in the relevant systems are only capable of achieving their recommended film thicknesses by spray application. Other application methods such as brush and roller can result in lower film builds being achieved per coat necessitating additional applications to achieve the specified thicknesses. The Bidder/Contractor must take cognisance of this in his tender. If during the course of the project the Bidder/Contractor is instructed to change his method of application any labour cost implications must be brought to the attention of the Engineer before any such costs are incurred.

Unless otherwise specified, all application work shall be carried out in strict accordance with the recommendations and instructions given in the current Product Data Sheet supplied by the coating manufacturer. This includes required climatic conditions, methods of surface preparation, substrate temperatures, blast profiles, over coating times, curing times, application equipment and methods to be utilized and pertinent requirements not addressed in this specification. The Product Data Sheet shall be deemed to be part of this specification.

Prior to the application of any coating material, the selected manufacturer's Product Data Sheet for the material being used shall be obtained by the Bidder/Contractor. A copy of data sheet shall be signed by the coating manufacturer. This is to ensure that the latest product data sheet has been provided to the Bidder/Contractor, that the coating manufacturer is aware of the relevant coating specification and the conditions under which the material will be applied and to allow for technical back-up where required in support of the joint guarantee.

In the case of equipment manufacturer's proprietary finishes on items such as pumps, motors, valves etc., these systems may only be used if prior approval has been obtained from the Engineer.

All coatings shall be evenly applied to form a smooth, continuous, unbroken coating free from tears, runs, sags, wrinkles, blisters, mud-cracking, change in colour or gloss, orange peel, visible pin-holes, dirt, dust or fluff occlusions or any other visible defects. Each coat shall provide complete coverage.

Surfaces which rest on concrete or other floors shall receive the full coating system prior to erection.

The Bidder/Contractor shall take adequate precautions to protect areas being painted against contamination and fall-out from adjoining sections of the structure during painting operations, should this become necessary.

Coated steel to be embedded in concrete or soil shall be painted so that the coated areas extend at least 100mm into the concrete or soil, unless otherwise specified.

Where surfaces are to be welded, no paint shall be applied within 50mm of the weld and the subsequent intermediate and finishing coats (where applicable) shall be stepped at 25mm intervals to produce a feathered edge for patch repairs after welding. The steps may be achieved by using masking tape at the time of surface preparation and coating applications. The masking tape on the blast cleaned surface adjacent to the weld area shall be left in place to provide temporary protection until the welding is carried out.

The Bidder/Contractor shall apply the full painting system specified on the bearing surfaces of catwalks before the gratings or relevant floor sections are put in place.

## Ambient Conditions

Coatings shall not be applied under the following conditions:

- a) When the surface may become damaged by rain, air borne dust, chemical fall-out, fog or condensation. When it is anticipated that these conditions will prevail during the drying period, suitable enclosures shall be provided to protect the surfaces.
- b) When the ambient air temperature or the steel temperature is outside the coating manufacturer's recommended range.
- c) When the ambient relative humidity exceeds 85%.
- d) When the steel temperatures is less than 3°C above the dew point.

## Hot Dip Galvanizing

Hot dip galvanizing shall be heavy duty in accordance with the requirements of ISO 1461:1999.

Galvanized surfaces that are to receive duplex organic coatings shall not be passivated.

All repairs to hot dip galvanizing shall be carried out in strict accordance with the requirements of (ISO 1461:1999. The zinc rich paint used for site repairs to galvanizing shall contain a minimum of 80% zinc in the dry film in accordance with ISO 12944.

## Shop Painting

The Bidder/Contractor shall furnish the materials specified and ensure that they are applied in strict accordance with this specification.

The Bidder/Contractor shall be wholly responsible for surface preparation and coating application. The coated surfaces shall meet the minimum dry film thickness required by this specification.

Unless otherwise specified, the primer and intermediate coats are to be applied in the shops with finishing coats being applied on site after erection and repairs to the handling damage.

## Site Painting

The Bidder/Contractor shall furnish the materials specified and ensure that they are applied in strict accordance with this specification.

Unless otherwise specified, all finishing coats shall be applied on Site after erection.

The finishing coats being applied on site shall be sourced from the same manufacturer as the shop applied primer and intermediate coats.

If site re-spraying is necessary, labels and all other areas not to be painted shall be carefully masked. Any overspray which occurs despite this masking shall be removed by the Bidder/Contractor.

The shop applied coats must be thoroughly washed to remove all traces of dust, dirt, grease, salts or any other forms of surface contamination. Where deemed necessary, detergent cleaners, as recommended by the respective coating manufacturers, may be used.

After cleaning, all areas of damaged coating shall be patch repaired as detailed in above.

Where more than one coat is being applied on Site, washing as per shop cleaning shall be carried out between coats.

Where paint is allowed to age before the application of finishing coats, the coating manufacturer may require that the surface be prepared by light sanding, scrubbing with potable water using a bristle brush and drying before over-coating.

Field fabricated items shall be cleaned and coated as specified in the relevant coating system.

All coatings shall be given adequate time for curing prior to service. On average, for most organic coating systems, full cure is achieved after 7 days at 25°C providing good ventilation is maintained.

## PAINTING AND CORROSION PROTECTION – CORROSION PROTECTION SYSTEM

INSULATED PIPES/EQUIPMENT	
Environment	Atmospheric
Material	Mild steel
Temperature	60 to 200°C
Typical Applications	Insulated piping and vessels.
<b>Surface Preparation (Under Lagging):</b> Degrease with an approved solvent and rinse with clean water. Remove weld splatter and smooth weld seams and sharp edges. Wire brush and/or mechanically abrade surfaces to grade St 2 1/2 of ISO 8501- 1:1998. Ensure that surfaces are dry and free from dust and other contaminants.	
<b>Surface Preparation (Parts Protruding through Lagging):</b> Any part of a vessel that will protrude through the lagging (e.g. brackets, cleats, supports, pipe, nozzles, stiffeners etc.) shall receive the full surface preparation and coating system as described above. The preparation and coatings at these protrusions shall extend at least 200mm under lagging.	
<b>Paint System:</b> Primer – One coat of inorganic zinc silicate – DFT 50-75 microns. Top Coats – No over-coating of the primer is required for surfaces that will be covered by lagging.	

NON-INSULATED PIPEWORK/EQUIPMENT	
Environment	Atmospheric
Material	Mild steel
Temperature	Ambient to 80°C
Typical Applications	Piping, air handling units.
<b>Surface Preparation:</b> Degrease with an approved solvent and rinse with clean water. Remove rust and sharp edges. Abrasive blast to Sa 2.1/2 of the standard ISO 8501-1:1998. Blast profile 40-60 microns. Primer to be applied before any oxidation of the blast surface. Any oxidised surface shall be re-blasted.	
<b>Paint System:</b> Primer – One coat of inorganic zinc silicate – DFT 50-75 microns. Intermediate – One coat twin pack polyamide/epoxy – DFT 100-125 microns. Finishing – One coat of twin pack re-coatable urethane – DFT 50- 75 microns.	



## NUTS AND BOLTS

Where nuts and bolts are used, the following shall apply:

- For similar applications all bolts shall be of the same length.
- Not more than 5 threads and not less than 2 threads shall extend through nuts.
- All bolts, nuts and washers shall be galvanized. Where applicable tapered washers shall be used.

## OMISSIONS

Not all equipment for the successful completion of the project is described in the specification. Where this is the case, the Sub-Contractor must follow accepted practice of a reasonable standard to the satisfaction of the Engineer.

## INSTRUMENTATION AND ENVIRONMENTAL CONTROL SYSTEM

### General

The controls shall be of the electrical/electronic type and shall incorporate modern, state of the art technology. All control devices shall be connected to perform the required function and operate in the required sequence.

The performance of controllers shall be stable under all conditions, and the control quality criteria shall be such that the area under the recovery curve of the controlled variable following on a disturbance shall be a minimum.