

A R T S C A P E



an agency of the
Department of Sport, Arts and Culture

ART 01/2023

NAME OF TENDERER	
ADDRESS OF TENDERER	
TELEPHONE No.	
EMAIL	
National Treasury CSD No. (MAAA.....)	

TOTAL TENDER PRICE Incl. 15% VAT

R.....

Tender Box Stage Door
Closing Date: 17 May 2023
Closing Time: 13:00 PM

A R T S C A P E



UPGRADING OF THE CONTROL DESKS OF STAGE MACHINERY IN THE THEATRE AT ARTSCAPE

ART 01/2023

GENERAL TENDER INFORMATION

COMPULSORY BRIEFING SESSION : **4 May 2023 at 12:00 pm**
TENDER CLOSING DATE : **17 May 2023 at 13:00pm**

TENDER SUBMISSION : Tender Box, Artscape Building 1-10
DF Malan Street, Stage Door, Cape Town

A R T S C A P E



ART 01/2023

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SBD 1
INVITATION TO BID

YOU ARE HEREBY INVITED TO BID FOR REQUIREMENTS OF THE ARTSCAPE

BID NUMBER: **ART 01/2023** CLOSING DATE: **17 May 2023** CLOSING TIME: **13:00 PM**

DESCRIPTION: **UPGRADING OF THE CONTROL DESKS OF STAGE MACHINERY IN THE THEATRE AT ARTSCAPE THEATRE**

The successful bidder will be required to fill in and sign a written Contract Form (SBD 7.1).

BID DOCUMENTS MAY BE HAND DELIVERED TO:

TENDER BOX, ARTSCAPE BUILDING 1-10, STAGEDOOR, DF MALAN STREET, FORESHORE CAPE TOWN

Bidders should ensure that bids are delivered timeously to the correct address. If the bid is late, it will not be accepted for consideration.

ALL BIDS MUST BE SUBMITTED ON THE OFFICIAL FORMS – (NOT TO BE RE-TYPED)

THIS BID IS SUBJECT TO THE PREFERENTIAL PROCUREMENT POLICY FRAMEWORK ACT AND THE PREFERENTIAL PROCUREMENT REGULATIONS, 2017, THE GENERAL CONDITIONS OF CONTRACT (GCC) AND, IF APPLICABLE, ANY OTHER SPECIAL CONDITIONS OF CONTRACT

THE FOLLOWING PARTICULARS MUST BE FURNISHED
(FAILURE TO DO SO MAY RESULT IN YOUR BID BEING DISQUALIFIED)

NAME OF BIDDER	.....
POSTAL ADDRESS	.....
STREET ADDRESS	.....
TELEPHONE NUMBER	CODE.....NUMBER.....
CELLPHONE NUMBER	.....
FACSIMILE NUMBER	CODE..... NUMBER.....
E-MAIL ADDRESS	.....
VAT REGISTRATION NUMBER	.....

HAS AN ORIGINAL AND VALID TAX CLEARANCE CERTIFICATE BEEN SUBMITTED? (SBD 2)
YES or NO

HAS A B-BBEE STATUS LEVEL VERIFICATION CERTIFICATE BEEN SUBMITTED? (SBD 6.1)
YES or NO
IF YES, WHO WAS THE CERTIFICATE ISSUED BY?

AN ACCOUNTING OFFICER AS CONTEMPLATED IN THE CLOSE CORPORATION ACT
(CCA).....

A VERIFICATION AGENCY ACCREDITED BY THE SOUTH AFRICAN ACCREDITATION SYSTEM (SANAS);
OR.....

A REGISTERED AUDITOR
[TICK APPLICABLE BOX]

(A B-BBEE STATUS LEVEL VERIFICATION CERTIFICATE MUST BE SUBMITTED IN ORDER TO QUALIFY
FOR PREFERENCE POINTS FOR B-BBEE)
ARE YOU THE ACCREDITED REPRESENTATIVE

IN SOUTH AFRICA FOR THE GOODS / SERVICES / WORKS OFFERED?
YES or NO [IF YES ENCLOSE PROOF]

SIGNATURE OF BIDDER

DATE

CAPACITY UNDER WHICH THIS BID IS SIGNED

TOTAL BID PRICE

TOTAL NUMBER OF ITEMS OFFERED

TOTAL BID PRICE IN WORDS:
.....

PREFACE INFORMATION

1. GENERAL

1.1 Tender Format

Tender numbering format must be adhered to. Compliance or Non-compliance with detailed information must be indicated per paragraph as per numbering format. If there are additional and/or alternative product options, every option/alternative proposal to an item, must be separately bid for in the form of a separate proposal, with a complete schedule and description. Deviations from specifications and technical brochures must be submitted where applicable. All documents submitted in response to this request for proposals will become the property of Artscape.

1.2 Validity Period

The proposal must remain valid for a period of 150 days.

1.3 Contractual Implications

After awarding the bid, this proposal together with its bidder's terms, conditions and scope of works will constitute a binding contract between Artscape and the successful bidder. The successful bidder will assume total responsibility, regardless of any third party or subcontracting agreements it may enter into. Artscape has the right not to award the tender.

1.4 Awarding of Contract

Proven relevant experience and success, as well as the ability to deliver a reliable, efficient and effective service will be important considerations. By the submission of a proposal, each bidder warrants that he/she/it is highly skilled, professional, competent and experienced in the area for which he/she/it has tendered. Any work performed by a successful bidder will be evaluated against these criteria. The bidder also warrants that the service provided will be of a superior standard, and is unlikely to cause undue difficulties. The bid may be awarded, in part or in full, at the sole discretion of Artscape Theatre Centre, to one or more concerns on a non-exclusive basis.

Proposals / bids that are qualified by a bidder's own conditions may be rejected as being invalid, and failure of the bidder to renounce such conditions when called upon to do so may invalidate the proposal. Artscape may request clarification or additional information regarding any aspect of the proposal. The bidder must supply the requested information within 24 hours after the request has been made, otherwise the bidder may be disqualified. Artscape may also request a demonstration, and bidders must comply with such a request within 24 hours.

1.5 Bid Notice

Bid Number: ART 01/2023

Bid Description: **UPGRADING OF THE CONTROL DESKS OF STAGE MACHINERY IN THE THEATRE AT ARTSCAPE THEATRE CENTRE**

Name of Institution: Artscape Theatre Centre

Place where goods, to be delivered: Artscape Theatre Centre, DF Malan Street, Foreshore, Cape Town

Closing Date / Time: 17 May 2023 at 13:00 pm

Enquiries:

Any enquiries regarding the bidding procedure may be directed to:

Natasja Pietersen

Supply Chain Manager

Tel number: 021 410 9835 /9800

Email: natasjap@artscape.co.za

Any enquiries regarding technical information may be directed to

Mr Marius Golding

Tel number: 021 410 9950

Email: mariusg@artscape.co.za

Where bids must be delivered:

Physical Address: Tender Box, Artscape Building 1-10, Stage door, DF Malan Street, Foreshore, Cape Town

The envelopes must be addressed to:

The Supply Chain Management Artscape and clearly marked "Upgrading of the Control Desks of Stage Machinery in the Theatre at Artscape Theatre Centre

Bidder must provide two (2) original bid documents and (1) Soft copy on a CSD or Memory Stick

Tender No. ART 01/2023 with the Bidder's name below. Bidders are welcome to attend the opening of the bids immediately following the closing of acceptance of bids.

Where bid documents can be obtained:

Website: www.etenders.gov.za

Physical Address: Artscape Theatre Centre, DF Malan Street, Foreshore, Cape Town

This bid may be downloaded directly from the National Treasury eTender Publication Portal at www.etenders.gov.za or Artscape's website at www.artscape.co.za free of charge. Alternatively, this bid documents may be purchased at R250 (non-refundable) [inclusive of VAT] per set for those bidders that require a copy from Artscape rather than downloading from the website. Request for printed bid document must be made in advance prior to collection.

Special Conditions:

Bids received will be evaluated in respect of the evaluation criteria as set out in the bid documentation and the **80/20** scoring principle as provided for in the Preferential Procurement Regulations, 2017. The Bidder must provide proof of registration on National Treasury's Central Supplier Database (CSD) which should reflect that the bidder is an active supplier, is tax compliant and is not a restricted supplier. www.csd.gov.za.

The bidder must complete all documents in full and submit these with the proposal.

2. CHECK LIST

ARTSCAPE SUPPLY CHAIN MANAGEMENT TENDER CHECKLIST

Item	Document Reference	Description	Action to be taken	Checked, Verified & Submitted
1	SBD1	Invitation to tender	To be completed in full	
2		Tax clearance requirements	Submission of a valid original tax clearance certificate/tax status Pin	
3	SBD3.1	Pricing schedule – Firm prices	To be completed in full	
4	SBD4	Declaration of Interest	To be completed in full	
5	SBD6.1	Preference point claim form	To be completed in full	
6	SBD8	Declaration of bidders past Supply Chain Management Practices	To be completed in full	
7	SBD9	Certificate of Independent Bid Determination	To be completed in full	
8	TOR	Terms of reference/Specifications	To be read and applied	
9	CSD	Registered on the National Treasury Central Suppliers Database (CSD)	Provide the CSD Supplier Number starting with MAAA_____	
10	GCC	General conditions of Contract	Initial each page	

11		B-BBEE status level verification certificate	Submit a valid original B-BBEE certificate or a certified copy of a B-BBEE rating issued by a Registered Auditor approved by IRBA or a Verification Agency accredited by SANAS View additional notes below : Note 1	
		Company Profile	To be submitted with Bid Invitation	
12		Proposal and Price NB. Technical Threshold – 70%	To be compiled and submitted in line with requirements of the Terms of Reference	
13		Completed Bid Pack	2 Originals and one (1) soft copy on a flash drive or CD	
14	COIDA	Letter of Good Standing in terms of Compensation for Occupational Injuries and Diseases Act	Submitted	
15	N.B.C.E.I	Declaration in Respect of Compliance with Labour Legislation (Good Standing with National Bargaining Council for the Electrical Industry in South Africa)	Submitted	
16	Proof of Insurance	Contract Works and Public Liability	Submitted	
17		Schedule of Subcontractors with their BBBEE Certificates. Indication of how much of the work will be subcontracted		

Additional Notes:

- 1. Broad Based Black Economic Empowerment (B-BBEE) rating level 3 or better to be submitted.
- a) Trust, consortium or joint venture must submit a consolidated B-BBEE Status Level Verification Certificate for every separate bid.
- b) Public entities and tertiary institutions must also submit B-BBEE Status Level Verification Certificates together with their bids.
- 2. Checklist to be completed and attached to the proposal
- 3. Incomplete documents will be regarded as non-responsive
- 4. All forms to be completed in black ink
- 5. No correction fluid to be used in the document, changes should be made by drawing a line through the incorrect information, and initialling the change
- 6. No late quotations / bids will be accepted
- 7. Artscape reserves the right to award or not award the bid, or to partially award.

SIGNATURE(S) OF BIDDER(S) (DULY AUTHORISED)

.....
.....

NAME:
TITLE:
DATE:

PURPOSE

Artscape invites suitably qualified and experienced contractor/service provider for the **Upgrading of the control desks of Stage Machinery in the Artscape Theatre**. Commencement to be confirmed by Artscape Theatre Centre.

INTRODUCTION

Artscape manages the Artscape Theatre Centre, a complex which belongs to the Provincial Government of the Western Cape. Artscape is a facilitator of stage performances, community arts activities, training programmes as well as audience development initiatives to sustain all forms of performing arts.

Artscape's Key Mandate is as Follows:

- Artscape was declared a Cultural Institution in terms of Section 3 of the Cultural Institutions Act, Act 119 of 1998.
- Artscape is listed as a schedule 3A (National Institute) under the Public Finance Management Act, Act 1 of 1999.
- Artscape's objectives were gazetted in the Government Gazette number 25242, 1 August 2003.

PART 2 : SCOPE OF WORKS

**PROJECT SPECIFICATION FOR THE
UPGRADING OF THE CONTROL DESKS
OF STAGE MACHINERY IN THE THEATRE**

2.1 TERMINOLOGY

1. Location of the works: “The Site”: Artscape Theatre, DF Malan street, Cape Town,
2. Client: Artscape. Representative: Mr Marius Golding.
3. Engineer: CA du Toit Western Cape (Pty) Ltd, Consulting Engineers. Representatives: Mr Coert Slabbert and Mr Pieter Conradie.
4. Contractor: The successful Tenderer.

2.2 SCOPE OF THE CONTRACT

1. This specification covers the upgrading of the control desks of the following stage machinery:
 - Fly bars (32) and cyclorama bar
 - Main curtain
 - Safety Barrier
 - Smoke ventilator
 - Sound barriers (2)
 - Lighting bridges (4)
 - Backstage wagon
 - Stage revolves (2)
 - Orchestra pit stage lifts (3)
 - Point hoists (12)
2. Before dismantling the existing control desks, each of the above stage machinery shall be separately tested with the existing control system to check that the stage machine complies with all relevant requirements as to speed of operation, controlling limits, pre-sets, noise level, etc. A detailed record of the test results must be drawn up and kept as proof of compliant operation of each machine in the “before” control upgrading condition. . If a machine does not operate correctly, the contractor shall provide a quotation for any repairs that may be required.
3. Remove the existing stage machinery control desk at mechanist level. Replace with a new control desk with modern control gear.
4. Remove the existing remote control box at stage level for the control of the main curtain, smoke ventilator and safety barrier. Replace with a new control box with modern control gear.

5. Re-use the existing circuit wiring to the contactor panels and to the stage machinery for the control of all the stage machinery.
6. While testing and commissioning the new control desks for specific stage machines, the contractor shall ensure that the particular machine is fully functional and shall record the test results.
7. The work to be done to upgrade the control desks shall comply with the general technical requirements of Part C2 Section 3 of this specification.
8. Over and above the equipment specified in this specification, the Contractor shall supply and install equipment and ancillary equipment that he may consider necessary for the proper operation of the complete electro-mechanical systems of the stage machinery to fully comply with the requirements of this specification.
9. Should the Contractor be of the opinion that certain levels of refinements or improvements of the total system could be introduced, based on equipment that is available on the commercial market, he may do so. If such proposals are acceptable, the alternative price for such a modification will be negotiated based on the unit rates included with the tender.

2.3 REFERENCE TO THE GENERAL TECHNICAL SPECIFICATION (PART C2 SECTION 3)

1. It is important that the Contractor upholds the general standards specified in Part C2 Section 3 of this specification when supplying, installing, testing and commissioning the new equipment.
2. The requirements of this particular Part C2 Section 3 of the specification shall be scrutinized to determine the particular procedure to be applied or material to be used, should detail of any particular requirement not be clearly defined in the subsequent parts of this specification.

2.4 PROGRAMMING OF THE WORK TO BE DONE

1. The first action on site for the upgrade project, shall be that each of the stage machines listed above, shall be separately tested by the Contractor with the existing control system to check that the stage machine complies with all relevant requirements as to speed of operation, controlling limits, pre-sets, noise level, etc. The tests shall be carried out with the assistance of Artscape operating staff. A detailed record of the test results must be drawn up and kept as proof of compliant operation of each machine in the “before” control desk upgrading condition. . If a machine does not operate correctly, a quotation shall be provided for any repairs that may be required.
2. The second activity on site shall be to trace and identify all existing control circuits and power supply cables in the control desk and stage control box. All circuits shall be carefully labelled for the future connection to the new desk and new control box terminals.

3. The design of the new desk and control box, including the preparation of construction drawings, may take place while the above two site activities are occurring.
4. The contractor shall install the new control desk on a modular basis, removing one cubicle of the existing desk at a time, while ensuring that all stage machinery stays in operation. When some stage machines cannot be kept in operation during replacement of a cubicle, Artscape shall be advised of this constraint well in advance for their production adaptations. Testing and commissioning shall take place on a modular basis as cubicle are replaced.
5. The Contractor shall do all site work in the most efficient and dedicated way according to a program he has to develop and submit to the Engineer for approval immediately after the tender has been accepted. The Contractor shall note that all productions in the Theatre will continue during the contract period and that delays may be experienced when work is stopped. It is estimated that up to 60% of the work on site may have to be done after normal working hours and the Contractor shall allow accordingly in his tender pricing and in his program.
6. This program shall be prepared in full co-operation with the planning staff of the Artscape. The periods during which certain stage machinery will be disabled, shall be clearly identified so as not to interfere with the productions planned for the Theatre.
7. This program shall include all the tasks as specified in this document. The start and completion dates of the work to be done and the interlinking work components shall be clearly identified. The Contractor shall strictly adhere to the target dates of the program as finally accepted by the Artscape.
8. When preparing this program the Contractor shall take note of the fact that the normal activities of the Theatre on a day-to-day basis and evening productions will continue. For this reason he shall closely liaise with the management of the Artscape and the Engineer, to determine whether any of his planned activities during the initial removal of the control desk and the installation of the new desk and during testing and commissioning may interfere or be a problem for management.
9. During the construction period, the program must be updated to keep track of all problem items encountered during the project period. This process must be taken into review on a week-by-week basis.
10. Training, fine tuning and testing shall be undertaken in agreed dark periods.

2.5 DRAWINGS

2.5.1 Drawings of existing control desk

The Contractor may obtain schematic drawings of the existing control desk from Artscape. These are the original (50 years old) drawings of the stage machinery control systems and may not be complete or accurate due to modifications over the years.

2.5.2 Drawings for approval

Three weeks after award of the contract, the Contractor shall submit electronic copies of the following drawings to the Engineer for approval. The cost thereof shall be included in the tender price. These drawings shall be approved by the Engineer prior to commencement of manufacture or prior to purchasing any equipment or components. The approval of any drawings, material or equipment, shall not in any way relieve the Contractor of his responsibilities for the successful and correct operation of the installation.

1. General arrangement drawings of the control equipment in the new control desk and stage control box showing functions of each control unit.
2. Drawings indicating the mechanical design of the new control desk and stage control box with dimensions and sections.

2.5.3 Final drawings

1. After the Engineer has approved in writing the drawings submitted for approval, the Contractor shall supply the Engineer with the drawings showing all detail as required including all changes indicated by the Engineer on the approved drawings.
2. Within two (2) months of completion of the installation, the Contractor shall supply the Engineer with electronic copies of all drawings. The Contractor shall confirm in writing that all copies supplied by him are final arrangement and working drawings of the installation as erected and that all corrections and/or amendments have been included.
3. A complete schedule of drawings showing the drawing number and title of the drawing shall be supplied as part of the drawings referred to in subpar (2).

2.6 OPERATOR'S INSTRUCTION MANUALS

1. Upon completion of the installation, the Contractor must supply three (3) copies of the Operator's manuals.
2. These copies must be prepared as general information for an Operator to understand the operational functions and use of the equipment as installed. In general, the Operator's Instruction Manuals shall include the following:
 - a. A detailed description of the control desk and stage control box and the purpose of the control components as installed.
 - b. Comprehensive and descriptive literature in respect of the various new components of equipment.
 - c. Step by step instructions for all applications and procedures to be followed by an operator.

- d. General directions and description of routine test procedures to be followed and conducted by an operator to establish whether basic functional features of the electro-mechanical control systems of the stage machinery are fully operational and compatible with the functional use as specified.
- e. A simple chart of possible problems, which could be encountered with the equipment and instructions of obviating such problems.
- f. Detailed instructions in respect of the procedure to be adhered to during any alarm or fault condition.

2.7 MAINTENANCE MANUALS

- 1. Upon completion of the installation, the Contractor must supply three (3) maintenance manuals including copies of all electrical drawings prepared by the Contractor. These copies must be prepared as general information to fully inspect and maintain the installation.
- 2. In general the maintenance manuals must include the following:
 - a. A general description of the complete mechanical and electrical system and ancillary equipment.
 - b. A general description of the control system in detailed block diagram format.
 - c. Final "as built" drawings and schedules. The drawings shall include all interconnecting cable information forming part of the installation.
 - d. Schematic diagrams for each electrical control system. On these drawings the position of limit switches, sensors, etc. must be identified.
 - e. A schedule of all interconnecting and interlocking control systems including interface switches, sensors, detectors etc.
 - f. Copies of instruction cards fitted to the control desk and stage control box explaining the function of each individual component of monitoring and control equipment such as indicator lights, push buttons, LED's, etc. Such instruction cards must also indicate the normal "NO ALARM" state and "ALARM" state of components as highlighted on the cards.

2.8 ATTENDANCE AT MEETINGS

1. The Contractor shall attend meetings at a time and date as determined by the Engineer or their authorised representative. Such meetings will be held at intervals as determined by the Engineer to ensure that the requirements of this specification and the requirements of Artscape are fulfilled.
2. The Contractor shall attend such meetings (including all his subcontractors) and interested parties under his control and jurisdiction who are involved with this contract. The Contractor shall be responsible for notifying all such persons under his jurisdiction in good time to ensure that they will attend such meetings as arranged.

2.9 RESPONSIBILITIES OF THE CONTRACTOR

1. The Contractor is obliged to build up good working relations with all staff of Artscape and Engineer and their authorised representatives during the contract period.
2. It will be expected from the Contractor to familiarize himself with the operation, working conditions and day-to-day activities of these staff members of Artscape that will ensure the smooth and successful completion of his obligations in respect of this contract.
3. The abovementioned statements, however, shall in no way relieve the Contractor from his responsibilities to carry out his duties according to the contractual conditions and requirements as specified in this document.
4. It shall be the responsibility of the Contractor to inform the Engineer and their authorised representatives in the event of problems which he may encounter and which prevents him from carrying out his duties in terms of this contract. This shall be done as soon as such problems are encountered and before the Contractor deems it necessary to claim for additional expenses, which he may have incurred resulting from such problems.

2.10 HOISTING EQUIPMENT FOR REMOVING AND REINSTALLING THE NEW CONTROL DESK

1. All hoisting apparatus must be supplied by the Contractor to remove the existing desk from the mechanist level. The Contractor shall provide all transportation and handling apparatus required for removing the existing desk from site and transporting, off-loading and installing the new desk on site.
2. The procedure, accessibility and method of utilizing such hoisting equipment shall be discussed by the Contractor in great detail with the Engineer and Artscape such that the Contractor may be aware of all obstacles and problems related to the transport, storage, removal and re-erection of equipment on site.

2.11 ORGANIZATIONAL, PLANNING AND LABOUR FORCE OF CONTRACTOR

1. The Contractor shall appoint a Contracts Manager who shall be responsible to coordinate the Contractor's activities, attend meetings and inspections, and who shall receive instructions on behalf of the Contractor.
2. The contract works shall be done by the Contractor's own personnel and subcontractors identified at the time of tender. No work shall be subcontracted to other parties during the contract period without the written permission of Artscape and the Engineer.

2.12 MAINTENANCE DURING THE GUARANTEE PERIOD

1. During the 12 months guarantee period the Contractor shall be fully responsible for the maintenance of the stage machinery control desk and stage control box.
2. A suitably qualified and trained person shall examine and test the equipment during 4 quarterly visits or as considered necessary during this period, and shall also perform all necessary maintenance tasks to ensure smooth and fault-free operation. Emergency calls for remedial maintenance shall be immediately attended to, separate from the regular intervals stated.
3. Any attendance offered by the Contractor during this period shall not be considered an addition to the contract in respect of cost of travel or travelling time.
4. During this period, the Contractor shall hand a suitable logbook to the User Client's technical representative, and all servicing and repairs by the Contractor's representative shall be meticulously recorded in this logbook. A representative of the User Client shall countersign each recording

2.13 ACCEPTANCE TEST PLAN

1. The Contractor shall submit, when requested by the Engineer, a draft of a recommended acceptance test plan for testing the control system before the installation is completed on site. Note that the new desk shall be installed on a modular basis and therefore tested and accepted as each module is completed.
2. The acceptance test plan will be reviewed and submitted to the Contractor including any alternative test procedure and/or testing and evaluation method and plan. The Contractor shall incorporate such a revised test plan in the future acceptance test plans scheduling the testing procedure to evaluate the performance of the new control desk and stage control box.

3. In general the draft test plan shall incorporate the following:
 - (a) Detailed test procedures.
 - (b) Tabulated results and recording sheets to be obtained during testing of each stage machinery element.
 - (c) Performance tests to determine whether all the requirements of the stage machinery functions specified in the specification are met.

2.14 TRAINING OF PERSONNEL

A suitably qualified person or persons, preferably one who has been involved with the commissioning of the equipment shall train and instruct operators and user personnel of Artscape in operating the equipment. Training shall be arranged with the Client, and shall be provided on an on-going basis as the work progresses to ensure that the theatre remains fully operational for shows as intended. A record of all personnel trained shall be signed by all attendees of the training, and shall be handed over to the Client after each completed training session.

2.15 ENVIRONMENTAL CONDITIONS

1. The following information is given as a general guide to environmental conditions, which might prevail in the areas where equipment will be installed:

(a) Average daily maximum temperature (summer conditions)	28,6°C
(b) Average daily minimum temperature (winter conditions)	14,3°C
(c) Absolute minimum temperature	-0,1°C
(d) Absolute maximum temperature	36,7°C
(e) Maximum relative humidity during summer conditions	53,1 % at +28,6°C
(f) Minimum relative humidity during winter conditions	42 % at + 14,3°C
(g) Extreme relative humidity (during winter conditions)	94 % at 0.9°C
(h) Altitude of highest repeater site	5 metres above sea level
2. Any new electrical and electronic equipment to be supplied and installed and equipment which has been repaired shall function with extreme stability, correctly and reliably under such conditions whether these conditions are experienced separately or in part or combined over a lengthy period.
3. All enclosures, being either metal or of synthetic material shall not warp, deform or be damaged in any way during such conditions.
4. The electrical and electronic equipment must be installed and operate with extreme stability, correctly and reliably during such conditions whether these conditions are experienced separately or in part or in combination.

5. The stage machinery control desk housing the electrical/electronic control equipment shall be installed on the mechanist level in the theatre. The stage control box shall be installed at stage level. The stage area has natural ventilation is by convection only. Any other form of ventilation required for the equipment shall be provided as part of the new equipment to be supplied and installed. If ventilation fans are required in the desk or control box, they shall have a very low noise level.

2.16 TERMINOLOGY ON THE DESK AND CONTROL BOX

1. The function of control equipment and components shall be fitted with identification labels, as specified in Part C2 Section 3 of this specification.
2. Where possible, all identification of control push buttons and control components shall be provided with logically internationally known acceptable symbols to identify the particular function and control features.
3. Where terminology must be included, this shall be in the English language.
4. When required, the Contractor shall submit a complete schedule of such terminology and symbols with a complete list of the identification and functional features represented by these symbols for approval.

2.17 SITE FACILITIES

1. Before the Contractor does any manufacture or erection work, a site survey shall be conducted by the Contractor to determine exact site dimensions.
2. In the manufacture of the supporting steelwork and equipment, the Contractor shall make allowance for any deviation of actual site dimensions when compared with actual dimensions shown on any drawings that may be available from the archives of Artscape.
3. Claims due to adjustments made on site, due to lack of a comprehensive site survey, shall not be entertained.
4. Water, lighting and power is available but the Contractor shall have the obligation to arrange for the use of such facilities as and when required. When working on site the Contractor shall have available his own extension lighting equipment for use in the working areas.
5. Scrap and waste material shall be regularly removed from the site and the environment must be left in a proper and clean condition.

2.18 DETAILED SPECIFICATION OF WORK REQUIRED

2.18.1 Removal of existing control desk at mechanist level

Before removing the existing control desk, the contractor and Artscape staff shall test all its functions on each of the stage machines that it controls. Detailed observations shall be recorded and malfunctions noted. The contractor shall investigate non-operational machines and make proposals for the repair thereof, including relevant quotations.

The existing control desk is made up of seven cubicles, each controlling a group of stage machines. The cubicles shall be removed one by one, starting from the right hand unit as number 1 cubicle.

Before removing a cubicle, all wiring circuits shall be identified and labelled for the correct connection to the new control desk control gear.

Also, before removing a cubicle, the Engineer shall be advised which stage machines will be affected and what temporary measures can be implemented to keep normal theatre productions going. The Contractor and the Engineer shall advise Artscape timeously of such arrangements for production planning purposes.

The process of lowering a removed cubicle to stage level, shall be planned in close co-operation with Artscape in the interest of safety and minimum disruption of productions.

All the cubicles of the control desk shall be removed from site to a scrap yard.

2.18.2 New control desk at mechanist level

The proposed layout of the new stage machinery control desk shall be fully detailed on drawings and submitted to the Engineer for approval refer to par C3.5 of the specification.

The desk shall be manufactured in modules to facilitate the change-over process of each existing cubicle. Each module shall consist of the sloped top deck containing the control gear mounted on a cabinet with doors for the wiring and termination blocks.

Supply and install a low level lighting system for ease of operating the desk during dark scenes on stage. A lighting system with colour changing LEDs and which is dimmable shall be provided.

All control gear items and indicating lights shall be identified clearly with English only script.

CUBICLE 1:

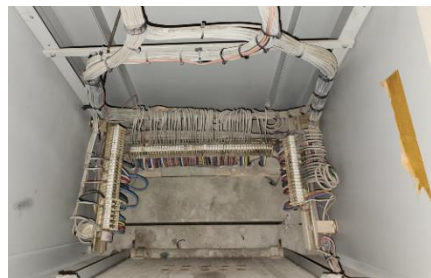
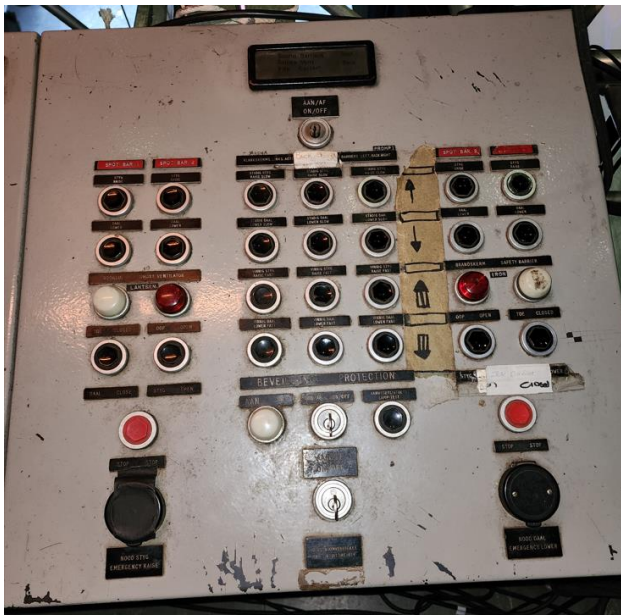
The existing desk cubicle 1 controls the following stage machines:

- 4 Lighting bridges (spot bars) each with raise and lower control push buttons.
- 2 Sound barriers each with slow raise and lower push buttons, as well as fast raise and

lower push buttons. Note that the third sound barrier is permanently closed to form the Arena Theatre.

- The smoke ventilator with open and closed push buttons and an emergency stop push button.
- The safety barrier (fire curtain) with open and close push buttons and emergency stop.
- Indications are provided for the sound barriers, smoke ventilation, fire curtain and spot bars.
- Protection circuits may be overridden by a key switch with a warning indicating light.
- The desk is activated by a key switch which controls a mains circuit breaker in the stage machinery DB.

When cubicle 1 is to be removed, the contractor shall ensure that the operation of the safety barrier, smoke ventilator and main curtain can be controlled from the control box at stage level to keep normal productions going



Pictures 1, 2 & 3 – Cubicle 1 top view and internal wiring

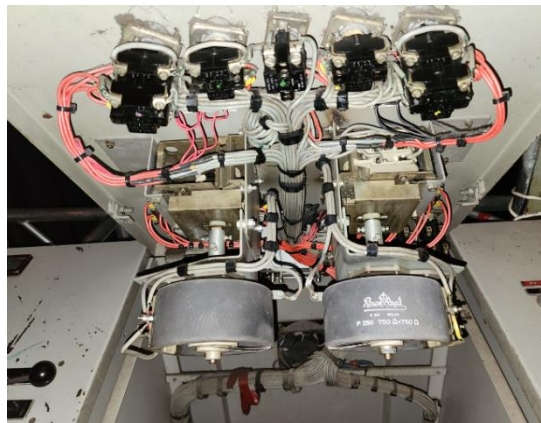
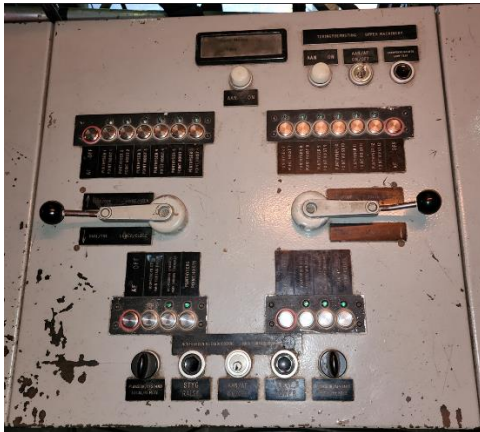
CUBICLE 2:

The existing desk cubicle 2 controls the following stage machines:

- 6 Point hoists push buttons with a single off push button operated with a potentiometer for up or down movement and speed control. Hoists can be grouped to run together.
- A similar bank of 6 push buttons for another 6 point hoists with a single off push button. This bank is controlled by a second potentiometer for up/down movement and speed control. Hoists can be grouped to run together.
- The two potentiometers are each selected with push buttons to control the main curtain sideways opening, the main curtain up/down and the point hoists.
- A key switch is provided for the panel on/off switch.

- Two local/remote selector switches and two up/down push buttons are provided for the maintenance operation of the main curtain from the control box at stage level.
- A key switch controls the power to the upper machinery level.
- Indications are provided for the point hoists and tabs (main curtain).

When cubicle 2 is removed, the main curtain shall be operational from the control box at stage level.



Pictures 4 & 5 – Cubicle 2 top view and internal wiring

CUBICLES 3 & 4:

Existing desk cubicle 3 controls the following stage machines:

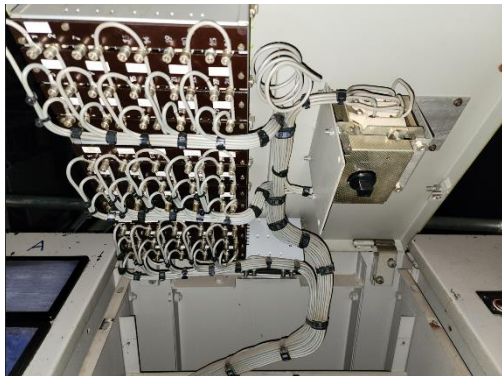
- 3 Panels of indications for the fly bars in group B. The indicators show which bars have been selected to operate as a group.
- A potentiometer for raising or lowering bars at higher or lower speeds.

Existing desk cubicle 4 controls the following stage machines:

- 3 Panels of indications for the fly bars in group A. The indicators show which bars have been selected to operate as a group.
- A potentiometer for raising or lowering bars at higher or lower speeds.
- A key switch to switch on power to cubicles 3 and 4.



Picture 6 – Cubicles 3 & 4 top view



Pictures 7 & 8 – Cubicles 3 & 4 internal wiring

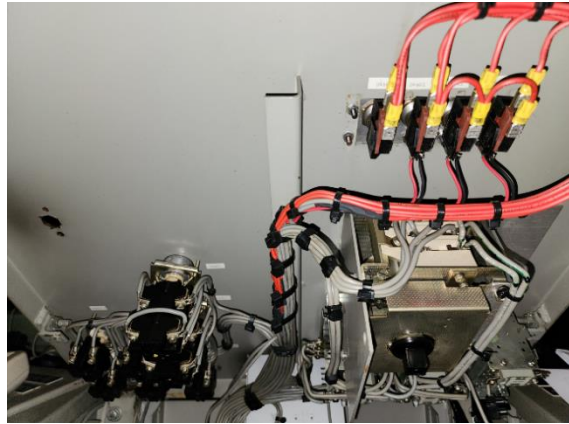
CUBICLE 5:

Existing desk cubicle 5 controls the following stage machines:

- Orchestra pit lifts 1, 2 and 3.
- 3 Push buttons to select each lift with one off push button for control by a potentiometer lever for raise/lower and speed control.
- 3 Selector push buttons per lift to select auditorium or orchestra levels or off. **In the new control desk provision shall be made for THREE (3) stop levels: orchestra pit,**

auditorium and stage levels.

- Two main control push buttons to select raise or lower.
- Two push buttons per lift for raise or lower.



Pictures 9 & 10 – Cubicle 5 top view and internal wiring

CUBICLE 6:

Existing desk cubicle 6 (filler piece) controls an intercom system. The requirement for this cubicle is to be evaluated and may be omitted from the new control desk.



Pictures 11 & 12 – Cubicle 6 top view and internal wiring

CUBICLE 7:

Existing desk cubicle 7 controls the following stage machines:

- Backstage wagon, inner and outer stage revolves.
- Key switch to switch on the stage level machines.
- 3 Push buttons to select backstage wagon, inner revolve, outer revolve and one off push button for control by a potentiometer lever for wagon forward/backward or

- revolves clockwise/anti-clockwise and speed control.
- The above 3 push buttons and potentiometer control is duplicated.
- Push buttons to couple/uncouple the revolves.



Pictures 13 & 14 – Cubicle 7 top view and internal wiring

Next to cubicle 7 is a metal kiosk fixed to the grid. It is suspected that this is a connection box for circuits to the control box at stage level. This box shall be investigated and circuits tested to discover its purpose. If feasible this box should be mounted in a more convenient position.



Picture 15 – Suspected junction box

All of the above control and indication functions in the existing control desk and above the existing desk shall be provided in the new stage machinery control desk at mechanist level. Reconnect existing circuits to the new control gear in the new control desk.

Note that the potentiometer lever units mentioned above in the description of the existing cubicles, were specially manufactured for this control application. It is highly unlikely that equivalent units will be available at suppliers today. The contractor shall therefore re-use these potentiometers in the new control desk and new control box. Should a unit prove to be faulty and not reusable, a new control system will have to be developed at additional cost.

2.18.3 New control panel at stage level

The existing stage machinery control panel at stage level shall be replaced with a new control panel with new control gear and indications. The existing control circuits and contactors and lever potentiometer shall be re-used.

Before removing the existing control panel, all wiring circuits shall be identified and labelled for the correct connection to the new control box.

The existing control panel shall be removed from site to a scrap yard.

The proposed layout of the new stage machinery control panel shall be fully detailed on drawings and submitted to the Engineer for approval, refer to par C3.4 of the specification.

All control gear items and indicating lights shall be identified clearly with English only script.

Supply and install a low level lighting system for ease of operating the desk during dark scenes on stage. A lighting system with colour changing LEDs and which is dimmable shall be provided.

The existing control panel controls the following stage machinery:

- Smoke ventilator with push buttons to control raising or lowering the vent. It has indications to show that the vent is open or closed. There is a normal stop push button and an emergency stop push button with a flap cover.
- Safety barrier (fire curtain) with push buttons to control raising or lowering the barrier. It has indications to show that the barrier is raised or lowered. There is a normal stop push button and an emergency stop push button with a flap cover. A break glass unit is provided for the control of the fire curtain drencher (sprinkler system).
- A key switch is provided to switch the protection circuits on or off.
- The main curtain can be controlled by a potentiometer lever to raise or lower the curtain. Indication lights show whether the curtain is raised or lowered. A graphic display

unit shows the vertical or horizontal (sideways) opening position of the curtain.



Pictures 16 & 17 – Stage level Control Panel

All of the above control and indication functions shall be provided in the new control panel to be mounted in the same position at stage level. Reconnect existing circuits to the new control gear in the new control box.

2.18.4 Point Hoists

The existing Point Hoists System with 12 point hoists shall be fully tested with the existing control system, keeping a detailed record of the operational performance of each hoist. Any malfunctions shall be recorded, investigated and a quotation provided for repairs.

Transfer the existing point hoist control circuits to the new stage machinery control desk with new control gear.

2.18.5 Back stage wagon

The backstage wagon has been seldom used in recent years due to its unreliability. The Contractor shall inspect and thoroughly test the operation of the backstage wagon, noting down

all test results, using the existing control circuits and desk. A quotation for any repairs that may be required must be submitted to the Client/Engineer for consideration.

Transfer the existing backstage wagon control circuits to the new stage machinery control desk with new control gear.

2.18.6 Fly bars, Cyclorama bar, sound barriers and lighting bridges

Each fly bar, the cyclorama bar, each sound barrier and each lighting bridge shall be fully tested to ensure that it is operating correctly and safely by means of the existing stage machinery control desk. Keep a detailed record of all operations and provide a quotation for repairs that may be necessary.

Transfer the existing control circuits for the fly bars, cyclorama bar, sound barriers and lighting bridges to the new stage machinery control desk with new control gear.

2.18.7 Fire curtain and smoke ventilator

The Contractor shall inspect and thoroughly test the operation of the fire curtain and smoke ventilator, noting down all test results, using the existing control circuits of the desk at mechanist level and the control box at stage level. Provide a quotation for any repairs that may be required.

Transfer the existing fire curtain and smoke ventilator control circuits to the new stage machinery control desk and new control box at stage level.

2.18.8 Main curtain

The Contractor shall inspect and thoroughly test the operation of the main curtain, noting down all test results, using the existing control circuits of the desk at mechanist level and the control box at stage level. Provide a quotation for any repairs that may be required.

Transfer the existing main curtain control circuits to the new stage machinery control desk and new control box at stage level.

2.18.9 Orchestra pit lifts

The existing 3 orchestra pit lifts shall each be fully tested with the existing control system, keeping a detailed record of the operational performance of each hoist. Note the requirement for 3 stops at pit, auditorium and stage levels. Any malfunctions shall be recorded, investigated and a quotation provided for repairs.

Transfer the existing orchestra pit lifts control circuits to the new stage machinery control desk with new control gear.

2.18.10 Stage revolves

The existing two stage revolves shall be fully tested with the existing control system, keeping a detailed record of the operational performance of each revolve. Any malfunctions shall be recorded, investigated and a quotation provided for repairs.

Transfer the existing two revolve control circuits to the new stage machinery control desk with new control gear.

PART 3

GENERAL TECHNICAL SPECIFICATION

3.1 GENERAL INFORMATION

- (1) This general technical specification covers the general requirements regarding material, equipment, installation, testing and commissioning of the installation and shall be read in conjunction with the conditions of tender, conditions of contract and the Generic Specifications for the specific installation.
- (2) The complete installation shall comply with the requirements of this specification. Should any differences or contradictions exist between this specification and the Generic Specifications for the specific installation, then the latter shall take preference.
- (3) It is in the interest of the Contractor to notify the Engineer when the installation reaches various stages of completion so that the Engineer may inspect the installation and point out deficiencies. These inspections will be informal and under no circumstances will they partly or wholly invalidate the requirements of the documents. Any costs incurred in correcting deficiencies shall be for the Contractor's account.

3.2 COMPLIANCE WITH REGULATIONS

3.2.1 Regulations

The installation shall be erected and commissioned in compliance with the latest amendments of the following acts and regulations:

- (1) The Occupational Health and Safety Act, Act No 85 of 1993.
- (2) The Minerals Act, Act No 50 of 1991, which includes the Mines and Works Regulations.
- (3) The local Municipal bye-laws and regulations as well as the regulations of the local Supply Authority.
- (4) The local Fire Regulations.
- (5) The National Building Regulations and Building Standards Act including the Code of Practice for the Application of the Regulations, SABS 0400.
- (6) The regulations of the Telkom SA Ltd.
- (7) The regulations of SATRA.

- (8) The standard regulations of any Government Department or public service company, where applicable.

3.2.2 Notices and Amendments to Regulations

- (1) In addition the Contractor shall issue all notices and pay all the required fees in respect of the installation to the local authorities and 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 aforementioned regulations.
- (2) It is assumed that the Contractor is conversant with the abovementioned requirements. Should any requirement, bye-law or regulation which contradicts the requirements of this specification, apply or become applicable during erection of the installation, such requirement, bye-law or regulation shall overrule this specification. The Contractor shall immediately inform the Engineer of such a contradiction. Under no circumstances shall the Contractor carry out any variations to the installation in terms of such contradictions without obtaining the written permission to do so from the Engineer.

3.2.3 Construction Regulations, 2003

- (1) These Construction Regulations No 1010 have been promulgated in the Government Gazette of 18 July 2003, and form an obligation, which the Contractor shall apply during the construction period of the contract.
- (2) These obligations of the Contractor are briefly dealt with in the following paragraphs of this specification. A comprehensive specification can be made available to the Contractor.

3.2.4 Safety Plan

- (1) The Contractor shall prepare a construction safety plan in terms of the Construction Regulation in cooperation with a competent person in the industry for the construction works, including:
 - (a) A risk assessment.
 - (b) A safety plan to address the construction risks identified.
 - (c) A program of activities to implement, control, manage and audit the safety plan.
 - (d) An administration process to control, manage and record the safety plan implementation process.
 - (e) Keeping a safety file on site.
- (2) The Contractor shall appoint a competent trainable employee on site as safety officer to manage the safety plan on the construction site, i.e.:
 - (a) The safety officer shall be trained to manage the site according to the safety plan.
 - (b) The safety officer shall be trained in the principles of the Safety Act.
 - (c)

3.2.5 Safety File

A safety file shall be kept on site with all the records of the safety plan, program, reports, incidents, etc. The file shall be handed over formally to the Employer for safekeeping at the end of the project.

3.2.6 Site Meetings

Construction safety plan shall be monitored and addressed under a special item during the site meetings. The Contractor shall submit a comprehensive report at each meeting covering the procedures applied on site to meet the requirements of these regulations. This information shall be retained as part of the minutes of the site meetings.

3.2.7 Independent Safety Inspector

- (1) The Project Manager of the Employer may appoint an independent Safety Inspector to assess the safety plan in terms of the OHS Act, audit the implementation of the safety measures and associated administration work on site for compliance with the safety plan.
- (2) The Safety Inspector shall report to the Principal Agent or Project Manager for action.
- (3) The project team may nominate the independent Safety Inspector.
- (4) The Principal Agent or Project Manager will be responsible for the remuneration of the Safety Inspector. Payments may be made through the contract.
- (5) Inspections will be done at random and unannounced. These inspections may be at intervals of fourteen (14) days.

3.3 QUALITY CONTROL

- (1) The Contractor shall apply the principles and procedures as prescribed by the codes of practice for quality systems as outlined in SABS ISO 9000 to SABS ISO 9004. Should the Contractor have an ISO rating, this must be disclosed when submitting a tender.
- (2) A formal quality control plan to manage the inspection process of delivery of quality on site shall be developed. This quality control plan shall at any time be available for perusal by the Engineer. The Inspector of the Employer may perform a separate quality control process on behalf of the Employer to ensure that the Employer's quality expectations are met on site.
- (3) The minimum requirement for the quality control plan shall be:
 - (a) Nominate in writing a quality control officer for the various disciplines.
 - (b) Prepare a program of inspection tasks and define what will be inspected (section of project, activity), when and by whom this should be done.
- (4) Sign the quality control check lists on completion of the tasks.
- (5) The formal documentation for the quality control process including detail technical checklists shall be developed based on the design documentation.
- (6) On completion of scheduled inspections, short inspection report of the works with comments on the following shall be prepared:

- (a) Progress on check list inspections
 - (b) List progress of the construction work
- (7) Comment on safety
- (8) Labour intensive compliance
- (9) The reports of the quality control program, inspection reports and signed check lists shall be retained in a file on site to prove that a quality control plan is being applied on site.
- (10) The information presented in the quality control plan shall be monitored and any relevant detail recorded as an item during the site meetings.
- (11) The particular codes of practice for quality systems to be applied during all stages of design, development, production, installation and servicing to be carried out by the Contractor are as follows:

Quality management and quality assurance standards – Guidelines for selection and use	SABS ISO 9000
Quality systems: Model for quality assurance in design/development, production, installation and servicing	SABS ISO 9001
Quality systems – Model for quality assurance in production and installation	SABS ISO 9002
Quality systems – Model for quality assurance in final inspection and test	SABS ISO 9003
Quality management and quality system elements – Guidelines	SABS ISO 9004

3.4 COMPLIANCE WITH STANDARD SPECIFICATIONS

- (1) Equipment, material and quality standards shall comply with the requirements of the specifications in the following schedules. The latest amendments of a specification shall be consulted.
- (2) (Material and equipment shall comply in respect of quality, manufacture, tests and performance with these standards or alternatively also to the current specification of at least one (1) of the following standards institutes:
 - (a) The British Standards Organisation (BS).
 - (b) The South African Bureau of Standards (SABS). In this specification reference is still made to "SABS", although some new specifications under the new name of South African National Standards (SANS) have been issued.
 - (c) The International Standards Organisation (ISO).
 - (d) The International Electro-technical Commission (IEC).
 - (e) Die Deutsche Industrie Normen (DIN).
- (3) In the schedules reference is made to certain of these standards.

- (4) When referring to the aforementioned specifications, the abbreviations, BS, SABS (or SANS), ISO, IEC and DIN will be stated. When a specific specification number is specified, the latest applicable issue and amendment shall be consulted.
- (5) Should material and apparatus used comply or be in accordance with the standard of any other recognized standards institution, this shall be clearly stated at the time of tender.
- (6) Upon being requested to do so by the Engineer the Contractor shall supply a certificate of a recognised Research Laboratory or Bureau of Standards for materials used.
- (7) Imported materials shall comply with the requirements of the appropriate SABS or BS specification or any other specification, although these materials need not necessarily bear the SABS mark.

3.5 STRUCTURAL AND MECHANICAL COMPONENTS WITH STANDARD EQUIPMENT AND MATERIAL SPECIFICATIONS

Note: The latest amendments of these specifications shall be applicable.

3.5.1 General Requirements

	SANS specification
Standard voltages, currents and insulation levels for electricity supply	1019
Earth rods, couplers and connections	1063
Protection of structures against lightning General Principles	IEC 1024
Installation and maintenance of electrical equipment used in explosive atmospheres	10086
Code of Practice for the Wiring of Premises	10142

3.5.2 Protection against Lightning

	SANS specification
Standard voltages, currents and insulation levels for electricity supply	1019
Protection against lightning - Physical damage to structures and life hazard	10313
Protection of structures against lightning General Principles	IEC 1024-1
Protection against lightning electromagnetic impulse General principles	IEC 1312-1
Protection against lightning electromagnetic impulse (LEMP) Shielding of structures, bonding inside structures and earthing	IEC TS 61312-2

	SANS specification
Protection against lightning electromagnetic impulse Protection of equipment in existing structures	IEC TS 61312-4

3.5.3 Transformers and Transformer Equipment

	SANS specification
Low voltage isolating transformers	743
Voltage transformers	60186
Current transformers	NRS 029

3.5.4 Distribution and Control Boards, Terminal Boxes And Enclosures

	SANS specification
Electrical distribution boards	1180
Enclosures for electric equipment	1222

3.5.5 Control Equipment

	SANS specification
Low voltage air-break switches, air-break disconnections, air-break switch disconnectors and fuse combination units	152
Moulded case circuit breakers	156
Surge arrestors for low voltage distribution systems	IEC 61643-1
Cartridge type fuse links for low voltage electric fuses	172
Fuse link holders for cartridge type fuse links	173
Earth leakage protection units	767
Contactors	1092
Low voltage switchgear and control gear assemblies	1473
Manually operated air-break switches (Schedule No 1)	VC 8003
Push buttons	BS 3955 VDE 0660
Specification for low voltage switchgear and control gear for industrial use. Position switches 42,5x80. Dimensions and characteristics	BS 6518
Specification for low voltage switchgear and control gear for industrial use, inductive proximity switches, identification of connections	BS 6519
Specification for coding of indicating devices and actuators by colours and supplementary means	BS EN 60073

3.5.6 Instruments and Measuring Devices

	SANS specification
Direct acting indicating analogue electrical measuring instruments and their accessories	BS 89 Parts 1-9 IEC 51
Electricity meters	BS 5685 Parts 1, 3-5 & 8
Current transformers	IEC 185
Potential transformers	IEC 186

3.5.7 Cables, Conductors And Busbars

	SANS specification
Rubber insulated cables and flexible cords	168
Flexible polyvinyl chloride (PVC) compounds for electric purposes	175
Metal enclosed busbar trunking systems	784
Enamelled copper conductors	1181
Busbars	1195
Materials of insulated electric cables and flexible cords	1411
Electric cables with extruded di-electric insulation for fixed installations - 300/500V to 1900/330V	1507
Electric cables - flexible cords	1574
Specification for copper for electrical purposes Rod and bar	BS 1433
Compression joints in copper conductors	BS 4579 Part 1
Flexible cords for power and lighting appliances (Schedule No 4)	VC 8006

3.5.8 Conduit and Conduit Fittings

	SANS specification
Unplasticised polyvinyl chloride (PVC) rigid conduit and fittings for use in electrical installations	950
Metal conduits and fittings (screwed-end and plain-end) for electrical wiring	1065

3.5.9 Sockets, Couplers and Connectors

	SANS specification
Plugs and socket outlets for household and similar purposes Part 1 and 2	164
Plugs, socket outlets, couplers and connectors of rated current in the range 16 - 200A	1239
Plugs, socket outlets and couplers for industrial purposes Part 1	IEC 60309
Plugs, socket outlets and socket outlet adaptors (Schedule No 6)	VC 8008

3.5.10 Electric Motors and Generators

	SANS specification
Three-phase induction motors	948
Single-phase induction motors	1189
Rotating electrical machines	IEC 60034
General requirements for rotating electrical machines	BS 4999
Rotating electrical machines of particular types or for particular applications	BS 5000

3.5.11 Appliances and General Equipment

	SANS specification
Pressure-sensitive adhesive tapes for electrical purposes	122
Wireways for electrical cabling	1197
Terminal blocks having screw and screw less terminals	1433

3.5.12 Standard Equipment and Material Specification for Structural Steelwork

	SANS specification
Fasteners Part 1 to Part 19 (Metric bolts screws and nuts)	1700-1 To 1700-19
Structural steelwork	1200 H
Corrosion protection of structural steelwork	1200 HC
Approval testing of welders Part 1 and Part 2	9606-1 and 9606-2
Specification and approval of welding procedures for metallic materials Part 1 to part 4	9956-1 To 9956-4

	SANS specification
Welding Part 2 and Part 2	10044 -1 and 10044-2
The general procedures and loadings to be adopted in the design of buildings	10160
The structural use of steel Part 1,Part 2 and Part 4	10162-1 10162-2 and 10162-4
Specification for weldable structural steels	BS 4360
Fasteners, clearance holes for bolts and screws	BS EN 20273
Fasteners, clearance holes for bolts and screws	BS EN 20273

3.5.13 Standard Equipment and Material Specification for Mechanical Equipment and Components

	SABS SANS specification
Safety rules for the construction and installation of electric lifts	1545 Part 1
Keys and keyways and taper pins	BS 46
Stranded steel wire ropes	BS 302
Spur and helical gears	BS 436
Specification for bevel gears	BS 545
Specification for power driven overhead travelling cranes, semi-goliath and goliath cranes for general use	BS 466
Specification for wrought steels for mechanical and allied engineering purposes	BS 970
Specification for straight-sided splines and serrations	BS 2059
Specifications for steel castings for general engineering purposes	BS 3100
Rope rollers, pulleys, mountings and assemblies for colliery track haulage	BS 3876

3.5.14 Material Specification of Paints and Application Methods

	SANS specification
Structural steelwork (high gloss paint)	630
Zinc-chromate primer coat	679
Structural steel paint	684
Wash primer (metal etch primer)	723
Epoxy tar paints	801
Two pack zinc rich epoxy primer	926
National colour standard	1091
Coatings applied by the powder-coating process	1274
Paints and varnishes – Resistance to impact of paint films	5146
Preparation of steel substrates before the application of paints and related products. Tests for the assessment of cleanliness of blast cleaned steel surfaces	5770 5771 5772 5773
The preparation of steel surfaces for coating	10064
Painting of buildings Part 1 to Part 6	10305-1 to 10305-6
Paints and varnishes – Corrosion protection of steel structures by protective paint systems Part 1 to Part 8	12944-1 to 12944-8

3.5.15 Material Specification of Lubricants

	SABS SANS specification
Lubricating nipples	BS 1486
Recommendation for centralized lubricating systems	BS 4807
Lithium-base lubricating grease	406
Calcium-base lubricating grease	344
Chassis lubricating grease	352
Straight mineral bearing and gear oil	CKS 42

3.5.16 Standard Specification for Safety Equipment

	SANS specification
Symbolic safety signs	1186

3.6 EQUIPMENT, MATERIAL AND APPARATUS

- (1) The equipment, materials and apparatus used in the installation shall be new and of best commercial quality with a high reliability and shall be selected for ease of maintenance.
- (2) All materials shall be suitable for the conditions on site. These conditions shall include weather conditions as well as conditions under which the materials are installed and used. Should the materials or components not be suitable for use under temporary site conditions, the Contractor shall at his own cost provide suitable protection until these unfavourable site conditions cease to exist.
- (3) Samples of all equipment shall upon request of the Engineer be submitted for approval before installation is commenced. All such samples may be retained until completion of the contract. All such samples shall have securely attached thereto labels designating the contract by name and number (if any), the name of the Contractor and any further relevant information.
- (4) Individual components or apparatus such as batteries, terminal blocks, electrical control equipment, etc., shall when used in the installation be of the same make, type or series for each item used throughout the installation. Standardisation and mutual interchangeability of parts and components are essential and the aforementioned requirements must be considered in the Contractor's approach to the interpretation of the specification, and may be subject to approval by the Engineer following demonstrations of the equipment capability by the Contractor.
- (5) The aim must be to standardize component types, series and make, thus reducing the number of items to be held by the Employer as spare parts.
- (6) Equipment shall also be readily available. It must be possible to have imported equipment available in South Africa on an agency basis. Upon request the Contractor shall guarantee that such equipment or components may be available in South Africa.
- (7) Manufacture of subunits or subassemblies forming part of a system shall be jig-built if required in quantities more than five to ensure uniformity and final manufacture to close tolerances to ensure smooth operation of such systems.
- (8) Notwithstanding the foregoing, and to best serve the Employer's needs and interests, tenders will only be considered for currently manufactured reliable equipment of good reputation which can properly be maintained and serviced without the necessity of the Employer carrying an extensive spares stock or being subjected to the inconvenience of long periods of interrupted service due to the unavailability of parts.

3.7 STANDARD OF CRAFTSMANSHIP

- (1) All work for this installation shall be executed according to the latest professional standards.
- (2) The Contractor shall nominate a senior and competent member of his staff to supervise all his staff on site throughout the period of installation in order that standards of

craftsmanship are maintained and safety regulations are adhered to. This nominated person shall also liaise with other contractors, where necessary, and with the Architect and Engineer on a day-to-day basis where applicable.

- (3) Site staff shall be experienced and competent personnel, adequately trained to execute the various duties assigned to them.
- (4) Before equipment is installed, all installed wiring shall be checked to ensure that routes are correctly followed, category segregation is maintained, and that no accidental damage has occurred to the cables during installation. All metal conduits shall be connected by a low impedance path to earth.
- (5) The Contractor shall liaise with the Engineer and other contractor=s working on site to ensure that areas where major equipment items, such as control boards, control consoles, etc., are to be installed, are finished clean and dry and secure before the installation of these items commence.
- (6) Material or workmanship which is not to the satisfaction of the Engineer, shall be rectified at the cost of the Contractor. All rejected material shall be removed from site at the cost of the Contractor.
- (7) The Contractor shall be responsible for the correct and complete erection of the installation to comply with the requirements of the Generic Specifications for the installation.

3.8 WORKSHOP ASSEMBLY AND IDENTIFICATION OF SUBSYSTEMS AND COMPONENTS

- (1) To assist in the erection and installation activities on site, components, equipment and subsystems must be assembled in the workshop, after manufacture. Individual units shall be clearly marked by employing an identification code in such a manner that actual re-assembly, erection and installation on site could be done in a minimum of time with a minimum of fitting and adjustment on site.
- (2) Equipment should be delivered to site in the largest subsystems which are practical.
- (3) Where practical according to the discretion of the Engineer, complete electronic and other control units shall be assembled in the workshop for preliminary tests. This shall be done to check whether the equipment complies with predetermined set values and produces certain predetermined set results.
- (4) The Engineer may upon request of the Contractor visit existing installations or inspect prototype assemblies of subsystems in the factory to determine whether such units and the workmanship are of the required standard for the installation. This may be done to obviate certain tests on subsystems in the factory related to electronic and other control units.

3.9 INSPECTIONS AND TESTS

3.9.1 Routine Inspections and Tests

- (1) The equipment and components of the installation will be inspected by the Engineer on a routine basis during the manufacture of the equipment and during installation on site. For this purpose the Engineer must be allowed access at all reasonable times to the workshops of all manufacturers of equipment and components for the installation.
- (2) Such inspections shall not exempt the Contractor from his responsibility in respect of the control of quality of equipment and workmanship.
- (3) The Contractor must execute all tests in the workshops of manufacturers or at any other venue or on site during or before erection of the installation in compliance with the requirements of this specification.
- (4) Any additional tests which according to the judgement of the Engineer may be necessary to determine whether the installation or equipment complies with the requirements of the specification, must be done upon instruction of the Engineer. All such tests must be done in the presence of and to the satisfaction of the Engineer at the place, date and time mutually agreed to.
- (5) The Contractor shall provide all test equipment, test apparatus and other auxiliary equipment and must prepare test certificates as specified or as requested by the Engineer.
- (6) The Contractor must report to the Engineer on a routine basis regarding the progress of manufacturing the equipment and the progress of installing the equipment on site, so that the Engineer may decide when progress inspections should be undertaken as necessary to inspect workmanship and quality of material.
- (7) The Contractor must, when necessary, arrange with the Inspector of Machinery for tests to be done as required by the Inspector of Machinery. The Engineer must be timely informed of such tests to be conducted.

3.9.2 Testing in the Workshops of the Manufacturer

- (1) Where necessary, equipment must be fully mounted in the workshop such that all moving and operational systems may be practically tested to ensure proper and smooth operation. Where required, such tests must be conducted in the presence of the Engineer or representatives of the Employer.
- (2) Before such tests are undertaken, the general arrangement, alignment and interchangeability of components and equipment shall be inspected by the Engineer or representative of the Employer to determine whether the specified requirements have been met.
- (3) After the equipment and components have been inspected in the workshop, any modifications or adjustments other than final adjustments for commissioning shall not be undertaken without the full knowledge of the Engineer and unless prior written approval has been received from the Engineer in this respect.

3.9.3 Testing on Site

- (1) After the equipment has been installed on site, the Contractor shall undertake performance tests of the equipment to ensure that the equipment is fully operational in compliance with the requirements of this specification. These tests shall be undertaken during the commissioning of the equipment on site.
- (2) Should the Contractor be satisfied that such tests meet all the requirements of the specification, the Engineer shall be informed thereof so that inspections and tests may be undertaken by the Engineer and representatives of the Employer to determine whether the specified requirements have been met.
- (3) All equipment, instruments and test equipment, including all interconnections for executing such tests, must be supplied by the Contractor.
- (4) The Contractor or Employer shall provide the electrical supply at the specified voltage and rating free of charge where required to test the equipment on site.
- (5) Should the results of such tests prove that the equipment does not comply with the requirements of this specification, the Contractor shall, without delay, at his own cost undertake modifications and adjustments as required, to ensure that the installation and equipment is modified to comply with the requirements of this specification. These modifications and adjustments shall be carried out with the full knowledge and approval of the Engineer.

3.9.4 Acceptance Tests and Test Schedule

3.9.4.1 *General Requirements*

- (1) The Contractor shall submit a draft of a recommended acceptance test plan for the equipment before proto-type test as required may be necessary to demonstrate the performance capability of the equipment. Two (2) months before the final commissioning and completion of the installation these acceptance test schedules shall be updated before final inspections are conducted on site.
- (2) The Engineer shall review the final acceptance test plan and submit to the Contractor any alternative test procedure and/or testing methods and plans. Such a revised test plan shall be incorporated by the Contractor in the final acceptance test plan scheduling the testing procedure on the site prior to handover.
- (3) In general the draft acceptance test plan shall incorporate the following:
 - (a) Detailed test procedures
 - (b) Tabulated results and recording sheets to be obtained during testing, including tolerance ranges, limits, etc.
 - (c) Test equipment required.

- (d) Performance tests to determine and confirm that all electrical and electronic equipment and components as installed comply with the specification and meet the performance and other guarantees specified.
- (4) In certain instances it may be necessary to test equipment such as control boards and control consoles in the factory. Draft test plans for such items of equipment shall be submitted to the Engineer two (2) weeks prior to such tests being conducted.
- (5) Copies suitable for reproduction of test results on site or test results of tests conducted in the factory shall be submitted to the Engineer.

3.9.4.2 Test Equipment

- (1) Properly calibrated standard test equipment shall be utilized at the factory of the Contractor or his Suppliers and on site to complete the tests to comply with the final acceptance test plan.
- (2) Where necessary the Contractor shall supply all the necessary temporary cables and interconnecting conductors and cables in the factory for conducting tests in the factory.
- (3) Testing on site shall be conducted after the installation has been completed.

3.10 STRUCTURAL STEELWORK

3.10.1 General

- (1) All structural steel members, or assemblies, or frameworks in combination with floors and walls and other structural parts of the buildings, shall be capable of sustaining in a structurally stable manner and without exceeding the permissible stresses and limits of deflection hereinafter stated, the total dead and superimposed loads and forces acting on such members, assemblies, or frameworks.
- (2) The maximum deflection as a result of distributed or point type applied loads on any beam with the exception of cantilever beams, must not exceed 1/1000 of the span length. The maximum deflection of cantilever type beams must not exceed 1/500 of the length of the beam fixed at one end. The aforementioned requirements must be adhered to unless alternative requirements are specified elsewhere in the Generic Specifications.
- (3) Each part of the structural installation shall be correctly designed, constructed and erected. The construction and design shall comply with the SABS specifications covering structural steelwork.
- (4) All welded joints shall comply with the requirements as specified in this General Technical Specification.
- (5) Where applicable allowance shall be made for expansion and contraction of structural steel members to prevent undue stresses due to thermal variations in the environmental conditions.

3.10.2 Holes

- (1) Holes shall be accurately drilled to a template. Burrs and rises shall be removed from the edges of holes before the work is assembled. Wherever possible, holes shall be drilled through all mating members or components in one operation.
- (2) The accuracy of all holes shall be such that when the work is assembled, a steel gauge of 0,8mm less than the diameter of the holes can be passed through irrespective of the number of plates. Drift pins shall only be used for bringing the work together and no drifting enlargement of any holes will be allowed.

3.10.3 Bolts

- (1) Bolts shall have well-formed heads forged from solid steel. Nuts shall closely fit the bolts so that they can only just be turned by hand and at least one clear thread shall project beyond the nut when fully tightened.
- (2) All bolts shall have one serrated or spring type lock washer under the nuts or bolt heads, whichever is to be rotated during the tightening operation, and shall be so tightened that the threaded portion does not bear on the members connected. Where bolt heads or nuts bear upon bevelled or tapered surfaces they shall be provided with tapered washers of 2,3mm mean thickness to provide a seating square with the axis of the bolt.
- (3) Where holding down bolts, brackets, etc., are to be embedded in concrete they are to be fixed in their individual exact positions. Any cost incurred by subsequent repositioning of bolts, etc., resulting from the incorrect setting will be for the Contractor's account.

3.10.4 Connections

All steelwork shall be shop welded and site bolted. Site welding will not be allowed without the approval of the Engineer. All end connections shall develop the full strength of the respective connected members.

3.10.5 Erection

- (1) The method of erection shall be approved by the Engineer.
- (2) The Contractor shall take all precautions to ensure safety and stability of the steelwork during erection and shall ensure that all steelwork is set in the exact position both horizontally and vertically as shown on the workshop drawings.
- (3) Should the Contractor find it expedient to erect any of the individual structural units in sections, he must obtain the Engineer's written approval of the position of the joints in the unit and the details of the splicing, etc., he intends using.
- (4) No loading by stacking or placing materials or plant on any portion of the steel structures will be allowed without the prior permission of the Engineer.
 - (a) "Erection" shall include the installation of all items specified in the specification and shown on workshop drawings.

- (b) Where machine base frames or steel structural members are supported on concrete floors or fixed against concrete walls, the steel structures shall be properly aligned by installing supporting steel plate shims and then bolting the machine frames and steel structures to the concrete by means of the specified anchor bolts. Timber wedges shall not be acceptable.
- (c) The Contractor shall set out, check and measure the line, level and plumpness of all steelwork using suitable recognised measuring instruments such as levels, theodolites, etc.
- (d) After the steel bases have been properly aligned and fixed as specified, the support points of steel bases and structures shall be provided with grouting by the Contractor to fill and close off all open spaces between steel shims and the lower face of the steel machine bases and structures. This grouting shall be neatly tapered to prevent any water or moisture from collecting against the steel machine bases or steel structures, and a proper bond between the grouting and the concrete structure shall be ensured.
- (e) Unless otherwise specified, the grouting shall be of 30 MPa strength.
- (f) All cutting of steel plates and sections shall be done with profile cutters.

3.10.6 Concrete Bases and Holding Down Bolts

- (1) All concrete bases and general concrete structural work shall comply with the general requirements as specified in the Generic Specifications.
- (2) The Contractor shall be responsible for the accurate positioning of holding down bolts in concrete foundations and bases. The Contractor shall be required to check on site the location of the holding down bolts to satisfy himself as to their accuracy prior to the delivery of steel structures and in any event seven (7) days before erection.
- (3) Holding down bolts shall be supplied in groups welded to form a grid with the grid holding straps at least 15 mm under the finished surface of the concrete.
- (4) After the steel machine bases or steel structures have been anchored by means of the holding down bolts after the members have been properly aligned by the installation of steel plate shims, grouting shall be provided as infill at all spaces below such steel structures similar to the grouting as specified.

3.10.7 Accuracy of Fabrication and Tolerances

- (1) All steelwork shall be fabricated to an accuracy so as to enable erection to the specified tolerances to take place without introducing permanent erection stresses into the structure.
- (2) The following fabrication tolerances shall apply:
 - (a) Deviation from line on any edge or surface: 1:1000 but not more than 6 mm
 - (b) Length of member: approximately 1 mm
 - (c) Distance between bolt or rivet holes and/or welded connections: approximately 1 mm

(d) Machined surfaces: approximately 0,025 mm

3.11 WELDING

- (1) Welding must be done under the supervision of a qualified person, who must decide on the sequence and welding procedure to be adhered to.
- (2) The welders employed by the Contractor during manufacture and erection must if required by the Engineer or Employer, undergo a test in welding.
- (3) The surfaces to be welded and the surrounding metal for a distance of at least 15 mm shall be cleaned and free from rust, scale, paint or other forms of foreign material. Fusion faces may be cut by shearing, clipping, machining or machine gas cutting. If the fusion face is rough, it shall be ground smooth before welding.
- (4) Welding shall be carried out in a manner which will prevent any distortion of the weld or the parent steel section.
- (5) Welds shall be of full strength without flaws, grooves or pits. Crater effects shall be prevented at the end of all welding joints.
- (6) All welds shall have adequate root fusion and shall be free from cracks, porosity or other irregularities and any undercutting shall be made good by the deposition of additional runs of weld metal. Any completed welds showing cracks, cavities or other defects shall be cut out and made good at the Contractor's own cost.
- (7) Intermittent welding joints and butt welding joints without sufficient penetration shall not be used. Joints in all main structures shall be annealed where necessary.
- (8) Welding shall only be done in the workshop or on level concrete floors on site only. In situ joints shall all be of the bolted type, unless specifically approved by the Engineer. In the latter case the Contractor might be called upon by the Engineer to have tests and inspections conducted of such joints in terms of the requirements stated.
- (9) When welding is done on site on steel plates and/or brackets cast into concrete, the plates shall be cooled by a cooling method which prevents the heat generated from damaging the concrete.
- (10) All welding joints must be thoroughly cleaned after welding.
- (11) The Engineer may at his discretion have welding joints inspected and tested by experts or a recognised Bureau of Standards to determine whether such joints comply with the specification. Should any doubt on the strength of a joint exist the Engineer may at his discretion instruct the Contractor to have such joints subjected to X-ray inspection.

3.12 FIXING OF STEELWORK COMPONENTS TO CONCRETE FLOORS, CONCRETE WALLS AND CONCRETE CEILINGS

- (1) Steelwork or any other components of the installation shall be fixed where necessary to concrete floors, concrete walls and concrete ceilings only.
- (2) Where steel components must be fixed to concrete walls by means of bolts and nuts, this shall be done by means of a self drilling anchoring system or by means of bolts

inserted in holes drilled in the concrete and fixed by means of the "Chemset" type anchoring system.

- (3) Where steel components must be fixed to concrete floors, the steel must be fixed by means of holding down bolts as specified or alternatively by means of the "Chemset" type anchoring system or expansion bolts.
- (4) In the event of any such bolts striking reinforcing steel in existing concrete structures, the bolts will have to be repositioned as specified by the Engineer. Base plates or gusset fixing brackets and plates will also have to be amended accordingly.
- (5) Alternatively a diamond tip drill may, with the approval of the Engineer, be utilized to drill into concrete and steel simultaneously for installing such anchor bolts.
- (6) No claims for additional cost in respect of such adjustments or modifications will be entertained. The Contractor must utilize a suitable testing device for ascertaining the position of reinforcing steel before drilling such holes for installation of anchor bolts.
- (7) Where load-bearing steel components must be installed in areas where brick walls are provided, special steel angle, channel or I-sections shall be installed spanning the brick wall section and bolted to concrete sections of the wall. Components shall then be welded to the latter sections.
- (8) Where non-direct load-bearing steel components are installed, these may, with the approval of the Engineer, be fixed to brick walls by means of bolts and nuts fixed with expansion bolts.

3.13 MECHANICAL INSTALLATION EQUIPMENT AND COMPONENTS

3.13.1 General

- (1) All material, equipment and components shall be of the best quality for the purpose and shall be new and manufactured of materials that are completely free of all obvious imperfections such as slag inclusions, cracks and blowholes.
- (2) No castings, forgings or any other materials that are obviously faulty shall be acceptable, not even under guarantee of replacement in case of failure.
- (3) No painting or filling-up of castings shall be permitted prior to inspection by the Engineer. No repair shall be undertaken on castings without the written consent of the Engineer.
- (4) All castings irrespective of type shall be thoroughly cleaned and annealed prior to final machining.
- (5) All holes and all securing bolts for equipment and components shall be properly fitted in the relevant holes and shall be accessible and must be securely locked, generally complying with the requirements as specified in the General Technical Specification of this document.

3.13.2 Bearings

- (1) All bearings installed shall be ball or roller bearings of the heavy duty or medium type based on a minimum life of 20 000 hours.
- (2) Unless these bearings are installed in an enclosure such as in a gearbox where splash lubrication is applied, these bearings shall be of the permanently lubricated and double sealed type (sealed on both sides).
- (3) Drawings showing the detail and positions of such bearings shall, if required, be provided by the Contractor. Detail of mounting, supporting and if applicable lubricating, such bearings shall be shown on such drawings. The manufacturer and the type of bearings which will be installed for the particular drive system shall be shown.
- (4) In certain applications where noise is a critical factor to be considered, special journal bearings of white metal or phosphor bronze may be used upon approval by the Engineer.
- (5) A standardised method of lubricating such bearings must be installed. The lubricating orifice shall be easily accessible.
- (6) All bearing enclosures must be dust-proof and where necessary packings must be installed to enclose bearings within bearing housings to prevent the ingress of dust.
- (7) The bearings shall be supported in rigidly designed cases, free from latent stresses and structural defects. The cases may be of close grained cast iron or of fabricated steel construction, stress relieved before machining.
- (8) Where applicable, bearings for diverter pulleys shall be of the permanently sealed type and installed with the inner ring securely fitted and clamped on the supporting shafts. Where applicable, bearings supporting the shafts of traction pulleys shall be of the permanently sealed type with the outer ring securely fitted and clamped in the supporting shrouds and bearing pedestals.
- (9) All sets of bearings supporting a particular shaft must be aligned and installed accurately to ensure smooth and vibration-free operation of the particular shafts.

3.13.3 Gearboxes

3.13.3.1 Gearbox Casing

- (1) All gearboxes shall be of rigid construction, manufactured either from mild steel plate (fabricated) or closed grained cast steel or cast iron, and shall be easily dismantled and designed to suit oil bath lubrication of the gears and splash lubrication of the support bearings.
- (2) The gearboxes shall be totally enclosed, dustproof, drip-proof and shall be equipped with inspection covers, drain and filler plugs, suitable oil seals, gaskets, level indicators and lifting lugs as required.
- (3) The gearboxes shall be stress relieved before final machining.
- (4) Fabricated boxes shall be guaranteed against distortion when in service.

- (5) The interior of all gearboxes shall be thoroughly cleaned, in the case of castings, by shot blasting or other suitable method, and shall be subject to paraffin tests for oil tightness prior to painting with an oil resisting enamel paint of a light shade.
- (6) Gearboxes to be installed for all hoist machinery utilized in an environment where persons will move below the hoist system as part of their duty or function (such as in theatres), shall be of the self-locking type at standstill or the complete drive unit shall be provided with two independent operating disc brakes. Should the driving power to the motor fail and one brake to the drive system fail, the drive system must be stopped by the second brake or by the inherent self-locking properties of the gearbox.

3.13.3.2 *Spur and Bevel Gears*

- (1) Spur gearing shall be of the double helical or straight spur type, unless otherwise stated. Bevel gears shall be of the spiral type.
- (2) Pinions shall be cut from solid blanks of heat treated forged steel.
- (3) Straight and helical gears shall have teeth of involute form, with a pressure angle of 20°, while double helical gears shall have a helix angle of 30°.
- (4) The proportions of the gears shall comply with BS 436 but the Contractor could offer gearing in accordance with the relevant DIN Standards or other recognised gear standards, provided the size and width of teeth chosen is in no way less than the life and strength requirements of the relevant BS specification. Special consideration shall be given to having gears cut to reduce the noise level of meshing gears.
- (5) Special attention must be given to ensure that the noise level of pairs of meshing gear teeth is a minimum. The gear teeth must be machined such that the generation of noise in a gearbox could be limited to a minimum.
- (6) All gears shall be machine cut to a high grade and shall be suitably heat treated before final machining.
- (7) The use of abrasives to polish or run-in gear tooth flanks, after assembly of the gearboxes, is not permitted without the written consent of the Engineer.
- (8) First and second stage pinions and gear wheels shall not be overhung. All pinions and gear wheels shall be supported between ball or roller bearings and shall be pressed on their shafts in addition to being fitted with keys and keyways. Final motion gearing shall, however, be shrunk and fitted with keys and keyways.

3.13.3.3 *Worm Gears and Wheels*

- (1) The worms shall be of involute helicoids thread form, integral with their shafts and shall be made from high tensile case-hardened alloy steel. They shall be accurately cut, hardened, ground and finished to precision limits.
- (2) The worm wheels shall be made of phosphor-bronze, centrifugally cast and shrunk on and secured to their shafts. The teeth of the worm wheels shall be hobbled to fine limits on specially designed machines ensuring accurate tooth form.

- (3) Both worm and wheel shafts shall be fitted with high quality dual-purpose ball bearings of suitable capacity for the radial and thrust loads imposed. Provision shall be made for and additional roller bearing on the wheel shaft in the cases where heavy overhung loads are imposed.

3.13.3.4 Lubrication

- (1) A positive lubrication system shall be installed to ensure a continuous film of oil between all meshing gear worm threads and wheel teeth to give high efficiency effective rotation in either direction.
- (2) All bearings shall receive an adequate supply of lubricant.
- (3) The lubrication system of gearboxes shall incorporate features such that the ball or roller bearings supporting the shafts in the gearbox are thoroughly lubricated when utilizing a splash type lubricating principle. Special care shall be taken such that lubrication of such bearings will be adequate even during slow speed of the gearbox (speeds at approximately 20 per cent of the nominal speed of the gearbox). Should this not be the case for normal commercially available gearboxes, special precautions and measures shall be taken for lubricating such bearings.
- (4) If required, the latter precaution shall include the supply and installation of a separate gear type oil pump complete with oil reservoir and feed lines connected to oil bath of the gearbox and provided with supply pipes leading from the oil pump to the discharge area within the gearbox to allow for proper lubrication of such bearings.
- (5) The quantity and viscosity of the oil required shall be given on the data plate fixed to the gear case.

3.13.4 Shafts and Couplings

3.13.4.1 Shafts

- (1) All shafts, axles, spindles, etc., shall be manufactured from the best quality steel, accurately machined with closely fitted keyways as required, of sufficient strength for the maximum combined stress to which they will be subjected.
- (2) Shafts shall generally be manufactured of EN 19 type steel with a T-grade heat treatment unless otherwise specified.
- (3) The machining tolerances of shafts where ball or roller bearings shall be fitted, must be within the range of 0,1 to 0,6 micron.
- (4) When determining shaft sizes, the exact size shall be determined according to the dynamic loading on the shafts in respect of the permissible bending stress, shear stress, crushing stress at support points and the maximum acceptable deflection for the particular application as utilized in the installation.
- (5) Particular attention shall be given to the conditions of load when shafts are subjected to cyclic stress variations to ensure that the shaft dimensions are within acceptable dimensional requirements to prevent failure due to fatigue.
- (6) The design and layout of shafts shall be such to permit easy removal for repairs.

- (7) All shafts shall be supported by a minimum of two bearings.
- (8) All shafts shall be of the bright steel type covered with a rust preventative varnish when machined. After installation the protective coating shall be redone should the surface be damaged during installation.
- (9) In particular applications, the shafts utilized for diverter pulleys shall be installed as fixed shafts between supporting plates and the pulleys shall be provided with bearings as a free-running component on the shaft.
- (10) These shafts shall be provided with a bolt head type collar at the one end and a slot at the other end such that the shaft could be locked between the supporting plates by means of a flat steel plate bolted to the side cover plates by a minimum of two M8 bolts screwed into the side plates to prevent the shaft from rotating.

3.13.4.2 *Shaft Couplings*

- (1) All shaft couplings shall be of machined steel, flanged or geared flexible type, except in particular applications where special type couplings are specified.
- (2) The flexible couplings shall serve to accommodate errors in alignment of shafts, or to accommodate relative axial motion of two shafts in order to isolate each from the effect of end thrust from the other.
- (3) The flexible couplings shall also have torsional flexibility to provide a cushioning effect against shock loads and cyclic torque fluctuations and shall thus reduce the destructive effects on associated mechanisms. The flexible couplings shall also serve the purpose of damping the torsional vibrations by the dissipation of energy in the flexible elements.
- (4) All couplings shall be fitted to the driving and driven shaft by means of keys and keyways. Taper lock type of couplings may only be utilized for special application upon approval of the Engineer.
- (5) If specified, all couplings utilized as brake drums must be machined and manufactured such that the braking torque applied by drum type brakes could be applied directly to the outer periphery of the driven (load side) of the coupling.

3.13.5 Disc Type Brakes

- (1) Where specified in the Generic Specifications, the Contractor shall supply and install disc type brakes for the units as specified.
- (2) When installed, these brakes shall be utilized with the drive system with the axis horizontal.
- (3) The disc brakes shall be provided complete with steel hub provided with boss and keyway for fitting on the driven shaft.
- (4) The driving hub shall carry the rotating friction discs and shall be installed to operate freely between the stationary springs and thrust braking plates.
- (5) The hub shall be provided with friction faces on both sides of the hub.

- (6) The brake shall be released by an electro magnet connected to a DC supply or alternative supply as specified in the Generic Specifications. As soon as the power is switched off, braking torque shall be applied by means of the action of springs applying the braking force on the braking pads operating on the hub.
- (7) All coils installed for the disc brakes shall have a Class B insulation and each brake shall be provided with a hand release lever such that the brake could be opened manually.
- (8) All brakes shall be supplied with sheet steel covers fitted with neoprene gaskets to prevent the ingress of foreign matter. A removable plate shall be fitted to the magnet and spring side of the brake such that the brake could be installed with through shaft applications, if required.

3.13.6 Rope Drums

3.13.6.1 *Traction Driving Rope Drums*

- (1) The rope drums used throughout the complete installation shall be of high quality cast iron or steel, free from surface defects or shall be of welded steel construction as specified.
- (2) The drums shall be machine grooved and shall be sufficiently wide to accommodate multi-way grooves for the number of rope laps required to obtain positive traction for all the ropes required for the particular hoist or driving system.
- (3) The drum shall be flanged at both ends and the flanges shall project a distance not less than two rope diameters above the outer periphery of the rope.
- (4) The minimum drum diameter at the bottom of the grooves shall be at least forty (40) times the rope diameter.
- (5) The contour at the bottom of the grooves shall be circular over an angle of approximately 120°. The radius of the groove shall be larger than the radius of the rope by not less than the amounts specified in BS 466. Grooving shall be finished smooth and be free from surface defects which may damage the ropes. The grooves shall be pitched so that the specified clearance between neighbouring turns of rope shall be maintained. The grooves shall be undercut to increase the friction between the rope and drum for the driving system.
- (6) The drums shall be provided with rope guards lined with grooved hardwood pads to retain the ropes in the grooves of the drum.
- (7) The traction drums shall be machined bored and fitted with keys and keyways for fitting to the shafts. The grooves shall in general comply with the requirements utilized in the passenger lifts engineering industry.

3.13.6.2 *Winding Rope Drums*

- (1) The rope drums used throughout the complete installation, i.e. the counterweight systems and hoisting equipment, shall be of high quality cast iron or steel free from surface defects, or shall be of welded steel construction as specified.

- (2) The drums shall be machined grooved and shall be sufficiently wide to accommodate the whole working length of the rope in one layer and allowing where applicable, at least two spare turns at each anchored end and one spare groove at the opposite end. Rope anchorages shall be readily accessible.
- (3) The drums shall be flanged at both ends and the flanges shall project a distance not less than two rope diameters above the outer periphery of the rope.
- (4) The minimum drum diameter at the bottom of the grooves shall be at least twenty-five times the rope diameter.
- (5) The contour at the bottom of the grooves shall be circular over and angle at approximately 120°. The radius of the groove shall be larger than the radius of the rope by not less than the amounts specified in BS 466. Grooving shall be finished smoothly and be free from surface defects which may damage the ropes. The grooves shall be pitched so that the specified clearances between neighbouring turns of rope shall be maintained. This specification shall also apply to multi-way drums that may be used.
- (6) The rope drums shall be machined bored and fitted with keys and keyways for fitting to the shafts.

3.13.7 Pulleys

3.13.7.1 *Traction Driving Pulleys*

- (1) The general construction of traction driving pulleys shall be similar as specified for traction driving rope drums. The profile of the groove of single and parallel multi groove traction pulleys must, however, be machined to ensure that the friction between the hoist or hauling rope and the traction pulley groove is sufficient for the drive application as specified.
- (2) In general the grooves of such traction pulleys shall be machined to comply to the following requirements:
 - (a) The profile of the groove must be circular with the radius equal to the radius of the rope spanning a minimum lap angle of 120° and an included angle of between 25° to 35°.
 - (b) The profile of the groove must be undercut at the base of the groove to increase traction between the rope and traction pulley.
 - (c) Alternatively the profile of the groove must be V-shaped with the base of the groove smaller than the rope diameter to increase traction between the rope and traction pulley. The base shall be slightly rounded to comply to the standards as specified by rope manufacturers to comply to the specific rope size for the particular application.
- (3) The arrangement of the traction pulleys must be such that the lap angle of the rope over the pulley is large enough to ensure that the required traction effort transmitted from the traction pulley to the rope without slip, complies with the requirements as specified.

- (4) The minimum diameter of the traction pulley must 40 x the diameter of the rope but shall not be less than 450 mm.
- (5) Each traction driving pulley shall be provided with a rope guard lined with a grooved hardwood pad at the points where the hauling rope enters and leaves the groove to retain the ropes in the grooves of the pulley.
- (6) The traction driving pulley shall be machine bored and fitted with keys and key-ways for fitting the pulley onto the driving shafts.
- (7) The pulleys shall be sufficiently wide to accommodate multi-way grooves for the number of rope laps required to obtain positive traction for all the ropes required for the particular hoist or driving system.

3.13.7.2 Diverter Pulleys

- (1) All diverter pulleys shall be manufactured of high quality cast iron or steel.
- (2) The pulleys shall be machine grooved to a depth of not less than one and a half times the diameter of the rope. The grooves shall be finished smoothly and be free from surface defects which may damage the rope.
- (3) The grooves shall be machined according to recommended BS or DIN standards for general purpose diverter pulleys. The grooves shall be provided with an inclined angle of 40° to 45° and the root diameter shall be 72 per cent larger than the rope diameter.
- (4) The minimum pitch circle diameter of the diverter pulleys shall be nineteen times the rope diameter when utilized with 6 x 36 strand steel ropes. The minimum pitch circle diameter of diverter pulleys utilized as main diverter double lap roping system with traction pulleys, shall be equal to the traction pulley pitch circle diameter.
- (5) Pulleys supporting or guiding ropes shall be provided with guards lined with hardwood pads mounted on steel brackets to retain the ropes in the grooves.
- (6) The pulleys shall all be provided with ball or roller bearings mounted on the pulley shafts. The bearings shall be packed with grease and be of the permanently sealed type.
- (7) Generally the bearings shall be mounted on the shafts such that the pulleys shall be free-running on the shafts. In exceptional cases the pulleys could be installed with a key and keyway on the shaft and the shaft be supported by means of pedestal mounted type bearings bolted to the steel supporting beams or framework of the machine frames.
- (8) Generally the pulleys supported free-running on shafts, shall be mounted between two reinforced supporting side plates provided with angle section reinforcing members and gusset sections such that the pulleys could be fixed to the supporting steelwork or supporting trusses in the positions as required and be fixed to the supporting steelwork by means of bolts and nuts.
- (9) Such free-running pulleys shall be provided with a suitable number of spacer rings mounted on the shafts to ensure that, when the shaft is clamped between the two side supporting plates, the bearings are correctly supported to allow for the pulleys to be installed in the centre between the supporting plates.

- (10) The arrangement of diverter guide pulleys in relation to traction pulleys shall be such that the angle of lap of the rope on the traction pulley shall ensure that the required traction force is transmitted from the drum to the ropes without slip.

3.13.8 Steel Ropes

- (1) All ropes to be utilized for general purpose drive systems for hoist application systems, shall be of the type as recommended by the manufacturer of the steel rope specifically applicable for elevator and escalator machinery. Where diverter pulleys smaller than 40 times the rope diameter are utilized, the ropes shall be of the 6/36 or 6/37 stranded construction.
- (2) All steel ropes utilized in a single fall of rope with a drum type hoist system shall be of the non-spin steel rope type such that the hoist unit shall not spin once the hoist system is utilized in the single rope fall type of hoist configuration.
- (3) The specified nominal breaking strength of the hoisting ropes shall not be less than ten (10) times the maximum working loads applied in each case, or according to the regulations applicable to the installation as specified in the General Technical Specification of this document. Should the load be supported by more than one fall of rope, the rope system shall be equalised. Where multiple ropes are used in any application, provision shall be made for adjusting their effective lengths, in order to equalise the tensions.
- (4) Suitable shackles, thimbles, ferrules and cable grips sized for each particular rope size, shall be installed wherever required. Ferrules installed for clamping ropes at rope ends shall only be utilized with the prescribed electro-hydraulic crimping machine, to ensure that the correct crimping pressure is applied to such ferrules.
- (5) Free rope ends shall be effectively bound to prevent the strands from fraying.

3.13.9 Power Driving Units

3.13.9.1 *Machine Frames*

- (1) Each driving unit, consisting of e.g. electric motor, gearbox, drum, couplings, hydraulic pump and control valves, etc., shall be mounted on a rigid machine frame.
- (2) The machine frames shall be fabricated of structural steel sections of sufficient strength and rigidity, welded together to the standard specified. In places where machine components are fixed to the frame, such surfaces shall be properly machined.
- (3) The assembled components and the complete machine frame shall be mounted on vibration dampers and sound attenuating devices to prevent the transmission of noise from the machine frame to the steel components installed on the supporting structure.
- (4) The vibration dampers and sound attenuating devices shall be installed for such machine frames in all main stage areas including side and back stages and stage basements and in areas adjacent to reception, office areas and general areas open to personnel.
- (5) Vibration dampers shall be installed such that the flexible elements are subjected to compressive or combined compressive and tensile load only.

3.13.9.2 Safety Covers

- (1) Removable safety sheet steel covers or wire mesh covers fitted with steel plate edge trims shall be installed to enclose or shield exposed moving components of drive systems from accidental contact by maintenance or operating personnel, where applicable to meet the requirements of the regulations as specified in the General Technical Specification of this document.
- (2) These safety covers shall be secured to the machine frames by means of a minimum of four bolts and nuts.

3.14 PAINTING AND FINISH OF STRUCTURAL STEELWORK AND MECHANICAL EQUIPMENT

3.14.1 General

- (1) All surfaces of structural steel members, including galvanized steel components and general components manufactured of cast iron, steel or any other alloy which under normal environmental conditions would be subject to corrosion shall be suitably protected as specified.
- (2) Paint shall be supplied in containers clearly marked with the manufacturer's name and the identifying brand number or name.
- (3) The paint shall be used as prepared by the manufacturer without thinning or other admixture, unless epoxy based paints are utilized.
- (4) All painting shall be done on dry surfaces which have been thoroughly power wire brushed or sand blasted so as to be free from rust, scale, grease or any other foreign matter to the satisfaction of the Engineer.
- (5) The type of paint utilized for structural steelwork and mechanical components shall comply with the requirements of the appropriate SABS specification and the correct primer coat shall be utilized with the appropriate final coat of paint as specified.
- (6) Galvanised components to be painted must initially be rinsed with a galvanised metal cleaner and thereafter a galvogrip calcium plum bate metal primer shall be applied before the final coat of paint to the surfaces is applied.
- (7) Should alternative paints be offered which do not comply specifically to SABS specifications, complete detail of the specification to which such paints apply or detail of the particular paints as offered, must be submitted at tender stage.
- (8) It is important that detail technical information be submitted should alternative paints be utilized, e.g. water based paints on structural steelwork, steel components or other type of metals.

3.14.2 Preparation of Steel Surfaces Before Painting

- (1) Depending upon the condition of the steel surfaces, the process of preparing these surfaces must be such that physically adhering contaminants are removed and, if required, chemical bonding contaminants must be removed according to the requirements of SABS 064.

- (2) Millscale, corrosion, weathered and disintegrating paint must be removed by means of scraping and brushing by hand or other mechanical means. Should this method not be possible, an acceptable grit blasting process must be utilized to prepare steel surfaces for painting.
- (3) After the cleaning process has been completed, a method of protecting the steelwork against corrosion must be applied according to the requirements of SABS 1200 HC. Dust, debris and decaying material which is present on the substrates of the steel surfaces must not exceed the recommended minimum of 0,3 % as described in SABS SM 769 before the primer coat of paint is applied.

3.14.3 Painting of Structural Steelwork

- (1) Before despatch from the factory, all structural steelwork used in the installation shall be painted with a zinc chromate or equivalent primer coat suitable for an epoxy based paint in compliance with the requirements of the appropriate SABS specification for structural steelwork. The paint shall be applied within 4 hours after wire-brushing or sand-blasting. The minimum film thickness shall be 0,025 mm.
- (2) A type 1 grade 1 primer shall be used throughout. The primer coat shall be applied before any portions are assembled.
- (3) All field bolting and welds and abrasions of the initial coats of paint shall be spot painted with the paint used for the final coat.
- (4) Structural steelwork must be covered with a single layer of corrosion inhibiting primer coat and thereafter with two separate coats of paint in agreement with SABS 1200. Structural steel exposed to the atmosphere must be provided with such coats of paint as specified in clause 5.8 of SABS 1200 HC and special care must be taken that the requirements of this specification are complied with.
- (5) Depending upon alternative type of water based paints as offered, the Engineer will determine whether such a primer coat is required before steelwork is despatched from the factory.
- (6) Certain paints of the type presently not complying to the SABS specification, include special corrosion neutralising additives which ensure that the paint is best applied after erection on site.
- (7) This alternative approach must however be done under strict control to ensure that steelwork is painted before corrosion has occurred in excess of the effective neutralising additives treatment can be effected.

3.14.4 Mechanical Equipment and Components

Equipment and components must be painted with a suitable primer and a minimum of one coat of paint of the final colour before being dispatched from the factory and shall comply with the requirements specified for structural steelwork.

3.14.5 Final Finish on Site

- (1) As soon as the installation of steelwork, equipment and components has been completed on site and after the building structure has been waterproofed (BY OTHERS) and after damaged paintwork and corroded areas have been thoroughly cleaned and treated as specified for structural steelwork, the steelwork, equipment and components shall be painted with two coats of a high quality paint in agreement with the appropriate SABS specification.
- (2) A minimum of thirty-six (36) hours shall elapse before succeeding coats of paint are supplied.
- (3) The equipment must be painted according to a colour code as determined by the Architect or as specified for colour codes.
- (4) Samples of all colours to be used shall be submitted to the Engineer and Architect for approval.
- (5) The minimum film thickness of the paint of all painted surfaces shall not be less than 0,06 mm. Care shall be taken that all edges, peaks and crevices are properly covered.
- (6) The paint shall have an impact resistance of 2,3 Joule and a tensile strength of 10 mPA tested by the Gardner direct impact test.

3.14.6 Colour Code

- (1) Generally the colour codes to be applied for particular equipment, shall comply with the general colour code specified by NOSA (National Organisational Safety Association).
- (2) For the particular installation as specified, the following general colour codes (according to SABS 1091) shall be applied, unless otherwise specified in the Generic Specifications:
 - (a) Fixed structural steelwork, i.e. supporting masts, steelwork, frames and structures, etc.:
Matt Black or as specified in the Generic Specifications
 - (b) Moving steel components, such as shafts, couplings, levers, pulleys, traction drums, etc.:
Light Orange - Code B26
 - (c) Large structural moving components, such as counterweight frames:
Light Orange - Code B26
 - (d) Counterweights:
Light Orange - Code B26
 - (f) Mechanical equipment and components, such as motors, gearboxes, brakes, etc.:
Mid Grey — Code G25

- (3) Wherever structural steel elements project into normal walkways or access paths (e.g. in the grid area) chevrons shall be painted on the protruding elements in 45° diagonal Lemon Yellow (Code C54) and black lines, each approximately 85 mm wide.

3.15 CONTROL BOARDS AND CONTROL CONSOLES

3.15.1 Control Boards

3.15.1.1 *General*

- (1) The boards shall be manufactured with a steel angle section framework and shall be equipped with sheet steel removable panels fitted to the framework.
- (2) The sheet steel shall have a minimum thickness of 1,6mm.

3.15.1.2 *Construction*

The construction of the boards shall be such that isolators, circuit breakers, contactors and all other electrical control equipment are mounted on the framework. Upon removal of the panels the wiring and equipment shall be easily accessible.

3.15.1.3 *Conductors*

Conductors of the internal wiring shall be large enough to carry the current in each respective circuit. Current ratings shall comply with the regulations as specified in the General Technical Specification of this document.

3.15.1.4 *Cable Gland Support Brackets*

- (1) Removable cable gland support brackets shall be fitted at the bottom just below the terminal strips and approximately 200 mm above the base of the board.
- (2) Should the terminal strips be installed at the top of the control board the upper framework and sheet steel panels shall be suitably strengthened to allow for the connection of the glands of the cables to the top panels of the control board.

3.15.1.5 *Panels*

- (1) Panels shall be of sheet steel, suitably stiffened with machine punched slots to allow for flush mounting of circuit breakers and isolators, such that toggles only protrude at the front panel.
- (2) Punched slots for future circuit breakers shall be fitted with blank plates. The space allowed for future installation of circuit breakers and isolators shall be provided with steel cover plates which shall be fixed to the panels by means of epoxy type adhesive.
- (3) Each panel shall be provided with return edge sections to cover rebate edge sections provided in the control board frame when the panel is fitted on the framework. Alternatively the panels can be installed flush in the board framework covering the rebate edge sections.
- (4) Panels shall be attached to the frame by means of studs and chromium plated brass hexagonal dome nuts and washers. Panels may also be fitted by means of two pins at

the bottom and a lock at the top. The panels shall be fitted with chromium plated handles for purposes of removal.

- (5) The distance between the panel and the inside of door(s) shall not be less than 35 mm in cases where doors are required.

3.15.1.6 Doors

- (1) Doors must have a smooth flat finish and shall be suitably braced to ensure stiffness. Doors must generally be manufactured similar to panels as specified.
- (2) The width of single doors must not exceed 600 mm and each door must be provided with suitable hinges supplied complete with latching washers to prevent doors from opening more than 120 ° such that paintwork on adjacent doors or panels cannot be damaged.
- (3) All doors shall be constructed of sheet steel with a minimum thickness of 2,0mm.
- (4) When doors are opened it must be possible to remove the doors from the hinges.
- (5) The doors must be provided with a latch flush mounted in the door panel and shall be provided with a rectangular 6 mm pin utilizing a normal standard rectangular key for opening the door.

3.15.1.7 Isolator or Isolating Switch on ohe Board

- (1) The main isolating switch or main isolator on the control board must be interlocked with the door panel such that the door panel can only be opened when the isolating switch is switched to the "OFF" position.
- (2) Should a control board be provided with control subsections for different components and these control components be connected to a common incoming supply, the Contractor shall install all interconnections to the main isolating switch on the control board.
- (3) The Contractor shall install separate sub circuit breakers to isolate and provide a supply connection to each subsection of the board. These circuit breakers shall be suitably graded such that over-current discrimination can be achieved with the supply circuit breaker to the particular control board.

3.15.2 Control Consoles

3.15.2.1 General

- (1) In general, control consoles shall be manufactured in a similar fashion to the control boards.
- (2) The following features shall be incorporated in the manufacture of control consoles as specified hereafter.

3.15.2.2 Construction

- (1) The construction of the operating face shall be such that equipment to be controlled such as individual controllers, toggle switches, push buttons and other control equipment protrude from the face of the console and are clearly visible to an operator. They shall be within easy reach of an operator sitting on a normal swivel writing desk type of chair.
- (2) The control equipment must be grouped and installed as compactly as practical. The grouping of equipment must in general be according to the following main groups:
 - (a) Control equipment for operating emergency equipment.
 - (b) Main control equipment used during a particular operational function.
 - (c) Subsidiary control equipment for individual control of components normally used in conjunction with the main control equipment.
- (3) The operating face of desk type consoles shall be inclined between 5° and 7° to the horizontal.
- (4) The inclined control panel of the console must be provided as a hinged panel which is installed flush in the console framework. The hinges of the panel must be provided at the far side of the console operating side whereas panels housing measuring instruments shall be hinged at the side. The panels shall be hinged to allow easy access to the wiring and connections to potentiometers, switches, push buttons, instruments, etc.
- (5) The hinged panels shall be secured at the non-hinged side by means of flush type "Philips" screws or "Dzus" type latch screws.
- (6) Desk type consoles shall be manufactured as a unit or alternatively the top section of the console must be manufactured as a separate unit from the plinth or base section of the console. The base or plinth section must be manufactured such that the console will be provided with sufficient knee space for an operator sitting on a chair in front of the console.
- (7) The height of the console nearest to the operator shall be approximately 750 mm. The base or plinth section of the console and the side and rear section of the base shall be wide enough to allow for the entry of cables on the side and bottom of the console base.
- (8) The vertical section of the plinth or base must be provided with removable cover plates similar to the panels of control boards to allow access to the console plinth and terminals installed in the console plinth. The latter cover plate panels must be installed flush in the sides and rear of the console plinth or base and must be fixed to the base section as specified for panels.

3.15.2.3 External Connections

External connections to the console must be done via the plinth or base frame of the console and must be connected to the terminals to be supplied and installed as part of the console.

3.15.2.4 Finish

- (1) Unless otherwise specified, the finish of consoles must comply with the general requirements as specified for control boards.
- (2) Should hinged steel panels be provided for inclined desk type consoles, the panels must be finished in a light grey colour. The surrounding framework of the console must be finished in a darker grey colour unless a different type of finish is specified in the Generic Specifications.
- (3) Should stainless steel type panels be specified, these panels must be brushed to a 150 grain finish parallel to the sides of the console. Samples of such a finish must be submitted to the Engineer for approval.
- (4) Should aluminium panel finishes be provided these aluminium panels must be of the anodized type similar to the aluminium panel finishes provided for standard 19" (483 mm) racks.
- (5) The plinth or base of the console must be finished as specified for control boards.

3.15.2.5 Wiring and Connections

The wiring and connections on busbars (if provided) must be done as specified for control boards.

3.15.3 General Construction and Finish of Control Boards and Control Consoles

3.15.3.1 Busbars

- (1) Busbars for each phase and neutral shall be of solid copper, each with a minimum cross section of 18 x 6 mm. The busbars shall be mounted on suitable insulators or must be connected directly to the terminals of single-pole circuit breakers.
- (2) The current density shall not exceed 1,5A/mm².
- (3) Busbars shall be mounted horizontally with the long edges of cross sections vertical and as a group, one above the other, in a vertical plane not less than 50 mm apart and 150 mm away from the nearest equipment. Each board must be provided with an earth busbar. Should the equipment installed on the board or console be provided with control equipment, which must be connected to a separate insulated or technical earth, the board and console shall be provided with an earth bar, which is insulated from the metal framework of the board or console.

3.15.3.2 Connections to Busbars

- (1) Connections to busbars shall be effected by means of lugs, sweated or crimped to wire and cable ends and bolted to busbars by means of cadmium plated 6 mm steel bolts and nuts. Bolts shall be of the hexagonal head type, with 6 mm (minimum) thread, and shall be provided with washers, spring washers and hexagonal nuts.
- (2) Three spare bolts, complete with washers and nuts, shall be mounted on each busbar to allow for future connections.

3.15.3.3 Wiring

- (1) Wiring shall be done by means of PVC insulated conductors neatly arranged in horizontal and vertical rows, and bound by means of suitable plastic band or installed in PVC type wiring ducts provided complete with snap-in type PVC plates.
- (2) The colour of the insulated conductors of the internal wiring of the boards shall be done according to a colour code used throughout the installation and the following colours must be utilized in agreement with the regulations:
 - (a) Alternating voltage phase conductors: red, white and blue
 - (b) Neutral conductor: black
 - (c) Earth continuity conductor: green or green/yellow
 - (d) Control wiring: grey
 - (e) DC voltage conductors: orange
- (3) All wiring shall be kept free and away from any exposed terminals, or other insulated current carrying components. All ends of wiring connected to circuit breakers shall be soldered or must be provided with tinned lugs which are fixed and clamped to the conductor ends by means of the hydraulic or crimping method before insertion into the terminals.
- (4) Looping from terminals of main switches, circuit breakers, isolators or contactors will be allowed for a maximum of two outgoing circuits only. Where there are more than two circuits, they shall be connected to busbars or be connected via terminals.
- (5) The boards shall be completely wired before installation. All external connections to the boards and consoles shall terminate in terminal strips.

3.15.3.4 Terminals

- (1) All external connections for control, alarm interlocking and measuring circuits must be connected to terminal strips for the control circuits.
- (2) The terminals shall be of the "Klippon" type SAK series or similar, the type number depending upon the current rating as required or as recommended by the supplier for the particular conductor size connected to those particular terminals.
- (3) All external cable connections shall terminate at the terminals.

3.15.3.5 Grouping Of Equipment and Circuits

- (1) Grouping of the control circuits and individual control components supplied and installed for one particular control function or for a particular section of the installation, shall be grouped separately from, but may be installed in the same control board console as other similar control equipment.
- (2) The extent of each individual group shall be clearly marked and fitted with a separate label, e.g.

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3.15.3.6 Subdivision in Sections

- (1) The Contractor shall verify the position of all control boards and consoles on site. For ease of transportation and to facilitate access to the allocated accommodation, the control boards and consoles may be dismantled into cubicles.
- (2) The section of the board or console shall be of suitable size to pass through doorways, passages, etc. Each section shall be rigidly manufactured to ensure that damage to the equipment will not occur during transportation and handling.
- (3) Where required, control boards or consoles shall be provided with temporary timber or steel bracing to protect the equipment and facilitate handling.
- (4) When positioned the sections shall be bolted together. Rubber packing shall be installed between joints to provide a finished appearance.

3.15.3.7 Identification Labels

- (1) Identification labels shall be installed for identifying the main function of the equipment or group of components or equipment within the area assigned to that equipment.
- (2) Control components such as contactors, relays, etc., shall each have an identification label corresponding to the identification letter and/or number shown on the schematic diagram.
- (3) Each individual control board shall have an identification label on the door stating which equipment or group of control equipment is housed in that particular board.
- (4) All labels shall consist of engraved plastic strips of the "Traffolik" type black letters or numerals on a white background and shall be fixed to or on the panel framework or below components with a non-ageing adhesive such as an epoxy type adhesive.
- (5) For individual components or equipment the size of the letters or numerals must be 6 mm.

3.15.3.8 Finish

- (1) All metal parts shall be degreased, rinsed, pickled, rinsed, phosphated, neutralised and then thoroughly dried.
- (2) Within 48 hours the metal parts shall be painted with one layer of a zinc chromate or other suitable primer utilized for an epoxy based paint, followed by two coats of good quality epoxy based paint.
- (3) The consoles shall be finished with a cured epoxy based polyurethane paint, ensuring that the surface finish of the console is very smooth and has good wear and tear properties.
- (4) In general the paint finish of control boards and control consoles shall comply with the general requirements as specified for steelwork.

- (5) After the boards and consoles have been installed on site, any damage done to the paintwork shall be neatly repaired by means of the specified epoxy based paint to the satisfaction of the Engineer.
- (6) The general external colour of the boards or consoles shall be navy light grey code G35 unless otherwise specified. The inside surfaces shall be cloud white code G80. Samples of all colours must be provided to the Engineer for approval. The finish of the paint must comply with the general requirements as specified for paintwork.
- (7) Cable gland support brackets shall be repainted after holes have been made in these panels to ensure that the openings made in the gland plate support brackets might not be the cause of future corrosion of these panels and consoles.

3.15.3.9 Drawings

- (1) Drawings of all control boards and the consoles shall be submitted to the Engineer for his approval prior to the manufacture of these boards or consoles, the Engineer shall be informed so that he may inspect them in the factory and that he may be present when the control systems are tested before despatch.
- (2) Upon completion of the installation, final "as-built" schematic diagrams of all control boards and consoles, including detail of all control and power interconnections between boards and consoles, shall be submitted to the Engineer in agreement with the requirements of the Generic Specifications. Should no requirement be specified, three copies of such drawings shall be submitted to the Engineer.
- (3) Refer to Part 5 or subsequent parts of this specification (the Generic Specifications) in respect of further details of information to be submitted for use by the Employer.

3.16 ELECTRICAL AND ELECTRONIC EQUIPMENT, COMPONENTS AND CIRCUITS

3.16.1 Selector Switches

- (1) Selector switches shall be of the cam-operated type provided with air-break type contacts. Each pole must be provided with two sliding action type contacts. The specified number of poles and the number of switching functions must be provided such that the switching functions could be done by means of one switch operating on a common shaft.
- (2) Unless otherwise specified the selector switches shall be manufactured for installation flush in control boards and consoles.
- (3) An identification label indicating the switching position and function of the selector switch for each switching position must be installed on the front face of the panel.
- (4) The contacts of selector switches must be of silver alloy and the matching mechanism must be such that the switching positions of the handle could be accurately aligned in respect of the switching positions of the contacts.

- (5) The voltage and current rating of the selector switch must be suitable for the control functions and for the current in the particular circuits to which the selector switch will be connected.
- (6) The current rating for closing contacts must be three times the normal full load current of the selector switch.

3.16.2 Contactors

- (1) Contactors shall in general comply with the requirements as specified under the heading "Compliance with Standard Specifications".
- (2) Self-locking contactors must be provided with a tripping coil and a closing coil. The contactor must remain in the closed position when the closing coil has been switched off and must open only when the tripping coils have been activated. Self-locking contactors must be suitable such that the tripping coil could be operated at 50 per cent of the normal rated voltage.
- (3) Contactors constructed in modular configuration and where auxiliary contacts could be added on site, will be the preferred type. Contactors supplied with permanent auxiliary contacts must be provided with a minimum of one N/O and one N/T spare auxiliary contact over and above the auxiliary contacts required for the particular control or interlocking circuitry. Should the number of auxiliary contacts be in excess of the normal auxiliary contacts of the contactor, additional auxiliary relays must be installed to provide such spare auxiliary contacts.
- (4) Auxiliary contacts must be suitable for a continuous current rating of 6 Amp at 220 Volt AC and unit power factor.
- (5) Auxiliary contacts with functions of make-before-break and break-before-make and wiping contacts must be provided as an inherent design of such contacts. These contacts shall not be provided by bending leaves or stems.
- (6) Spare auxiliary contacts must be wired and connected to the terminals of control boards or control consoles. Such connections must be identified on the schematic diagrams of the control boards and control consoles.
- (7) All contactors installed in groups and utilized as forward/reversing, star/ delta, main supply, emergency supply or similar control configuration, shall be provided in the control group with a mechanical interlocking system. If required, such pairs or groups of contactors shall be mounted and accurately aligned on special rigid base frames to ensure proper operation of the mechanical interlocking system.
- (8) The contactors shall be fitted with nameplates marked according to the specified requirements. The current rating shall appear on the nameplate.

3.16.3 Relays

- (1) All relays installed in the installation shall be fitted with transparent plastic or other moulded type housing. The housing shall enclose the contacts, relay mechanism and coil and shall ensure that these components are kept in a dust-free environment.

- (2) Each relay shall be fitted with a plug-in type base of Bakelite or other equivalent type of insulating material. The base shall be fixed to the control board in such a fashion that the relay and its housing may be unplugged easily.
- (3) When the relay is plugged into the base, the relay and housing shall be secured by means of a wire spring type clip onto the base framework such that the relay contacts would not be dislodged from the socket during abnormal vibration of the relays.
- (4) The choice of contact material of the relay must be done after having considered all factors influencing the operation of the relay such as:
 - (a) Current, voltage, inductance and capacitance of the circuit, and the duty cycle of the relay;
 - (b) Environmental conditions such as temperature and humidity, and
 - (c) The switching and mechanical operating mechanism of the relay.
- (5) The relays must be provided to allow for the switching functions as specified in the Generic Specifications. Contacts of the break-before-make and make-before-break type must be inherent in the design of the relay. These contacts shall not be provided by bending contact leaves or stems.
- (6) All external connections to the relay shall be soldered to the contacts on the base of the relay.

3.16.4 Push Buttons

- (1) Impulse type push buttons or self-locking type push buttons must be manufactured for the rating and the operational duty as required and must be provided with the required number of contacts for the particular circuit at which the push buttons are installed.
- (2) The push buttons must be suitable for flush mounting in control boards and control consoles or in draw boxes installed in the walls. Push buttons must be provided with a screw type fixing ring for mounting these on a sub framework in the equipment shroud.
- (3) Red push buttons must generally be provided for the "TRIP", "STOP" or "OFF" control functions, whereas green push buttons must be provided for "ON" control functions. For other control functions the colour of the push buttons shall be selected to a logical format associated with the particular function to meet the requirements of the Engineer.
- (4) Push buttons installed in walls or other non-metallic surfaces and flush mounted in the surfaces must be provided with special draw boxes such that the cover plates are installed flush in the wall.
- (5) Self-locking push buttons must be manufactured similar to impulse type push buttons. When the self-locking push button is pressed a second time, the self-locking latch of the push button must be released.
- (6) Where required push buttons must be provided with internal light emitting diodes (LED's) or key switches as specified in the Generic Specifications. If push buttons are provided with indicator lights, series resistors must be installed such that the voltage rating of the LED's are not exceeded.

- (7) Generally switching functions of push buttons shall be indicated by means of symbols or figures engraved on the moulded shroud. This shall be the preferred method of identifying the push buttons. Details of the proposed symbols shall, however, be submitted to the Engineer for approval, prior to installation of the push button bezels.

3.16.5 Indicator Lights

- (1) All indicator lights on control boards, and consoles shall be provided with light emitting diodes (LED's) only. The size of the indicator light shall be approximately 18 x 24 mm suitable for the particular applications as specified in the Generic Specifications.
- (2) The LED's shall consist of the multiple LED's installed in a common screw or bayonet cap lamp holder (depending upon the lamp holder type of the indicator light) and shall be provided complete with a series protective diode and series resistors suitable for the particular circuit. In general the number of LED's shall be suitable to fully illuminate the shroud of the indicator light (approximately 6 LED's).
- (3) Indicator lights installed on control boards and control consoles must generally be manufactured similar to the push buttons. The LED to internally illuminate the indicator light shroud must switch on when a certain switching function must be displayed.
- (4) The colour of the shroud shall be green and red for indicating an "ON" and "OFF" switching state respectively or any other colour for a particular control function as required.
- (5) Indicator lights on consoles shall generally be of the rectangular type installed in logical groups for each particular control function.
- (6) Where indicator lights are installed on boards or consoles connected to a common control voltage supply, a lamp test push button shall be installed and connected via diodes such that all indicator lights could be tested simultaneously for operation of these indicator lights.
- (7) Generally indicator light functions shall be indicated by means of symbols or figures engraved on the moulded shroud. This shall be the preferred method of identifying the display function of indicator lights. Details of the proposed symbols shall however be submitted to the Engineer for approval prior to the installation of the indicator light bezels.

3.16.6 Limit Switches and Proximity Switches

- (1) Where technically possible, proximity switches shall be installed to monitor the proximity of a particular device or component when that device or component has reached a particular position or status.
- (2) The choice of each type of limit switch or proximity switch shall be such to ensure that the most suitable type is utilized for the particular application.

3.16.6.1 Limit Switches

- (1) Limit switches shall be of robust design. The contact and switching mechanism shall be housed in a totally enclosed cast steel or cast alloy shroud. The covers shall be fitted with packings to prevent dust from entering the housing.
- (2) Micro limit switches shall be enclosed in a similar shroud as specified or may be enclosed in a robust strong type shroud of synthetic material.
- (3) Limit switches and micro limit switches shall each be provided with an activating arm suitable for the particular application.
- (4) Rocker-arm type limit switches shall be fitted with synthetic type free running rollers and a rocker arm fitted to the operating arm by means of a spline shaft, slotted or keyed type fixture. Adjustable length type rocker arms shall be provided with a serration or saw tooth edge to prevent slip in the locking clamp should the clamping screw loosen accidentally.
- (5) Spindle type limit switches (rotating shaft type) shall be of the worm gear or square tooth spindle type. The adjusting mechanism of the strikers shall be of the micro-adjustment type, utilizing a cam unit in association with a rotating gear train fitted with locking mechanism or of the micro-screw type fitted with a locking screw.
- (6) The rotating shaft shall, where possible, be fitted with needle or ball type bearings.
- (7) The gear train mechanisms shall be rugged, employing high carbon self-lubricating steel. The trains shall be of close tolerance to provide accurate mechanical performance.
- (8) The type of limit switches shall be standardised throughout the installation so that the number of different types may be kept to a minimum. If possible, limit switches supplied by one reputable manufacturer only, shall be installed.

3.16.6.2 Proximity Switches

- (1) Proximity switches shall generally be of the high frequency inductive type and shall be of the high performance, high precision, and heavy duty type and shall be suitable for long detecting distances.
- (2) Each proximity switch shall be selected for the particular application such that the detecting distance matches the actual site conditions of the component or item to be detected in the particular control application.
- (3) The proximity switches shall be suitable for detecting ferrous metals, but should other metals have to be detected, special electro-static or capacitance type proximity switches must be installed.
- (4) All proximity switches must be of the totally encapsulated water resistant type encapsulated in a synthetic material to ensure that the complete unit is water resistant and must be approved by a recognised research laboratory for the particular application as specified. The connections to the unit shall be suitably protected to prevent penetration of water into the unit.

- (5) Each proximity switch shall be provided complete with all power supply units and circuitry to enable the proximity switch to operate satisfactorily in the particular application as specified.
- (6) The rating of the power supply unit and control circuitry shall allow for the total quiescent current conditions or detected current conditions as specified for all proximity switches connected to the particular detector circuit.
- (7) In certain instances proximity switches of the completely self-contained type (i.e. the type equipped with permanent magnets) requiring no external power supply may be specified for a particular application. Such proximity switches shall be equipped with high quality magnets, which should not lose more than 1% of their magnetic force per 100 years.
- (8) The response time should not be more than 10 milliseconds.
- (9) The body of each proximity switch shall be provided with locking adjustment nuts or spacer plates such that the proximity head of the proximity switch could be adjusted accurately to respond accurately to the signal to be conveyed to the control circuit.

3.16.7 Potentiometer Type Controllers

- (1) Controllers shall be of the quadrant type with linear movement. Controllers shall be of the best available quality. Each controller shall be fitted with a scale marked as specified with tenth unit divisions indicated by divisions and unit divisions indicated numerically.
- (2) The quadrant controller shall rotate about a swivel operating through an arc of approximately 90° with the "OFF" position at the bottom end nearest the operator and a maximum at the top. Controllers fitted with the null point at the centre shall have a spring return mechanism to the centre and shall be fitted with a notch in the centre "OFF" position. These type of controllers shall be utilized for forward/reverse operation of the motor control system.
- (3) The controller shall operate the potentiometer controlling the supply to the control system for each individual thyristor or other form of speed control system.
- (4) The potentiometer of each of the master controllers on the console shall control the input section of a stabilized group amplifier, the output of which shall be coupled by selection to the sub controllers of the control circuit of any individual or selected group of motor control systems. The rating of these group amplifiers shall be such that the total complement of motor control systems in a particular group may be controlled by one master controller. The drift in each group amplifier shall be an absolute minimum. The stability shall be such that the control system shall comply with the specified characteristics.
- (5) Each controller shall be a "plug-in" type unit. The units shall be of the modular, removable, interchangeable type.
- (6) Each unit shall have its terminals grouped together on a terminal strip to plug into a female socket fixed to the control console. Two rigid guide pins shall be provided to ensure that the male and female sockets mate correctly.

- (7) Each controller unit shall be equipped with an identification label as required by the operational function thereof.

3.16.8 Multiple Plug and Sockets

3.16.8.1 *General*

- (1) Generally, when selecting particular plug and sockets, care shall be taken that the selection shall be such that the connecting cables are not exposed to undue stress at the point where the cable enters the plug or socket receptacle.
- (2) The selection shall thus be made that straight connectors or angled connectors shall be utilized to ensure that, when the plug and socket is housed in the normal operational state, the cable is not subjected to a short bend directly after leaving the clamping device of the plug or socket.
- (3) Where possible, either the plug or socket (depending on which is at the supply side) shall be screwed and mounted on a solid box, which in turn is mounted against the wall or framework in a permanently fixed and mounted position.
- (4) The latter requirement generally applies to external panel connections. Interior panel connections need, however, not comply with the latter requirement.

3.16.8.2 *Plug and Socket Connectors for Electronic Circuits*

- (1) Sub miniature connectors shall generally be provided with plastic metal shells (screw or clip type) and with male and female screw lock assemblies.
- (2) Plug and socket connectors utilized for high frequencies shall be of the brass shrouded type and be provided with a screw cap and receptacle only.
- (3) Generally the connecting pins shall be suitable for solder connection only to individual conductors.
- (4) The sockets and plug connectors shall be provided with shrouds to enclose and clamp any cables, either round or ribbon cables, securely to the plug or socket to prevent any strain on individual conductors soldered to the terminals.

3.16.8.3 *General Purpose Low Power Connections*

- (1) These connectors shall in general be of the MS series standard circular connectors with the exposed pins provided in a shrouded protected configuration.
- (2) Both the plug and socket connectors shall be provided with a secure screw type clamping arrangement to clamp the connecting cable to the plug or socket housing to ensure that any tension in the cable is not transferred to the terminations of the lug and socket.
- (3) Cable terminations shall be soldered to the pins of both the plug and socket connector respectively.
- (4) The shroud of the plug and socket connector may be of metal such as brass or copper alloy or alternatively of polyester reinforced glass fibre.

- (5) The engaging shroud of the lug and socket connectors and the coupling ring to lock the plug onto the socket shroud shall however be of brass or copper alloy.
- (6) When the plug is inserted into the socket, the plug shall be retained in the socket by means of a screw type coupling or a bayonet type latching arrangement.
- (7) Each plug and socket connector shall be provided with environmental dust caps, either screwed or latched by means of the bayonet cap arrangement to cover the pins and sockets once the lug has been removed from the socket connector.
- (8) Each plug and socket shall be provided with guide pins, which are longer than the pins of the plug or socket to ensure proper mating. Matching notches shall be provided in the enclosure housing of the plug and socket to ensure that matching sockets and plugs could be inserted in a selected configuration only.

3.16.9 Keyboards

- (1) Keyboards of the alpha-numeric type and associated with computer control systems, shall be of the "QWERTY" type.
- (2) If required, a separate numerical keypad shall be supplied adjacent to the alpha-keyboard. Functional keys must be provided and arranged in a logical order above the alpha-keyboard.
- (3) If more than one computer is required for control purposes, the keyboards of all computers must be similar and where possible, the same keys and passwords must be used to enter program instructions to the computers.
- (4) The individual keys must be manufactured in a pyramid form with a slight concave finger touch surface. The individual keys for various functions, e.g. alpha-numerical board, functional instruction keys, cancel-, break-, or escape keys must be in distinguishable colours. The keys shall not be transparent.
- (5) The keys shall be of the non-contact induction type and shall be provided complete on one printed circuit board with plug in contacts.
- (6) The total unit that houses all keys for the relevant functions must be installed either together with or separate from the electronic circuit and equipment of the computer in a solid thermoplastic injected housing. The unit shall either be installed flush with the console or elsewhere as described in the Generic Specifications.

3.16.10 Digital Display Units

- (1) Display units must be manufactured as single units, i.e. multi-digit display units may not be made up of single digit display units.
- (2) The display unit must be legible at a distance of at least one metre (1m).
- (3) The display units shall be mounted flush into the faceplate and shall be protected by means of a non-reflecting glass cover.
- (4) The display unit must consist of a sufficient number of digits to display all the relevant information as required. All the digital data pin connections shall be connected by means of ribbon cable and DIN type sockets.

- (5) All display units shall be protected against the following:
 - (a) Accidental physical damage.
 - (b) Over-voltage.
 - (c) Surge currents.
 - (d) Voltage spikes.
 - (e) Reverse voltage.
- (6) All multi-digit displays shall be multiplexer driven and must be powered of the same power supply than the control equipment.
- (7) A segment display for numerical characters shall consist of at least 8 digits.
- (8) A segment display for alpha-numerical characters shall consist of at least 16 digits.
- (9) A dot matrix display for alpha-numerical characters shall consist of a matrix of at least 16 x 16 dots with a dot size of 0,55mm wide and 0,55mm high.

3.16.11 Electronic Components and Circuits

3.16.11.1 *General*

- (1) The general arrangement, composition and build-up of electronic circuits and components shall be in a clear logical fashion, with a view to ease of maintaining these components.
- (2) Components shall be of the high quality industrial type to ensure maximum precision and close tolerances as required for the installation.
- (3) As far as possible, electronic circuits shall be built up in logical banks of printed circuit frames, which can easily be withdrawn for maintenance or replacement purposes.
- (4) The logical build-up of printed circuit frames shall be such to allow for sequential fault tracing by means of the instruments referred to in the acceptance test plan and procedure for tracing faults, after having plugged in the printed circuit and inserted the test probe into the plug-in base. Terminals of the plug-in base engaging on a printed board shall be gold electro-plated.
- (5) Printed circuits shall be mounted with the long or short edges vertical to allow for free movement of air over components for cooling purposes. Care shall be taken that the emission of heat by components and printed circuit boards does not cause the ambient temperature to rise above an acceptable level as allowed by the manufacturers of the components.
- (6) All electronic equipment, components and circuits shall be suitably protected against damage due to voltage surges. The protecting devices shall generally be similar to the protective devices as specified for the earthing systems in the General Technical Specification of this document.
- (7) The design and manufacture of components intended for mounting on boards with printed wiring and printed circuits shall be in accordance with Publication 321 of the International Electro-Technical Commission, as amended.

3.16.11.2 Printed Circuits

- (1) The design and manufacture of printed circuits shall be done according to the most modern techniques and developments.
- (2) Circuitry shall be accurately positioned and accurate registration of circuitry common to both sides of the boards such as terminals and edge contacts shall be maintained. Definition of all circuitry, coding and solder masking shall be of a high standard, without rough edges and saw tooth. Component leads through the boards shall be short and neatly trimmed.
- (3) Holes through the boards shall be through-plated and the diameter shall be such to ensure effective capillary action between component leads and sides during soldering.
- (4) The printed boards used shall be of epoxy glass or equivalent material and shall be of the general purpose type.
- (5) Edge contacts and terminals shall be of electro-deposited gold on the printed circuits. The gold shall be clean and bright in appearance without porosity.
- (6) All other circuitry and the holes shall be of bright electro-deposited tin on the surface.
- (7) The overall appearance of the completed printed circuit shall be neat with accurate definition, clean and uniform plating. The outer edges of the board shall be neatly machined.
- (8) Components in printed circuit boards shall be open and installed on one side only, the leads being soldered and fixed on the opposite side.
- (9) After the printed circuit board has been completed, all components and all printed circuit tracks shall be covered by means of a suitable insulated varnish to protect the circuitry against faults due to the collection of dust or other foreign objects such as ants or termites.
- (10) Each printed circuit board shall be fitted with a frame of insulating material on the outer perimeter, which shall ensure that the board shall not work loose when inserted in the plug-in unit.
- (11) The frame shall be fitted with an identification code corresponding to a code number on a particular printed circuit board used at that particular plug-in base for identification purposes. The code number on the frames shall be visible when opening the control board doors when viewing the printed circuit boards inserted vertically in the bases. The code numbers shall correspond to the code number shown on the schematic diagrams.

3.16.11.3 Thyristor And Power Diodes

- (1) Thyristors shall be of the best quality silicon, manufactured by means of the most accurate diffusion technique to produce ultra-pure semi-conductor material.
- (2) The thyristors installed in the load output circuitry of control modules shall be fitted with heat sinks liberally dimensioned and arranged vertically to allow for free movement of air through the fins for cooling purposes.

- (3) The thyristors in the control circuits shall be selected for a continuous rated load of 20 per cent in excess of the full load rating of the control module.
- (4) The peak positive anode voltage and the reverse breakdown voltage of thyristors shall generally be a minimum of 2,5 times the peak operational voltage to which the thyristor will be subjected during normal operation and allowing for supply voltage fluctuations.

3.16.11.4 General and Electrical Properties of Electronic Modules

- (1) Each module shall have its terminals grouped together at a terminal strip to plug into a female socket installed in the control board. Two rigid guide pins and sliding rails shall be provided to ensure that the male and female sockets mate correctly.
- (2) Each control module shall be fitted with a filter to suppress the harmonics in the output voltage. The filters shall be of the high quality air-gap reactor type. The windings and core shall after manufacture be encased in a high quality epoxy type resin having a high di-electric strength after manufacture.
- (3) Each control module shall comply with the following detailed requirements in addition to any other requirements, which the Contractor shall consider necessary for trouble-free operation of the complete control systems.
 - (a) The units shall be shielded against any external radio frequency interference.
 - (b) The units shall be adequately suppressed to prevent interference with professional quality mains-operated call and sound systems.
 - (c) The units shall be adequately suppressed to prevent any electromagnetic interference with radio and television broadcasting systems.
 - (d) Each unit shall be shielded to prevent false triggering by interaction with other units during operation of the control system.
 - (e) The characteristics of the control modules shall be such to comply with the control and operational characteristics of the drive systems or components connected to the modules as specified in this document.

3.16.12 Electric Motors

3.16.12.1 General

- (1) Electric motors shall generally comply with the requirements as specified under the heading "Compliance with Standard Specifications".
- (2) All electrical motors shall be of the continuous rating (CMR) totally enclosed (TE) type.
- (3) The motors shall be designed according to the preferred kW and speed values given in the aforementioned specifications. Slower speed motors may, however, be supplied.
- (4) The motor for each particular application shall be designed in such a way that during full connected load the load on the motor shall not exceed 100% of its own normal C.M.R.

- (5) The motors shall be designed to cope with the aforementioned load without special cooling services such as heat exchangers, fans, etc.
- (6) Motors utilized in the control rooms, remote from areas occupied by personnel, may in certain cases be of the protected (P) type. Care must, however, be taken to minimise sources of noise or concentration of noise emitted by the motors.
- (7) All motors shall be suitable for flange mounting onto the gearbox or drive unit or shall be suitable for horizontal pedestal mounting onto the machine frame.
- (8) The Contractor shall timeously inform the Engineer of the required rating of the supply circuit breaker to the control room, to allow for surge inrush current control during starting.

3.16.12.2 Ac Motors

- (1) As far as practical, all AC motors shall be of the 3-phase squirrel cage induction type, unless specified differently. The winding shall have a "Class F" insulation and shall be suitable for operation at the specified environmental conditions.
- (2) Should motors be supplied which are controlled by means of thyristor control units, these motors shall be purposely manufactured and shall be suitable for use with thyristor type control systems.
- (3) The rating shall be such to allow sufficiently for cooling of the motor when operating at reduced and slow speeds.

3.17 BATTERIES AND BATTERY CHARGER COMPONENTS

3.17.1 General

- (1) The battery standby power source for the control system shall be of the stationary type and shall be suitable for the particular application as required. The batteries to be installed may be of the following type:
 - (a) Lead-Acid (Lead-Antimony) low maintenance batteries.
 - (b) Lead-Acid (Lead Calcium) sealed, maintenance free batteries with deep discharge protection.
 - (c) Nickel-cadmium or batteries.
 - (d) Lithium batteries.
- (2) The battery capacity shall be sufficient to trip and recharge all circuit breakers at least five times in the case of switchgear applications; or
 - (a) maintain constant power output for the equipment specified for the time specified in the case of emergency supply applications; or
 - (b) maintain the supply to equipment used in back-up applications as required for computer assisted and controlled equipment for periods of seven days or for a period as stated in the Generic Specifications, the object being to maintain any programmed memory of the system.
- (3) Positive terminals shall be permanently marked and the battery rating shall be marked on the battery.

3.17.2 Quality of and Maintenance Procedures of Batteries

- (1) Lead-acid batteries whether of the conventional or sealed type shall comply with the requirements as stated under the heading "Compliance with Standard Equipment and Material Specifications".
- (2) Control circuitry shall monitor the current and voltage capability of the batteries during conditions of open circuit or under conditions of load. In the case of lead-acid batteries the level of the electrolyte and the correct pH value of the electrolyte must be displayed on the container.
- (3) Battery terminals must be of the type to ensure a proper and correct electrical contact between the battery terminals and cables. Where required terminals must be covered with a thin film of protective paste to prevent deterioration of the terminals and sulphate deposits on terminals.
- (4) Maintenance instructions shall be obtained from the supplier and the Contractor shall include these maintenance instructions in the manuals to ensure that they may be strictly maintained in accordance with these instructions. A copy of these instructions shall be sealed in a plastic enclosure and mounted at the battery installation for each type of battery system.

3.17.3 Battery Charger

3.17.3.1 *General*

- (1) The battery charging equipment must be highly reliable and maintain batteries in the normal state of charge also when the battery charger is in the condition of trickle charge.
- (2) The Contractor shall ensure that the battery charger characteristics suits the type of battery and must generally comply with the following requirements:
 - (a) A constant voltage charger (CVC) with current limiting facilities shall be supplied for all applications unless clearly specified to the contrary. The value of the current limiting control system shall be chosen to prevent damage to the batteries when completely discharged batteries are reconnected to the charger output.
 - (b) The output voltage under float charge conditions shall be kept within 1% of the required charging voltage of a $\pm 10\%$ variation in input supply voltage.
 - (c) The following charging rates shall be regularly checked and monitored:
 - (i) Float charge at approximately 1,4 volts per cell for nickel-cadmium batteries and 2,35 volts per cell for lead-acid batteries.
 - (ii) Boost charge at approximately 1,45 volts per cell for nickel-cadmium batteries and approximately 2,6 volts per cell for lead-acid batteries. A further special boost charge capability shall be available.
- (3) The boost charge facility when provided shall be operated by means of a switch mounted on the front panel housing the charger.

- (4) The voltage ripple content in the output of the charger shall be less than 1% and this shall be monitored to protect batteries.
- (5) Chargers shall incorporate a “charger fail” alarm. The alarm shall monitor the float or charge current and display an alarm condition if the charging current drops below the normal steady state float charge current. The alarm shall be interlocked with a mains failure monitoring device to prevent an alarm being given during mains failure.
- (6) A “high voltage” alarm shall have the same sensitivity and setting range as the low voltage alarm.
- (7) The charger shall be protected against input voltage spikes and transients.
- (8) A “battery test” push button shall be provided on the front panel. When the push button is actuated the following test procedure shall be initiated:
 - (a) The charger shall be disconnected from the main supply. A load resistor shall be connected to the battery terminals. The current to the resistor must be equal to the full load current which the battery must supply to the specified load.
 - (b) The battery voltage must be determined under the aforementioned conditions of load, and the battery low voltage alarm must be activated should the output voltage drop below the pre-set value.

3.17.3.2 Main Control Equipment of Battery Charger

- (1) The battery charger shall consist of (unless otherwise specified) a single phase, double wound vacuum impregnated transformer, full-wave integrated circuit type rectifier and filter circuitry.
- (2) With switchgear applications the front panel of the battery charger unit shall be supplied with monitoring and control equipment enabling maintenance personnel to check the condition and status of the batteries and battery charging equipment. HRC-fuses shall protect auxiliary output circuit.

3.17.4 Battery Container

- (1) Stationary batteries shall be housed in suitable corrosion resistant cabinets or enclosures designed for the accommodation of batteries (generally glass fibre containers). The construction of the enclosures shall in general comply with the requirements as specified for control boards and control consoles.
- (2) For lead-acid batteries the cabinets shall be manufactured in three compartments, the compartments housing the batteries, battery charging equipment and the control equipment respectively. The general construction and finish of the battery container shall be such that the cabinet can be easily inspected, checked and cleaned.
- (3) The battery cabinet shall be provided with the correct ventilation louvres for ventilation by natural convection, or if required provided with a fan, to comply to the recommendations of the battery manufacturer.

3.17.5 Manuals for Batteries

- (1) Maintenance and instruction manuals, which include general arrangement drawings, and schematic diagrams and a general description of the method and periods of maintenance, shall be supplied by the manufacturer and/or supplier of the batteries.
- (2) The Contractor shall obtain these manuals and include these in the overall manuals to be provided as specified for the proper and trouble-free maintenance of the batteries.

3.18 CONDUIT AND TRUNKING WIREWAYS AND THE INSTALLATION OF CONDUIT AND TRUNKING WIREWAYS

3.18.1 General

- (1) Conduit, conduit fittings and trunking wireways for electrical cabling shall comply with the requirements as specified under the heading "Compliance with Standard Specifications".
- (2) The conduit and trunking shall be installed by the Contractor and all wiring in the conduit and trunking shall be done by the Contractor.
- (3) The Contractor shall install the conduit and trunking according to the requirements as specified in the following subparagraphs.
- (4) Generally all interconnections between control boards, control consoles, sockets, electronic monitoring equipment, sensors and alarm points shall be done by means of PVC-insulated multi-core cables.
- (5) When conductor interconnections are installed, these conductors shall be installed in conduit and trunking wireways.
- (6) All conduit, conduit fittings and trunking installed surface mounted in lift shafts, machine rooms, ducts, false ceiling voids, in false floor areas or surface against walls, shall be of the steel galvanised type.
- (7) Where equipment must be connected by means of flexible conduit, such flexible conduit shall comply with the requirements as specified in the General Technical Specification of this document.

3.18.2 Fixing

- (1) Conduit in open roof spaces or in horizontal or vertical ducts, shall be installed parallel and at right angles to the roof members or structure and shall be fixed to the structure at intervals not exceeding 1 200 mm.
- (2) Where conduit is surface mounted, it shall be fixed with galvanised spacer bar saddles as specified. Where conduit is installed surface in ducts against walls or ceilings in groups of more than one in parallel, the conduit shall be fixed to the walls and ceiling by means of galvanised "O-Line" type P3300 channels. These channels shall be supplied and installed by the Contractor at distances not exceeding 1200 mm and shall be rigidly fixed to the walls and ceilings by means of "Rawl" bolts or a self drilling anchoring system.

- (3) Trunking shall be similarly installed with proper 45° metered corners, 45° T-section joints and end cover sections, securely joined by means of smooth connector fish plates and smooth pop rivet joints.
- (4) All trunking shall be provided complete with galvanised steel cover plates, properly metered at corners and special 45° cover plate sections at corners and T-section joints.

3.18.3 Position of Connection Points

- (1) All accessories such as remote indicator lights, limit switch points, door monitor points, etc., shall be accurately positioned. It is the responsibility of the Contractor to ensure that all accessories are installed level and square at the correct height from the floor, ceiling or roof level as specified. It shall be the responsibility of the Contractor to determine the correct final floor, ceiling and roof levels in conjunction with the Engineer or Contractor.
- (2) Draw boxes shall not be installed in positions where they will be inaccessible after completion of the installation. Draw boxes shall be installed in inconspicuous positions to the approval of the Engineer. All installed draw boxes shall be pointed out to the Engineer. The positions of all draw boxes shall be indicated on the "as-built" drawings.

3.18.4 Wall and Ceiling Connection Points

- (1) Where more than one outlet is connected to the same circuit, the conduit shall be looped from one connection box to the following on the same circuit.
- (2) Where a metal channel is used, the conduit may be installed from the channel directly to the connection box on condition that the conductors can be looped from one outlet to the next without making any joints in the conductors.
- (3) Connection points installed in areas where plastered false ceilings are provided, shall be connected according to the loop principle.
- (4) Where equipment is specified which may be fixed directly to the draw box, this shall be done by a minimum of two screws screwed to the box or by screws fixed directly to the concrete ceiling.
- (5) The edges of flush mounted connection boxes shall not be deeper than 10 mm from the final surface. Where this is not the case, an extension box which ends flush with the surface, shall be screwed to the connection box. This method shall be used in partitions and cladded surfaces.

3.18.5 Bends and Draw Boxes

- (1) A maximum of two 90° bends or the equivalent displacement will be allowed between outlets and/or draw boxes. Draw boxes shall be installed at maximum intervals of 9 metres in straight conduit sections. All bends shall be made without heating the conduit or without reducing the diameter of the conduit. The inside diameter of a bend shall not be less than three times the outside diameter of the conduit.
- (2) Draw boxes in ceilings and walls shall have flat metal covers plates. Cover plates shall overlap boxes by 12 mm on all sides and shall be painted to match surrounding finishes.

- (3) Draw boxes shall as far as possible be installed near gangplanks. Socket and switch boxes will not be accepted as draw boxes in open roof spaces.
- (4) All excess holes in draw boxes, distribution boxes, control boards, cable ducts or trunking, power skirting, etc., shall be securely blanked off to render the installation vermin proof. Brass stopping plugs shall be used in conduit accessories.

3.18.6 Expansion Joints

- (1) All conduit crossing expansion joints shall make special provision by having connection boxes or trays in approved positions on one side of the expansion joint.
- (2) Conduits crossing the expansion joint to the box, shall enter into the box freely and without being secured thereto but with a close fit. Other conduit entering the box shall be secured in the conventional way.
- (3) Each metal conduit entering freely into the box, shall be earthed with a clip wired to a bolted and properly secured earth connection on the box, and in addition an earth wire shall be installed in each conduit and connected between outlets on each side of the joint.

3.18.7 Terminations

- (1) Conduits shall be connected directly to draw boxes with spouted connections. Conduits shall be screwed home tightly and screw thread shall not be visible.
- (2) A brass female bush and two locknuts shall be installed where conduits terminate in pressed steel control boards and boxes, cable ducts power skirting, etc. The conduit end shall only project far enough through the hole to accommodate the bush and locknut.
- (3) A female bush and two locknuts shall be used to terminate conduits at draw boxes and connection boxes without spouts should there be sufficient room in the box. Where there is insufficient room, a coupling, brass male bush and locknut may be used.
- (4) Holes to accommodate brass bushes shall be large enough to accommodate the bush with a minimum of clearance.
- (5) Bush nuts for the connection of earth conductors to conduits are not acceptable.

3.18.8 Removal of Debris and Finish

- (1) Care shall be taken to prevent any debris or moisture from entering the conduit during and after installation of the conduit.
- (2) All conduit ends shall be sealed by means of a solid plug, which shall be screwed to the conduit end. PVC plugs are not acceptable. All conduits shall be cleaned and swabbed to remove all oil, moisture or other debris that may be present, before conductors are installed. Swabs shall not be attached to the conductors.
- (3) All joints shall be painted with red lead to prevent corrosion in damp areas, areas within 30 km of the coast and in cases where the installation is exposed to the weather for any length of time.

- (4) Where the galvanising or black paint has been damaged, the area shall first be cleaned and a coat of zinc base paint applied subsequently. Additional coats of paint shall only be applied after the undercoat has been completed.

3.18.9 Flexible Conduits

- (1) Where equipment has to be moved frequently to enable adjustment during normal operation, e.g. for the connection of motors, any other equipment subjected to vibration, connection of sensors and limit switches, or where otherwise specified in the Generic Specifications, such equipment shall generally be connected by means of cables. Should flexible conduit be installed, such flexible conduit shall be as short as possible to comply with the general requirements for the particular connection.
- (2) Should connectors exceed a length of 600 mm, except where approved by the Engineer or specified in the Generic Specifications, this conduit shall be suitably supported by means of a flexible or non-rigid support bracket fixed to the stationary structural members of the building or machine frame.
- (3) Flexible conduit shall preferably be connected to the fixed structural components of the installation or the building structure by means of a dust-proof draw box provided with terminals. Each draw box shall be provided complete with cover plate provided with four screws for securing the cover plate to the draw box.
- (4) This draw box shall be securely fixed to the structure or walls of the building by means of suitable screws and nuts and shall be provided with terminal box and for the connection of the conductors to be installed in the flexible conduit.
- (5) Flexible conduits shall consist of metal reinforced PVC covered metal conduit or flexible metal conduit covered by a PVC shroud with a minimum internal diameter of 20 mm, unless otherwise specified. The flexible conduit shall be provided with screw type connector glands at both ends suitable for screwing to the socket or connector at the terminal box or suitable for fixing to the terminal box by means of a lock nut and bush. These connector glands shall be manufactured of brass or cadmium mild steel.
- (6) Flexible conduit connections shall be provided with an internal earth wire connection such that the component or equipment shall be securely earthed to the metal work of the structure or supply earth wire terminating at the terminal box.

3.19 CONDUCTORS AND WIRING IN CONDUIT AND WIRING CHANNELS OR DUCTING

3.19.1 Type of Conductors

- (1) Conductors shall comply with the requirements as specified under the heading "Compliance with Standard Specifications".
- (2) All wiring with the exception when cables are specified must be done with PVC insulated single-core copper conductors with a minimum section of 3-strand 1,5 mm. The earth conductor must consist of an uninsulated single-core stranded copper conductor or a green PVC insulated copper stranded conductor.
- (3) The wiring of low voltage circuits with a voltage less than 50 Volt, may be done by PVC insulated multi-stranded single conductors, or by means of PVC shrouded type cables.

- (4) The colour code of the PVC insulating material for the conductors must be the following:
 - (a) Alternating voltage phase conductors: red, white and blue
 - (b) Neutral conductor: black
 - (c) Earth continuity conductor: green or green/yellow
 - (d) Control wiring: grey
 - (e) DC voltage conductors: orange

3.19.2 Wiring in Conduit and Wiring Channels or Ducting

- (1) All PVC insulated conductors must be installed in galvanised sheet metal ducting supplied complete with galvanised cover plate or shall be installed in conduit.
- (2) Should the conductors be bunched in cable ducting, the appropriate derating factor as specified in SABS 0142 must be utilized for determining the size of conductors such that these conductors shall not overheat when carrying the normal calculated full load current for the particular circuit.
- (3) Conductors must not be exposed and must be installed in conduit or in the sheet metal ducting along the total route of a particular circuit.
- (4) PVC insulated conductors must be lubricated with high quality French chalk before they are drawn into conduit.
- (5) The total sectional area of all conductors (including insulation) in cable ducting or floor ducting must not exceed 40 per cent of the total sectional area of the ducting.

3.19.3 Connections

- (1) The insulation of the ends of conductors must be removed only to allow for the connection of ferrules where such conductors are connected to terminals of equipment and components. Where more than one conductor must be connected together, the strands must be securely bound together before inserting the ferrule.
- (2) All conductor ends must be provided with tinned ferrules soldered to the conductor ends or must be provided with ferrules or lugs fixed to the conductor by means of a crimping method.
- (3) All connections at control boards must be done via the terminals supplied as part of the control boards and consoles.
- (4) Earth conductors must be connected similar to the conductors as specified and must be connected from terminal to terminal on control boards and consoles.
- (5) All conductors must be installed without joints and may only be connected from terminal to terminal on control boards and consoles and equipment connection terminals.

3.20 CABLES AND THE INSTALLATION OF CABLES

3.20.1 Type of Cables

- (1) Cables shall comply with the requirements as specified under the heading "Compliance with Standard Specifications".
- (2) All power supply cables installed must be of the PVC insulated **wire armoured type unless otherwise specified**.
- (3) Should unarmoured cables be specified in the Generic Specifications, the construction of unarmoured cable must be similar as specified for armoured cables with the exception that the steel wire armouring is omitted.
- (4) The individual cores of multi-core cables must be identified by means of multi-colour PVC insulating material or alternatively by means of a numbering system for the identification of the individual conductors.
- (5) The size of cables installed by the Contractor must be determined according to the regulations for each particular application. Unless specified elsewhere in the Generic Specifications, a correction factor of 0,6 must be allowed for cables installed parallel and adjacent to each other on cable trays or in ducting.

3.20.2 Termination of PVC Insulated Cables

- (1) All cable ends must be terminated by means of grooved glands, which shall ensure that the outer sheath of the cable and the cable gland is terminated watertight. When copper conductors provided as part of the steel wire armouring is used as earth continuity conductors, the special cable glands must be installed for such cable connections.
- (2) The cable glands must be such that the steel wire armouring between the cable and the gland must be compressed between two conical sleeves and secured by means of a screwed clamp. The cable gland must be fixed to the equipment gland plate by means of a locking screw.
- (3) A neoprene or PVC housing must be utilized to cover the complete cable gland to ensure a watertight seal with the outer PVC sheath of the cable.
- (4) Cable cores must be connected to equipment by means of suitable cable lugs.
- (5) Any steel wire armouring, which is exposed, must be thoroughly covered by means of suitable corrosion neutralising paint.

3.20.3 Flexible Cables

- (1) Rubber insulated flexible cables and flexible cords shall comply with the requirements as specified under the heading "Compliance with Standard Specifications".
- (2) The copper conductors shall consist of individual strands with an approximate diameter of 0,2mm.
- (3) In certain cases flat PVC type flexible cable may be used in festoon system.

- (4) Samples of all cables to be used shall be submitted to the Engineer and Supply Authority for approval prior to installation thereof.

3.20.4 Installation of Cables

- (1) Cables shall be installed as specified in this document.
- (2) All cables shall be marked by means of an identification code corresponding to a code given on the cable connection schedules.
- (3) The marking shall be done by means of lettering punched into aluminium foil. The foil shall be wrapped around each respective cable and bound with aluminium tape.
- (4) Alternatively a PVC type cable marker system utilizing printed numbers on PVC strips may be installed.
- (5) The cables shall be marked as follows:
 - (a) At both terminations.
 - (b) At T-section or four-way joints of cable trays.
 - (c) At entries to vertical ducts should cables extend up or down at the particular point of entry. The cables shall be marked directly above and below such a point of entry.
- (6) All cables shall be supplied and installed without joints and individual conductors of cables may only be connected from terminal to terminal on control boards and consoles.

3.20.4.1 Cable Fixed to Walls and Vertical Ducts

- (1) Cables to be installed and fixed to walls and in vertical ducts shall be clamped to galvanised "O-Line" type P3300 channels fixed to the wall face. The "O-Line" channels shall be installed at vertical distances not exceeding 600 mm and shall be secured to the walls by means of "Rawl" bolts or by means of a self drilling anchoring system.
- (2) Cables shall be arranged parallel and adjacent to each other and each cable shall be supported and fixed to the "O-Line" channels by means of "O-Line" type K2028/1, K2042/1 clamps or clamping plates bent and shaped to clamp cables securely. The size of the clamp shall be determined from the diameter of the cables.
- (3) All cables larger than 35 mm² 4-core shall be clamped to the "O-Line" channels by means of "O-Line" J type cleats.

3.20.4.2 Cables Installed on Horizontal Distribution Sections

- (1) Cables shall be installed on cable trays. The proposed routes and positions of these cable trays are as shown on the drawings.
- (2) All cable trays shall be of the galvanised type supplied and installed by the Contractor. The cable trays shall be of the perforated type as supplied by Messrs O-Line, or an equivalent approved type.

- (3) The Contractor shall determine the size and number of cable trays for the individual routes and positions shown on the drawings and submit this information to the Engineer.
- (4) Cable trays must be supported from the concrete ceilings by means of angle section brackets or "O-Line" type P1000 channel brackets. The support brackets for each section shall in width match the size of the particular cable tray and all components shall be of the galvanised type.
- (5) All cable trays must be supported at distances not exceeding 1 200 mm.
- (6) Power cables shall be installed in a single layer parallel and adjacent to each other and the width of the cable tray on each route shall be determined on the aforementioned basis.
- (7) Horizontal and vertical bends, T-junctions and 4-way junctions shall where required, be supplied and installed by the Contractor, and the dimensions of such bends and junctions shall correspond to the adjoining linear sections of the cable trays. The radius of vertical bends shall not be less than 1 000 mm.
- (8) Cable trays, support channel sections and accessories shall be of the hot-dipped galvanised type. The edges shall be 50 mm high and bent in an inverted U-shape at both top edges. Cable tray joints must be reinforced by means of 50 mm x 6 mm steel sections approximately 300 mm long. Joints must be rigidly joined by means of bolts and nuts. The support brackets must be painted with a corrosion-proof paint and thereafter finished in an aluminium colour paint.
- (9) For tendering purposes the Contractor must assume that the length of the suspension arms of the support brackets are 600 mm each unless otherwise specified.

3.21 CONNECTION OF EQUIPMENT AND COMPONENTS

3.21.1 General

- (1) Components and equipment utilized and installed in the installation and which are not installed in control boards and control consoles, shall be connected by means of PVC insulated wire-armoured cable or by means of PVC insulated conductors installed in flexible conduit.
- (2) When utilizing cable connections, such cable connections shall be connected to the particular component or equipment by means of suitable glands connected to the terminal box of the component or equipment.
- (3) Should equipment be connected by means of conductors installed in flexible conduit, the supply cable or solid conduit shall terminate in a draw box near the component or equipment and the flexible conduit installed according to the requirements as specified in this document.
- (4) The length of the connecting cable or flexible conduit shall have sufficient slack to allow for the positioning of the component and equipment such that the component and equipment can be finally positioned and set in the preselected position and particular configuration as required.

- (5) The final cable connection or flexible conduit connection from a draw box or fixed structural component of the installation to the particular component or equipment, shall be bound to the structural members of the fixed and the movable structural member by means of suitable saddles or binding straps to ensure that any movement of the movable member on which the equipment and component is installed, does not exert any tension on the individual conductors and terminals at both ends of the connection.

3.21.2 Connection to Electric Motors

- (1) Connections from a fixed position to a motor which may be moved or which could move or vibrate, shall be done as specified in the General Technical Specification of this document.
- (2) Each motor installed remotely from the control board at a distance exceeding the requirements as specified in the regulation, shall be provided with a separate isolator and/or contactor type starter with push buttons at a distance not exceeding 2 000 mm from the motor.
- (3) Should it not be possible to install such control equipment to isolate all power conductors to the motor, a key operated isolating switch shall be installed in lieu of such isolator or starter.
- (4) This key operated switch shall disconnect all control and power cable connections to the motor and drive system should such a drive system incorporate the brakes, etc.

3.21.3 Connection Of Brakes

- (1) In general the connections to brakes shall be done as specified for connections to electric motors.
- (2) Should the brakes be of the disc or solenoid type, the electrical connections to the component mounted on the machine frame and drive unit shall be isolated by means of the key operated isolating switch installed near the motor such that all control cable connections to the motor and brake shall be isolated simultaneously.

3.21.4 Connection of Tachometers and Encoders

- (1) Where screened type cables are installed as supply to a tachometer or encoder, such screened supply cables shall be connected directly to the terminal box of the tachometer or digital encoder and such cable shall be connected to the appropriate equipment in the control board without any joints.
- (2) The screen of the screened cable shall be securely earthed at the control board side only to prevent earth loops whereas the tachometer and encoder housing shall be properly earthed to the machine frame of the drive unit on which the particular tachometer or encoder has been installed.
- (3) To ensure the highest level of reliability, double screened cables shall be used throughout such applications.

3.21.5 Connections to Ancillary Electrical Control Equipment

- (1) All control equipment such as limit switches and other monitoring and control devices utilized to control any equipment installed as part of the installation, shall be connected by means of flexible conduit according to the details as specified in This document.
- (2) In general, the cable connections shall be done complete with cable glands and be directly connected to the particular limit switch or component as required.
- (3) Where flexible conduit is utilized for the final connection, this conduit may not be longer than 600 mm and shall be utilized as a connection between a fixed draw box installed against the structural components of the installation or concrete structure of the installation.
- (4) Where a multi-core cable is employed as connection to a number of limit switches, such multi-core cable shall terminate at a terminal box provided complete with numbered terminals according to the requirements as specified for control boards. This particular terminal box shall be identified by means of an identification label as shown on the schematic electrical diagrams.
- (5) From this draw box the final connections to the individual limit switches may be done by means of individual PVC insulated armoured cables or flexible conduit as specified.

3.22 EARTHING OF EQUIPMENT AND THE INSTALLATION

3.22.1 General

Fixed installations must be properly maintained and earthed to comply with the requirements of SANS 10142: The Wiring of Premises, and according to the by-laws of the local Supply Authority.

3.22.2 Earth Connections

- (1) The Contractor shall ensure that all individual components such as control cabinets are connected to the earth connection.
- (2) Under no circumstances shall a domestic earth supply be interconnected to the earth supply utilized for electronic control equipment and installations unless separate protection equipment is fitted to prevent damage to electronic equipment.
- (3) The ends of all earth conductors shall be tin plated and provided with lugs for the connection to earth terminals or clamps provided with bolts and nuts. Where bolts, nuts, clamps or terminals are utilized, these shall be of the brass type only.
- (4) If required, separate earth connections shall be supplied and installed by the Contractor according to the requirements specified in the Generic Specifications for particular connections to electronic control components and circuits of the installation.

3.22.3 Earthing of Sub Circuits and Components

- (1) Earth conductors of all sub-circuits shall be maintained and connected to the earth bar of the main earth connection as provided.

- (2) The ends of all metal channels, cable trays, etc., containing cables and conductors, shall be earthed to the nearest control cabinet by means of earth straps or conductors.
- (3) The latter earth connections shall be connected to the domestic earth supply system.
- (4) All metal conduit where this is installed by the Contractor, shall be terminated at control cabinets or junction boxes. Where this cannot be done, conduit ends shall be earthed separately by means of stranded earth conductors according to the requirements of the regulations.
- (5) Earth conductors shall be installed in all flexible type of conduit to interconnect the two ends of the flexible conduit.

3.22.4 Earthing of Electronic Equipment

- (1) Interconnections and proper earthing between electronic components must be done on a radial wiring system and be diligently maintained.
- (2) To minimise interference with the operation of electronic components, the earthing system of the components must generally comply with the following:
 - (a) The individual earth connections must be interconnected by means of suitable green PVC insulated conductors.
 - (b) The total earthing network must be connected at one point at the earth mat or earth rods forming the main earth connection at the building or site by means of green PVC insulated conductors.
 - (c) All connections to individual electronic components must be connected from the main insulated earth bar on the control cabinet and must be radially connected to each individual component to prevent earth loop currents between individual control equipment and components.
 - (d) Should the contractor consider it essential that the interconnecting earth connections between individual components be done according to the floating earth principle, such interconnections shall be done according to the radial method of connection. In such a case individual earthing points must be maintained and protected by means of gas discharge diodes connected directly to the domestic earth such that peak voltage transients in the electronic earthing system could be discharged via the gas diodes. This must be done to protect electronic components and circuits against such peak voltages and transients, which could be induced in such electronic circuits.
- (3) To avoid formation of earth loop currents in electronic circuits, printed circuit layouts must be designed such that a common earthing track or point is established.
- (4) Where digital integrated circuits are used, decoupling of the supply line (VCC) to earth must be done with suitable decoupling capacitors at regular intervals to avoid fluctuation of potentials during switching.
- (5) Feedback loops in earth potential tracks and stray capacitance between pointed tracks must be avoided in radio frequency (RF) circuits.

- (6) Common earthing bars or points should be utilized where banks of electronic equipment are connected to function on common banks. These points could either be at "absolute" earth potential i.e. returning to the earth of the input power circuits, or may be at "floating" earth potential i.e. an earth potential isolated (by making use of an insulating transformer) from the supply earth potential.
- (7) The resistance between the earth electrode and earth strata for earth connections utilized for electronic equipment shall be less than 5 ohms.

3.22.5 Connections to Electronic Equipment

- (1) Earthing methods applied in electronic equipment shall be diligently planned to adhere to the requirements as specified. The size of earthing bars and lugs, etc., could be of a lower rating than for electrical installations.
- (2) Any conducting material that has been anodized, e.g. aluminium may not be used as an earth busbar unless special precautions have been taken to ensure that the anodizing material has been removed where the earthing connections are made.
- (3) Connections to electronic equipment must be made using cadmium plated lugs, bolts and nuts fixed to properly cleaned and prepared surfaces on the electronic sub-racks or trays.
- (4) From the sub-rack earthing point to all the individual earthing points of the electronic equipment, separate copper conductors must be installed for each electronic rack.
- (5) The conductor size shall be determined according to SANS 0142 and must be sufficient for that particular rack and must be soldered to the terminal(s) of the edge connector(s) on that rack.
- (6) All connections between racks or sub-racks used to transmit audio, video, radio frequency or digital data must be made using co-axial type cable having the correct matching impedance.
- (7) Terminations of co-axial cables shall be in proper connectors (plugs and sockets) of the BNC, RG8U or equivalent approved type, depending on the particular application.

3.22.6 Installation Procedure

When the equipment is installed and commissioned, the Contractor must accurately determine that all earth connections are done as specified. It is recommended that the Contractor utilize suitable measuring equipment and auxiliary equipment such that the earth connections can be individually monitored during installation of the earth connections to obviate any earth loops, which might occur.

3.23 LIGHTNING AND SURGE PROTECTION DEVICES

3.23.1 General

- (1) General lightning protection shall be maintained in accordance with the Code of Practice for the Protection of Structures against Lightning, SABS 03.

- (2) Lightning protection down conductors and earthing of equipment shall be connected to a common earth mat system of domestic or industrial installations.

3.23.2 Lightning and Surge Protection

- (1) The Contractor shall ensure that electronic equipment is suitably protected against lightning surges and voltage transients emanating from or via power supply networks.
- (2) The correct type and rating of surge protection devices (SPD's) shall be installed to protect electronic control circuits and interconnections. Where appropriate avalanche diode protection devices shall be incorporated in the SPD's included for the protection of digital control circuits for any application used in the particular installation.
- (3) These devices shall be suitable to divert the surge currents, which might occur in the network and inflict damage on the devices. These SPD's shall respond in the shortest time possible, the time generally being equal or less than 8 μ s.

3.24 SOFTWARE PROGRAM AND OTHER SOFTWARE SUPPORT EQUIPMENT

3.24.1 General

- (1) It is a requirement that the Contractor must ensure that the total software documentation and support equipment of the programme software is correctly utilized and maintained in compliance with the requirements of this specification.
- (2) Should the Contractor wish to employ another Subcontractor to maintain and ensure the correct operation of the software he shall by approval of the representative of the Employer and Engineer employ such a Subcontractor for any work to be undertaken in respect of maintaining the software programmes and database.
- (3) Should micro controller software updates be developed, new updated micro controller chips/memory chips shall be made available to the Employer. Such future development must be offered to the Employer, such that they could consider acquiring such updates.
- (4) Should such future development be offered to the Employer by the original supplier of the software the Employer might consider acquiring such updates. This information submission shall include all documented and printed material describing in detail the improved features which could in future be incorporated in the present control systems as offered.

3.24.2 Requirements of The Software Information to be Presented

- (1) The software package shall include the software development facilities and other support information which normally relates to the software package. The information must be supplied in a format which is standard to the way such organisations supply the software information.
- (2) Any special developed software which shall be used in the system must be supplied in a format which will normally be made available to accredited users.
- (3) The programming flow charts and instructions to enable all modules of the subsystems in the control systems to be programmed to operate as one total control system must be supplied.

- (4) Software documentation which describes the functioning of all programmable operational characteristics of the equipment must be supplied.
- (5) This shall be done such that the interests of the Employer are safeguarded on a long term basis.

3.24.3 Supply of Software

- (1) Should such updated software become available the Employer may with the assistance of the Contractor decide to enter into negotiation with the supplier with such updated software.
- (2) The Contractor must therefore be willing to enter into a formal agreement with the Employer and other interested parties for the provision of the software such that this agreement will be acceptable to all parties.
- (3) Negotiations for surrendering the aforementioned software information shall commence at the stage when such software becomes available and when the Employer decides that it is in his interest to obtain this information.
- (4) The Employer may alternatively wish to start such negotiations during the Contract period. The Contractor shall assist and support them with these efforts.

3.25 SPARE PARTS

- (1) One (1) month before completion of the installation, the Contractor shall supply to the Engineer a recommendation containing a list of components which should be acquired as spares for maintenance purposes. The list shall include the number of components which should be kept in stock as well as the unit price of such components (the date and exchange rate of prices, if applicable, shall be stated).
- (2) The following information shall be submitted with the list:
 - (a) The exact code or identification number of the component.
 - (b) The firm or agency in South Africa from whom or through which an additional number of the components could (if necessary) be acquired.
 - (c) Cross-reference numbers of such components referring to identification numbers given in the maintenance and instruction manuals. When tendering, the tenderer shall recommend which component values shall be acquired as spares for the installation.

PART 4

HEALTH AND SAFETY SPECIFICATION

FOR

UPGRADE OF CONTROLS OF STAGE MACHINERY AND FLYING SYSTEM IN THE THEATRE VENUE

ON BEHALF OF

ARTSCAPE

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FOREWORD

This Health and Safety specification has been compiled under the guidelines of the Occupational Health & Safety Act no.85 of 1993 and amended Construction Regulations.

Huge emphasis is placed on the requirements of the New Construction Regulations 2014 under the Occupational Health and Safety Act and the Baseline Risk Assessment that form the basis of this specification. Contractors are encouraged to not only read these two documents in isolation but must consider the By-Law Relating to Community Fire Safety 11257 and Relevant National Building Regulations SANS Codes 10400.

Should there be any contradiction between then document and the Act; the Act must take preference except where explicitly stated.

Similarly, where this document is silent on a specific Health & Safety requirement, the Act must be used as the minimum requirement.

Should you be unclear about anything set out in this document, please contact this office.

Ensuring you of our best intentions and service at all times

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1. INTRODUCTION AND BACKGROUND

1.1 Background to the Health and Safety Specification

The Construction Regulations (February 2014) place the onus on the Client to prepare a pre-construction Health and Safety specification, highlighting all risks not successfully eliminated during design setting standards for Health and Safety during construction phase. The Health and Safety Specification will be based on the findings of the Baseline Risk Assessment.

1.2 Purpose of the Health and Safety Specification

To assist in achieving compliance with the Occupational Health and Safety Act 85/1993 and the promulgated Construction Regulations (February 2014) to reduce incidents and injuries. This specification shall act as the basis for the drafting of the construction phase Health and Safety plan by the Principal Contractor.

The specification sets out the requirements to be followed by the Principal Contractor and their contractors so that the Health and Safety of all persons potentially at risk may receive the same priority as other facets of the project e.g., Cost, programme, environment, quality etc.

2. DEFINITIONS

Agent	means a competent person who acts as a representative for a client.
Angle Of Repose	means the steepest angle of a surface at which a mass of loose or fragmented material will remain stationary in a pile on the surface, rather than sliding or crumbling away.
Bulk Mixing Plant	means machinery, appliances or other similar devices that are assembled in such a manner so as to be able to mix materials in bulk for the purposes of using the mixed product for construction work.
Client	means the Western Cape Government
Competent Person	means a person who- (a) has in respect of the work or task to be performed the required knowledge, training, and experience and, where applicable, qualifications, specific to that work or task: Provided that where appropriate qualifications and training are registered in terms of the provisions of the National Qualification Framework Act, 2000 (Act No.67 of 2000), those qualifications and that training must be regarded as the required qualifications and training. and (b) is familiar with the Act and with the applicable regulations made under the Act.

Construction Manager	means a competent person responsible for the management of the physical construction processes and the coordination, administration, and management of resources on a construction site.
Construction Site	means a workplace where construction work is being performed.
Construction Supervisor	means a competent person responsible for the management of the physical construction processes and the coordination, administration, and management of resources on a construction site.
Construction Vehicle	means a vehicle used as a means of conveyance for transporting persons or material, or persons and material, on and off the construction site for the purposes of performing construction work.
Construction Work	means any work in connection with - a) the construction, erection, alteration, renovation, repair, demolition or dismantling of or addition to a building or any similar structure. or

	<p>b) the construction, erection, maintenance, demolition or dismantling of any bridge, dam, canal, road, railway, runway, sewer, or water reticulation system. or the moving</p> <p>c) Page 7 of 79</p> <p>d) of earth, clearing of land, the making of excavation, piling, or any similar civil engineering structure or type of work.</p>
Contractor	means an employer who performs construction work.
Demolition Work	means a method to dismantle, wreck, break, pull down or knock down of a structure or part thereof by way of manual labour, machinery, or the use of explosives.
Design	in relation to any structure, includes drawings, calculations, design details and specifications.
Designer	<p>means-</p> <ul style="list-style-type: none"> a) a competent person who- <ul style="list-style-type: none"> I. prepares a design. II. checks and approves a design. III. arranges for a person at work under his or her control to prepare a design, including an employee of that person where he or she is the employer. or IV. designs temporary work, including its components. b) an architect or engineer contributing to or having overall responsibility for a design. c) a building services engineer designing details for fixed plant. d) a surveyor specifying articles or drawing up specifications. e) a Contractor carrying out design work as part of a design and building project. or an interior designer, shopfitter, or landscape architect.
Excavation Work	means the making of any man-made cavity, trench, pit, or depression formed by cutting, digging, or scooping.
Explosive Actuated Fastening Device	means a tool that is activated by an explosive charge and that is used for driving bolts, nails, and similar objects for the purpose of providing fixing.
Fall Arrest Equipment	means equipment used to arrest a person in a fall, including personal equipment, a body harness, lanyards, deceleration devices, lifelines, or similar equipment.
Fall Prevention Equipment	means equipment used to prevent persons from falling from a fall risk position, including personal equipment, a body harness, lanyards, lifelines, or physical equipment such as guardrails, screens, barricades, anchorages, or similar equipment.
Fall Protection Plan	<p>means a documented plan, which includes and provides for-</p> <ul style="list-style-type: none"> a) all risks relating to working from a fall risk position, considering the nature of work undertaken. b) the procedures and methods to be applied in order to eliminate the risk of falling. and c) a rescue plan and procedures.

Fall Risk	means any potential exposure to falling either from, off or into.
Health And Safety File	means a file, or other record containing the information in writing required by these Regulations.
Health And Safety Plan	means a site, activity, or project specific documented plan in accordance with the client's H&S specification.
Health And Safety Specification	means a site, activity or project specific document prepared by the client pertaining to all health and safety. Page 8 of 79 requirements related to construction work.
Material Hoist	means a hoist used to lower or raise material and equipment, excluding passengers.
Medical Certificate Of Fitness	means a certificate contemplated in CR 7(8).
Mobile Plant	means any machinery, appliance or other similar device that is able to move independently and is used for the purpose of performing construction work on a construction site.
Principal Contractor	means an employer appointed by the client to perform construction work, used interchangeably with the term "Principal Contractor".

"Professional Construction HealthAnd Safety Agent	means a person holding registration as a Professional Construction Health and Safety Agent in terms of the Project and Construction Management Act (Act No. 48 of 2000).
"Professional Engineer Or Professional Certificated Engineer	means a person holding registration as either a Professional Engineer or Professional Certificated Engineer in terms of the Engineering Profession Act, 2000 (Act No. 46 of 2000).
Professional Technologist	means a person holding registration as a Professional Engineering Technologist in terms of the Engineering Profession Act, 2000.
Scaffold	means a temporary elevated platform and supporting structure used for providing access to and supporting workmen or materials or both.
Shoring	means a system used to support the sides of an excavation and which is intended to prevent the cave-in or the collapse of the sides of an excavation.
Structure	means- a. any building, steel, or reinforced concrete structure (not being a building), railway line or siding, bridge, waterworks, reservoir, pipe or pipeline, cable, sewer, sewage works, fixed vessels, road, drainage works, earthworks, dam, wall, mast, tower, tower crane, bulk mixing plant, pylon, surface and underground tanks, earth retaining structure, or any structure designed to preserve or alter any natural feature, and any other similar structure. b. any false work, scaffold or other structure designed or used to provide support or means of access during construction work. or (b) any fixed plant in respect of construction work which includes installation, commissioning, decommissioning, or dismantling and where any construction work involves a risk of a person falling.
Suspended Platform	a working platform suspended from supports by means of one or more separate ropes from each support.
Temporary Works	means any false work, formwork, support work, scaffold, shoring or other temporary structure designed to provide support or means of access during construction work.
The Act" Or "OHS Act	means the Occupational Health and Safety Act, 1993 (Act No. 85 of 1993).
Tunnelling	means the construction of any tunnel beneath the natural surface of the earth for a purpose other than the searching for or winning of a mineral.

2.2 References

- a) Occupational Health and Safety Act (85 of 1993)
- b) Construction Regulations, 2014
- c) Compensation for Occupational Injuries and Diseases Act (130 of 1993)

- d) CoCT//001148: Covid 19 OHS Guideline for Construction
- e) Department of Employment and Labour COVID-19 Direction on Health and Safety in the Workplace, 29 April 2020 (and subsequently 04 June 2020)
- f) Notice on Compensation for Occupationally Acquired Novel Coronavirus Disease (COVID- 19) under COIDA Act, 130 of 1993 as amended
- g) COVID-19 Occupation Health & Safety Guideline for Construction Visitors at Western Cape Government Health Facilities – appended at the end of this document.
- h) Disaster Management Act (57 of 2002)
- i) Hazardous Substances Act (85 of 1973)
- j) Prevention of Environmental Pollution Ordinance Act (21 of 1981)
- k) Project and Construction Management Act (48 of 2000)

and any other act or regulation passed in terms of, or as amendments to, the above.

3. PROJECT DIRECTORY

Project Client: Artscape	Tel: 021 410 9800
Contact Person: Marius Golding	e-mail: marius@artscape.co.za
Project Manager: CA du Toit Western Cape (Pty) Ltd.	Tel: 0832706121, 0219192280 e-mail: coert@cadutoit-wp.co.za
Contact Person: Coert Slabbert	
Architect:	Tel:
Contact Person:	e-mail:
Project Electrical Engineer:	Tel:
Contact Person:	e-mail:
Project Structural Engineer:	Tel:
Contact Person:	e-mail:
Project Quantity Surveyor:	Tel:
Contact Person:	e-mail:
Construction Safety Agent: Frontline SHEQ	Tel: 072 828 5953
Contact Person: Stephan Julius	e-mail: stephan@frontlinesafety.co.za
OTHER PARTIES DIRECTORY	
Department of Labour for submission of Annexure 2: Notification of Construction Work	Tel: 021 441 8158
WESTERN CAPE – Fezeka Ngalo	e-mail: Fezeka.Ngalo@LABOUR.gov.za
PROJECT DETAILS	
Description of Works includes but not limited to: <ul style="list-style-type: none"> • Upgrade of group control of fly bars • Upgrade of main curtain control system • Upgrade of control of safety barrier, smoke ventilation, sound barriers and lighting bridges • Upgrade of control system of backstage wagon and revolves • Upgrade of orchestra pit lifts control systems • Upgrade of point hoists 	
Provisional Start Date: May 2023	
Completion Date: +-May 2024	
Contract Duration: +-12-18 months(Phase approach)	

4. HEALTH AND SAFETY SPECIFICATION

4.1 Scope

This specification covers the requirements for eliminating and mitigating incidents and injuries on **Upgrade of controls of stage machinery and flying system in the theatre venue Project**.

The scope also addresses legal compliance, hazard identification and risk assessment, risk control and promoting a Health and Safety culture amongst those working on the project.

The specification also makes provision for the protection of those persons other than employees.

4.2 Provision for Health & Safety Cost

The Principal Contractor and their contractors shall make adequate provision for the cost of Health & Safety Measures during the construction process as required by the Construction Regulation 5(1)(g).

5. INTERPRETATIONS

5.1 Application

This specification is a compliance document drawn up in terms of the South African legislation and is therefore binding. It must be read in conjunction with relevant legislation as noted previously.

6. MINIMUM ADMINISTRATIVE REQUIREMENTS

6.1 Notification of Intention to Commence Construction Work

A client who intends to have construction work carried out, must at least 30 days before that work is to be carried out apply to the provincial director in writing for a construction work permit to perform construction work if the intended construction work starts from the 7th of August 2018 and will –

1. exceed 365 days and will involve more than 3600 person days of construction work.
2. the tender value limit is grade 7, 8 or 9 of the Construction Industry Development

Board(CIDB) grading

CIDB Grading chart

Tender Value Range Adjustments TVR)

CIDB Grade	Current TVR	Proposed Adjustment TVR
1	200 000	500 000
2	650 000	1 000 000
3	2 000 000	3 000 000
4	4 000 000	6 000 000
5	6 500 000	10 000 000
6	13 000 000	20 000 000
7	60 000 000	60 000 000
8	130 000 000	200 000 000
9	No Limit	N/A

Construction work permit:

Condition 1:

- is intended to exceed 365 days; or will involve more than 3600 person days of construction work; or

Condition 2:

Condition 2 is dependent on the Construction Industry Development Board (CIDB) grading, which are as follows:

- Grade 7 = R60 000 000
- Grade 8 = R130 000 000
- Grade 9 = No limit

If a construction work permit is not required for projects that forms part of the tender, then a Notification of Construction to the Department of Labour must be completed as below explained.

The appointed Principal Contractor shall notify the Provincial Director of the Department of Labour in writing that construction work commences as per the Annexure 2 in terms of CR 4.

A copy of the Notification must be placed in the Principal Contractors Health and Safety File on site and one copy shall be sent to the Client.

The Principal Contractor must ensure that the Notification of Construction Work is completed at the start of the project and kept on file for the duration of the project.

6.2 Assignment of Contractor's Responsible Persons to Manage and Supervise Health and Safety on Site.

The Principal Contractor shall submit management and supervisory appointments as well as any relevant Appointments in writing (as stipulated by the OHS Act and Construction Regulations), prior to commencement of work. Proof of competency must be included.

Note: All appointments shall be done by the Chief Executive Officer/Managing Director or his/her assistant in terms of Section 16 of the OHS Act 85/1993 with exception to the Construction Manager in terms of Construction Regulation 8. The Construction Manager shall be full time on site unless an Alternate Competent Construction Manager has been appointed in writing.

6.3 Competency of Principal Contractor Responsible Persons

The Principal Contractors' competent persons for the various risk management portfolios shall fulfil the criteria as stipulated under the Definition of Competent in accordance with the Construction Regulations (February 2014). Proof of competence for the various appointments must be included prior to start of work.

6.4 Compensation for Occupational Injuries and Diseases Act (COIDA) 130 Of 1993.

The Principal Contractor and their contractors shall submit a valid Letter of Good Standing from their Compensation Insurer-FEM or Compensation Commissioner to the Client's Representative as proof of registration before they commence work on site.

Note:

A client must ensure before any work commences on a site that every Principal Contractor is registered and in good standing with the compensation fund or with a licensed compensation insurer as contemplated in the Compensation for Occupational Injuries and Diseases Act, 1993 (Act No. 130 of 1993).

Principal Contractor must ensure prior to work commencing on the site that every contractor is registered and in good standing with the compensation fund or with a licensed compensation insurer as contemplated in the Compensation for Occupational Injuries and Diseases Act, 1993.

6.5 Occupational Health and Safety Policy

The Contractor and their contractors shall submit a Health and Safety Policy signed by their Chief Executive Officer. The Policy must outline objectives and how they will be achieved and implemented by the Company / Contractor.

6.6 Health and Safety Organogram.

The Principal Contractor and their contractors shall submit an organogram with contact numbers, outlining the Health and Safety Site Management Structure including the relevant appointments / competent persons. In cases where appointments have not been made, the organogram shall reflect the intended positions. The organogram shall be updated when there are any changes in the site Management Structure and must be site specific.

6.7 Preliminary Hazard Identification and Risk Assessment

The Principal Contractor and their contractors shall develop Risk Assessments and Method statements by a competent person for the risk that they foresee during construction.

Note, the Principal Contractor shall ensure that a competent Risk Assessor is appointed in writing and shall be Full Time on site for the duration of the project.

Principal Contractor to provide a 14-day Look Ahead Hazard Identification Risk Assessment (HIRA) for upcoming activities before they are encountered on a bi-weekly basis and forward an electronic copy to the appointed Health and Safety Agent. Contractor to ensure that provision is made should physically impaired/challenged employees be employed.

Furthermore, the Principal Contractor and their contractors to ensure that Daily Safe Task Instruction/ Planned Tasked Observations are conducted prior to any activity with proof placed on file. Contractors may use their own Formats/Templates.

The following is a site-specific source of risks that have been identified but is not limited to and must as a minimum, be appropriately addressed by the Principal Contractor in their Health & Safety Plan with Control Measures but is not limited to:

Site Establishment

- Offloading of containers/site office
- Secure / Safe Storage of Material, Plant & Equipment
- Ablution Facilities
- Eating facilities
- Vehicle Access to Site
- Location of existing Services
- Dealing with existing structures and Traffic

- Provision for drinking water for all staff

Crane Management System (i.e., All Cranes)

- Competency and Medical Certificates of Operator
- Load Test Certificates
- Rescue Plan
- Crane Management Plan/System to be provided.
- (Emergency Procedures)
- CR 23 and Driven Machinery Regulations (2015) must be adhered to
- Relevant Inspections conducted by an LMI as per DMR 18 (2015)

Hoarding & Access Control

- Public Liability / Access Control / Compliance to Section 9
- Site needs to be Adequately Secured.
- Relevant Construction Warning Signage
- Daily inspections with proof placed on file.
- Hoarding to be in line with approved Design Drawings

Public Liability

- Effect of Construction Work on members of the public and existing property e.g. Neighbouring Property
- Noise Control
- Dust Control
- Temporary lighting
- Relevant signage
- Hazardous Chemical Substances

Working near existing services

- Identification and protection of existing services
- Electrical Cables, Telkom, Data etc.

Plant & Machinery

- Principal Contractor to provide designated area should any plant and machinery be parked at night. Plant to be fully secured to avoid possible unauthorized access.

Unplanned collapse of Material or structures- Contractor to provide control measures.

- Principal Contractor to provide adequate protection to avoid falling objects e.g., Crash Decks, Catch Nets, Apron Fans etc. or any other similar protection as and where needed. Principal Contractor to assess all work areas prior to start of work.
- Structure to be inspected periodically by a competent person to render the structure safe. The structure to be maintained in such a manner so that it remains safe for continuous use.
- Records of inspections and maintenance are to be kept on file and must be made available on request to an inspector.
- Principal Contractor to provide full method statement and risk assessment.

Procedure to identify underground HV/Electrical Cables Compliance to the Driven Machinery Regulations (2015)

Traffic Management Plan to include but is not limited to i.e.:

- Scheduling of traffic management
- Inspections for during night traffic management
- Delivering of Material and Equipment
- Signage, Competent Flagmen and Compliance with all relevant regulation and legislation.
- Plan to be Monitored and Reviewed at least monthly (Every 30 Days) or as the building programme/activities changes.
- Adequate barriers and delineators to be provided and placed strategically as needed.
- Procedure for maintaining road signage.
- All employees/ visitors to wear Hi-Viz vests always.
- Competent Flagmen shall be provided and readily available to assist with all Deliveries.

Lifting and Installation Procedures

- Principal Contractor to submit Full Method Statements of their lifting and installation procedures e.g., manually, or mechanically.
- All lifting equipment to comply with Driven Machinery Regulation (2015)

Waste Management Plan/System to be implemented.

- Rubble to be stored neatly in bags/bins and collected as needed.
- Principal Contractors to provide sufficient Bins / Bags always and must be removed on a regular basis or as and when needed.
- All hazardous material to be stored separately and must be disposed of at an authorized landfill site. Proof of Disposal to be provided.
- Rubble shall not be allowed to accumulate on site and shall be removed at regular intervals.

Hot Works

- Principal Contractors and their contractors to ensure that Fire Equipment and adequate precaution measures are in place when grinding, welding / hot works etc. including PPE and demarcation.
- Hot work permits to be issued once the area has been inspected by a responsible person and declared safe with proof placed on file. (Note- All permits should not exceed one (1) working day)
- Compliance with CR 25& 29

Temporary Flammable Liquid/Material Storage

- Principal Contractor to ensure that adequate ventilation is provided with Relevant Signage and Fire Precautions provided.
- Adequate Fire Equipment to be readily available.
- Compliance with all relevant legislation and regulations including the Community Fire Safety By-law Compliance and CR 25& 29.

Structural Steel

- Principal Contractor to submit Task Specific Method Statements and Task Specific Risk Assessments of their lifting and installation procedures e.g. Manually or Mechanically.
- Full compliance with CR 9, 10, CR 23 and DMR 18 (2015)
- Guide Ropes shall be used as far as reasonably practicable when busy with all lifting operations to assist with possible uncontrolled loads especially during inclement weather and restricted areas.
- Only competent persons to conduct operations
- Task Specific Fall Protection & Rescue Plan
- All work areas shall be adequately demarcated with spotters' present.

Working near of Electrical Cables

- Contractor to provide full method statement and risk assessment when working on live electrical Cables. Must be communicated to all staff prior to the activity.
- All Staff must be provided with the relevant Personal Protective Equipment (PPE)

Procedure to identify HV/Electrical Cables Electrical Installations – High and Low Voltage

Compliance to the Driven Machinery Regulations (2015)

Safe Use of Portable Electrical Equipment

- Electrical Drilling Machine/ Angle Grinder
- Kango / Jack Hammer
- High Pressure Equipment
- Any Other Equipment used by Principal Contractor

Emergency Preparedness

- Emergency Evacuation Plan with Relevant Emergency Numbers
- Revision of Emergency Plan
- Principal Contractor to monitor site conditions and conduct Evacuation Drills as and when needed with proof placed on file (Roll call, report to be placed on file etc.)
- Enough workers are Trained (Competent) in the use of Fire Extinguishing Equipment
- Emergency assembly point to be established with the relevant signage displayed.
- Air horn/alarm/siren to be provided on site.

Manual and Mechanical Handling Mechanical Installations

Protection of Storm Water System

- Method to Prevent Run Off into Storm Water System

Health Hazards

- Storage of hazardous materials
- Dust
- Noise
- Contaminated land
- Vibration

Additional Activities foreseen on site.

- Public Safety- Relevant precautions to be taken (Hoarding/Physical Barriers, signage etc.)
- Process to move equipment, tools, scrap material, etc. to and from elevated positions.
- Storage/control of Hazardous substances
- Use of Temporary Access
- Unforeseen activities

N.B. A risk assessment will be performed for all unplanned work and submitted to Health and Safety Agent for approval prior to work commencing.

Principal Contractors and their contractors to ensure that the risk assessments, as well as other risks identified by them, are updated at least every 30 days or as the risk changes are recorded and communicated to all relevant parties with proof placed on file- CR 9. Note: All reviews must be signed off by the appointed Risk Assessor.

Note: All identified risks and hazards must be based on a documented method (method statements)

Furthermore, the Principal Contractor and their contractors shall provide a Monitoring and a Review Plan including a Risk Register indicating all activities.

Note: Principal Contractor must ensure as far as is reasonably practicable, ergonomic related hazards are analysed, evaluated, and addressed in a risk assessment.

6.8 Fall Protection Plan: Erecting and Working on Scaffolding, Working at Heights.

Working at heights includes any work that takes place in an elevated position. The Principal Contractor and their contractors must submit a risk/task-specific Fall Protection Plan in accordance with Construction Regulations 10. The Fall Protection Plan must be job specific, be reviewed at least monthly (Every 30 Days) or as the risk changes or after any incident.

Contractors to ensure that medicals are provided for all persons exposed to elevated positions.

Scaffolding must comply with the requirements of **SANS 10085-1:2004**. Scaffolds are used extensively by Contractors and strict control measures must be in place to prevent Unauthorized alterations to scaffolding such as removing ties and scaffold boards.

Competent persons to be appointed in writing to:

- erect scaffolding (Scaffold Erector/s)
- act as Scaffold Team Leaders
- inspect Scaffolding daily and after inclement weather (Scaffold Inspector/s).
- The Scaffolding must comply with SANS 10085:1-2004, fully cladded including, Crash Decks etc. as and when needed.

Written Proof of Competency of above appointees to be available on Site.

Where scaffolding or work from scaffolding may negatively affect the public, it must include a scaffold fan/apron or access tunnel. Shade cloth must be used to enclose the scaffolding below the first fan/apron. Should the scaffolding be adjacent to an existing pavement of similar public walkway, a pavement **gantry and crash deck** will be required (overhead protective structure).

All employees working on heights must have a Medical Certificate issued by an Occupational Health Practitioner (OHP)

Note, The Principal Contractor shall provide a programme for the training of employees working from a fall risk position and the records thereof.

A fall protection plan must include.

- a) a risk assessment of all work carried out from a fall risk position and the procedures and methods used to address all the risks identified per location.
- b) the processes for the evaluation of the employees' medical fitness necessary to work at a fall risk position and the records thereof.
- c) a programme for the training of employees working from a fall risk position and the
- d) records thereof.
- e) the procedure addressing the inspection, testing and maintenance of all fall protection equipment; and
- f) a rescue plan detailing the necessary procedure, personnel and suitable equipment required to affect a rescue of a person in the event of a fall incident to ensure that

therescue procedure is implemented immediately following the incident.

6.9 Health and Safety Officer 8(5)

The Principal Contractor shall provide a Part-Time on site depending on the contract value and combined discretion of the client and Health and Safety Agent, with proof of SACPCMP registration, proof of SACPCMP examination date or payment placed on file.

Important Note: Part-Time Safety Officer will be discussed and agreed upon based on the extend of work. Part time Safety Officer must visit the site at least weekly with proof of inspections.

All contractor that has been appointed by the Principal Contractor shall ensure that they appoint a Part Time safety officer that will visit the site at least bi-weekly.

Note: “No contractor may appoint a construction health and safety officer to assist in the control of health and safety related aspects on the site unless he or she is reasonably satisfied that the construction health and safety officer that he or she intends to appoint is registered with a statutory body approved by the Chief Inspector and has necessary competencies and resources to assist the contractor”, however an exemption was issued and all Safety Officers/Practitioners must now provide confirmation of application for registration of the construction health and safety discipline with the SACPCMP should he/she not be registered as yet.

6.10 Medicals

The Principal Contractor to ensure that all his or her employees including all appointed contractors have a valid medical certificate of fitness specific to the construction work to be performed and issued by an Occupational Health Practitioner in the form of an Annexure 3.

6.11 Health and Safety File (HSF)

The Principal Contractor and their contractors shall, in terms of CR 7(1), maintain the HSF on site always. The HSF is a file with permanent records containing information on aspects of the construction project - which will be necessary to ensure the health and safety of any persons who may be affected by the construction work.

The HSF must include all documentation required in terms of the Act and Regulations and must also include a list of all Contractors on site that are accountable to the Principal Contractors and the agreements between the parties and details of work being done.

The Principal Contractors shall appoint a suitably qualified person to prepare the HSF and to keep it up to date for the duration of the contract.

Health and Safety Requirements as per the contract:

Contractor Requirements
<p>Health and Safety File that includes but is not limited to the below:</p> <ol style="list-style-type: none">1) Notification of Construction Work to Department of Employment Labour2) COIDA Letter of Good standing3) Health and Safety Policy4) Health and Safety Plan5) Risk Assessments6) Method Statement and Safe Work Procedure7) Fall Protection Plan (if required)8) Section 37.2 Mandatory Agreement9) Contractor Appointment10) Appointment Letters<ul style="list-style-type: none">• Competency Letters11) Emergency Procedures (in line with the premises)12) Incident & Accident Procedure13) Inspection Registers14) Training<ul style="list-style-type: none">• Induction• Toolbox Talk

6.12 The HSF Shall Include At Least The Following Information:

- a) Notification of Construction Work (CR 3) or construction work permit depending on the contract.
- b) Copy of OHSA (updated) (GAR 4.)
- c) Proof of Registration and good standing with a COIDA Insurer (CR 5(1)(j) (The Principal Contractors shall submit a letter of good standing with the compensation Insurer, at the tender stage).
- d) OHSP agreed with client including the underpinning Risk Assessment/s & Method Statements CR 9(1)
- e) Designs/drawings including scaffolding and form work.
- f) A list of Contractors (Sub-Contractors) including copies of the agreements between the parties and the type of work being done by each Contractor (CR 7)
- g) Appointment/Designation forms
- h) Registers
- h) Inductions

The HSF/CD shall be handed over to the Client on completion of the contract. It must contain all the documentation as set out above, or as instructed, as well as any handed to the Principal Contractor by any subcontractors together with a record of all drawings, designs, materials used and other similar information concerning the completed project.

6.13 Health and Safety Representative(s)

The Principal Contractor and their contractors shall ensure that competent Health and Safety Representative(s) are appointed under consultation and trained to carry out their functions as soon as the total workforce has reached a number of 20 employees or more. Should the Principal Contractor and their contractors have less than 20 employees, then the accumulative amount shall apply. The appointments must be in writing. The Health and Safety Representative shall carry out regular inspections at least monthly, keep records and report all findings to the Responsible Person forthwith and at Health and Safety meetings.

Note: The Principal Contractor and their contractors shall ensure that all certificates provided are issued by an accredited service provider as required by the National Qualification Framework Act 67/2000.

The number of representatives for each contractor shall be as per Section 17 of the OHS Act 85/1993, but as a minimum, The Principal Contractor shall appoint at least one competent Health and Safety Representative on the project.

6.14 Health and Safety Committees

Principal Contractor shall organize at least monthly Health & Safety meetings. Minutes and records shall be kept. Principal Contractors Health & Safety representative and responsible

person shall attend this meeting. Principal Contractor to ensure that all Contractor Representatives attend these meetings.

Note: These meetings shall be conducted regardless how many contractors are appointed.

6.15 Health and Safety Training

6.15.1 Induction

Principal Contractor shall ensure that all (including site visitors etc.) undergo site-specific induction presented by a competent person and proof placed in the Safety File prior to start of work. Employees to carry proof of inductions.

6.15.2 Awareness

The Principal Contractor shall ensure that, on site, toolbox talks take place at least once per week. These talks should deal with risks relevant to the construction work at hand. A record of attendance shall be kept in the Health and Safety file. All Principal Contractors have to comply with this minimum requirement. Contractors to ensure that the discussion is recorded on file (Topics with notes).

6.15.3 Health and Safety Site Rules

The Principal Contractors must develop a Set of Site-Specific Health and Safety Rules that will be applied to regulate the Health and Safety aspects on Site. Security and Access control must be included in the rules and those non-employees or visitors will not be allowed on site unaccompanied.

6.15.4 Competency

In accordance with the Construction Regulation the Principal Contractors shall appoint, in writing, competent persons (in addition to the Construction Managers – CR 8 (1)(2) & Construction Supervisor/s-8(7)(8) responsible for supervising construction work for the following work situations that may be expected on the site of the works, as applicable to the project.

A competent person may be appointed for more than one part of the construction work with the understanding that the person must be suitably qualified and able to manage and supervise at the same time the construction work on all the work situations for which he/she has been appointed.

The appointment of competent persons to supervise parts of the construction work does not relieve the Principal Contractors from any of his responsibilities to comply with all requirements of the Construction Regulations.

Note: The Principal Contractor and their contractors shall ensure that all certificates provided are issued by an accredited service provider as required by the National Qualification Framework Act 67/2000 and the South African Qualifications Authority (SAQA).

6.16 Environmental

Environmental terms and conditions are to be adhered to. All relevant legislation and bylaws are to be adhered to. All necessary permits are to be applied for by the contractor such as transport permits, possession permits and flammable certificates.

7. GENERAL RECORD KEEPING

The Principal Contractor and their contractors shall keep and maintain Health and Safety records to demonstrate compliance with this Specification, with the OHS Act 85/1993, and with the Construction Regulations (February 2014).

The Principal Contractor and their contractors shall ensure that all records of incidents / accidents, emergency procedures training, inspections, audits, etc. are kept in a Health and Safety file held in the site office.

The Principal Contractor must ensure that every contractor keeps and maintains its own Health and Safety file and must be readily available at all times. (The file must include the Contractor's health and safety plan). These records are crucial for inclusion in the Principal Contractors' consolidated health and safety file for handover to the Client on completion of construction work.

8. HEALTH AND SAFETY AUDITS, MONITORING AND REPORTING

The Client's Health & Safety Agent shall conduct monthly Health and Safety audits/inspections with follow up audits of the work. Operations including a full audit of physical site activities as well as an audit of the administration Health and Safety. The Health and Safety Agent may conduct unannounced visits as and when needed.

The Principal Contractor and their contractors are obligated to conduct similar audits on their contractors.

Detailed reports of the audit findings and results shall be reported on at all levels of project management meetings.

Copies of the reports shall be kept on file and must be readily available for inspection. The Principal Contractor must audit their contractors and keep records of these audits in their Health and Safety files and must be available on request.

Note: The Principal Contractor shall ensure that all contractor's documentation is assessed and approved prior to start of work with proof placed on file.

8.1 Internal Audits/Inspections

The Principal Contractor's safety manager/responsible person must conduct weekly inspections/audits with a detailed report. A copy of these inspections/audits must be placed on file for perusal by the Health and Safety Agent.

Principal Contractor to provide a Corrective Action Plan within 3 days for all non-compliances noted in the Audits conducted by the Client's Health and Safety Agent. Note: An electronic copy must be sent to the Client Representative including the appointed Health and Safety Agent.

9. EMERGENCY PROCEDURES

The Principal Contractor/s shall submit a detailed Emergency Procedure and Evacuation Plan with assembly point and contact details in the case of any emergency. The procedure shall detail the response plan including the following key elements:

- ❖ List of key competent personnel; Details of emergency services.
- ❖ Actions or steps to be taken in the event of the specific types of emergencies; Information on hazardous material/situations.
- ❖ Emergency procedure(s) shall include, but shall not be limited to, fire, spills, accidents to employees, use of hazardous substances, bomb threats, major incidents/accidents, etc.

The Principal Contractors shall advise the Client, Agent, Engineer, and all relevant authorities forthwith, of any emergencies, together with a record of action taken. This shall be confirmed in writing as soon as possible after the incident.

A contact list of all service providers (Fire Department, Ambulance, Police, Medical and Hospital, etc.) must be maintained and available to site personnel. These procedures shall form part of the OHSF. The Principal Contractor to ensure that the relevant staff is trained to perform such duties as required by the OHS Act. All emergency procedures must be monitored on a regular basis and must be in line with the building program.

The Emergency/Evacuation plan and routes must be revised on a regular basis for all employees and contractor (including staff) should any unforeseen event take place during the implementation phase/s of the project.

Evacuation Drills must be conducted as and when needed. Contractor to assess all activities to ensure this is implemented with proof placed on file.

Principal Contractor to familiarize with the ARTSCAPE emergency procedures.

10. FIRST AID BOXES AND FIRST AID EQUIPMENT

The Principal Contractor and their contractors shall appoint in writing First Aider(s).

The appointed First Aider(s) are to be sent for accredited first aid training. Valid certificates are to be kept on site. All Contractors with more than 5 employees shall supply their own

first aid box. Principal Contractor with more than 10 employees shall have trained, certified first aider on site at all times & First aid Box adequately stocked always.

10.1 RESCUE

The procedure to rescue persons from contact with a live conductor cannot definitely be laid down for all cases. However, certain principles and methods are outlined which all persons working on electrical apparatus or assisting in such work should know.

11. ACCIDENT / INCIDENT REPORTING AND INVESTIGATION

Injuries are to be categorized into first aid, medical, disabling, and fatal. The Principal Contractor and their contractors must stipulate in its construction phase Health and Safety plan how it will handle each of these categories. When reporting injuries to the Client, these categories shall be used. All contractors must investigate and report on the 4 categories of injuries to the Principal Contractor at least monthly.

Contractors must investigate injuries and accidents involving their employees within seven days of the incident in the form on Annexure1 (General Administrative Regulations) and forward a copy on the investigation report to the Principal Contractor forthwith.

All incidents reportable in terms of the provision of Section 24 of the OHS Act 1993 must be reported to the local Dept. of Labour in the prescribed manner.

Should construction work be finished within 3 days after any occurrence, the investigation shall be conducted before such construction work is completed.

The Principal Contractor and their contractors must report all injuries to the Client in the form of a spreadsheet, which includes all contractor injuries/incidents including near misses, property damage and man-hours worked for the month as well as the cumulative total. This report must be done on a monthly basis and must form part of the Principal Contractor's progress report.

The Principal Contractor shall immediately notify the client and Client's Health & Safety Agent of any hazardous or potentially hazardous situations that may arise during the performance of construction activities immediately or within 24 hours by means of a flash report.

In case of any Section 24 Incident, the Principal Contractor shall ensure that the Health and Safety Agent verify and peruse the report and all relevant documentation before it is sent to the Department of Labour.

12. HAZARDS AND POTENTIAL SITUATIONS

The Principal Contractor shall immediately notify the client and Client's Health & Safety Agent of any hazardous or potentially hazardous situations that may arise during the performance of construction activities.

13. PERSONAL PROTECTIVE EQUIPMENT (PPE) AND CLOTHING

The Principal Contractor shall ensure that all workers are issued and wear but is not limited to i.e., hard hats, protective footwear, Hi-Viz vests and overalls. The Principal Contractor and their contractors shall make provision and keep adequate quantities of SANS approved PPE on site always.

Contractors to provide control measures should employees continuously fail to use the prescribed PPE.

Contractors to provide control measures should employees continuously fail to use the prescribed PPE.

Note no employees will be allowed on site without a high viz vest.

14. OCCUPATIONAL HEALTH AND SAFETY SIGNAGE

The Principal Contractor shall provide adequate on-site OHS signage. Including but not limited to: "no unauthorized entry", "report to site office", "site office", and "hard hat area". Signage shall be posted up at all entrances to site as well as on site in strategic locations e.g., Access routes, entrances to structures and buildings, scaffolding and other potential risk areas / operations. All Contractors to adhere.

15. CONTRACTORS

The Principal Contractor shall ensure that all Contractors appointed by them comply with this Specification, the OHS Act 85/1993, and Construction Regulation (February 2014).

The Principal Contractor may only appoint a contractor after approving the contractor's health & safety plan with proof placed on file. The Principal Contractor must audit each of its Contractors at least monthly, with audit reports filed in the health & safety file on site.

The audit must include an administrative assessment as well as a physical inspection of the contractor's health & safety system.

The Principal Contractor must stop any Contractor from carrying out construction work that is not in accordance with the Principal Contractor's or Contractor's health & safety plan or if there is an immediate threat to the health and safety of persons.

The Principal Contractor shall take all reasonable steps necessary to ensure co-operation between all Contractors to enable each of those Contractors to comply with the provisions of these regulations.

The Principal Contractor must ensure that their contractors are registered and in good standing with a recognized compensation fund or with a licensed compensation insurer prior to work commencing on site.

The Principal Contractor must ensure that potential Contractors submitting tenders have made provision for the cost of health and safety measures during the construction process; The Principal Contractor shall discuss and negotiate with their Contractor the contents of the health and safety Plan and shall finally approve that plan for implementation.

16. NO-GO AREAS

Principal Contractor and their contractors to avoid all no-go areas and ensure that all relevant parties/employees and visitors are adequately informed. **These areas will be identified by the Client.**

17. PHYSICAL REQUIREMENTS

17.1 Cranes (All) including a Crane Management Plan, Rescue Plan & (Emergency Procedures)

The Principal Contractor and all Contractors shall ensure that lifting machinery and tackle is inspected before use and thereafter in accordance with the Amended Driven Machinery Regulations (2015). There must be competent lifting machinery and lifting tackle inspectors who must inspect the equipment daily or before use, considering that:

- Contractors to plan carefully when crane work is required. Overhead electrical cables to be kept in planning.
- All lifting machinery and tackle must carry a load test certificate and must have an inspector register.
- All lifting machinery and tackle have a safe working load clearly indicated,
- Regular inspections and servicing are carried out.

Note: Records are kept of inspections and of service certificates conducted by an approved LMI

- There is proper supervision in terms of guiding the loads that includes a

- trained banksman/rigger to direct lifting operations and check lifting tackle,
- Rescue Plan to be provided.
- Inventory to be provided and updated as and when needed.

The operators are competent as well as physically and psychologically fit to work and in possession of a medical certificate of fitness to be available on site.

17.2 High & Low Voltage Electrical Installations

Should high voltage electrical lines/fencing be present on the site perimeter, the Contractor must take extra caution and demarcate as far as reasonably practicable. These demarcations must be maintained for the duration of the construction work. The minimum safety clearances as per Electrical Machinery Regulations must be adhered to.

The Principal Contractor and their contractors must ensure that prior notice is given to Local Authority Electrical Department of any work involving electrical installation. A lock-out certificate must be issued to the relevant Principal Contractor. The Principal Contractor must ensure that a lock-out procedure is adhered to by his/her employees whenever required. The Principal Contractor must ensure that safety measures stipulated in the Electrical Installation Regulations, Machinery Regulations, General Machinery Regulations and Construction Regulations are always adhered to.

All installations must comply with SANS 10142 & the regulations of the OHS Act 85/1993 and Construction Regulation 24.

All temporary electrical installations must be inspected at least weekly with proof placed on file.

17.3 Edge Protection and Penetrations

The Principal Contractor and their contractors must ensure that all exposed edges and openings are guarded at all times until permanent protection has been erected.

The Principal Contractor has the following options when contemplating the protection of openings, slabs and edges:

- A physical barrier at the edge of the opening, which must be strong enough to carry the weight of **any** person in the process of falling.
- External façade scaffold with fully boarded platform with a handrail.
- Any other suitable means of protection may be used that will prevent a fall.
- Timber to be nailed on all penetrations, alternatively any other means of protection may be used that will prevent a fall.
- Any person working on an unprotected slab/deck to wear fall arrest and prevention equipment devices, like safety harness, life lines etc.

The Principal Contractors' risk assessment must include these items. E.g. all other openings and areas where a person may fall. **All Lifelines shall be certified as per the relevant standards and Anchorage points shall be load/pull tested by a competent person.**

Note: Danger Tape and shade cloth shall not serve as edge protection. Furthermore, the Principal Contractor shall provide adequate control measures to avoid Falling Objects especially at all walkways.

17.4 Construction Vehicles

Construction Vehicles and Mobile Plant may be inspected by the Client prior to being allowed on a project site and suppliers of hired vehicles, plant and equipment will be required to comply with this specification as well as the OHS Act and Regulations.

Construction Vehicles and Mobile Plant (CV & MP) to be:

- of acceptable design and construction
- maintained in good working order.
- used in accordance with their design and intention for which they were designed.
- Operated/driven by trained, licensed competent and authorised operators/drivers.
Nounauthorised persons to be allowed to drive or operate CV & MP.
- Operators and drivers of CV must be in possession of a valid medical certificate declaring the operator/driver physically and psychologically fit to operate or drive CV.
- fitted with adequate signalling devices to make movement safe including reversing.
- excavations and other openings must be provided with sufficient barriers to prevent CV from falling into same
- Provided with roll-over protection, appropriate seat fitted which shall be used during CV operations.
- inspected daily before start-up by the driver/operator/user and the findings recorded in a register/logbook.
- CV to be fitted with two head and two taillights whilst operating under poor visibility conditions, in addition they shall be equipped with 'hazard warning' lights, which must be used whenever the CV is on site.
- No loose tools, material etc. is allowed in the driver/operator's compartment/cabin nor in the compartment in which any other persons are transported.
- CV used for transporting persons must have seats firmly secured and sufficient for the number of persons being transported.
- Operators to be issued with Personal Protective Equipment as required and identified by the Risk Assessments.
- Only licensed and road worthy vehicles will be allowed on the public roads.

No person may ride on a CV except in a safe place provided by the manufacturer for this purpose.

The construction site must be organized to facilitate the movement of CV so that pedestrians and other vehicles are not endangered. Traffic routes are to be suitable, sufficient in number and adequately demarcated. CV left unattended after hours adjacent to roads and areas where there is traffic movement must be fitted with lights reflectors or barricades to prevent moving traffic meeting the parked CV.

In addition, CV left unattended after hours must be parked with all buckets, booms etc. fully lowered, the emergency brakes engaged and, where necessary, the wheels chocked, the transmission in neutral and the motor switched off and the ignition key removed and stored safely.

Workers employed adjacent to, or on public roads must wear reflective safety vests. All CV inspection records must be kept in the OH&S File.

17.5 Erosion and Sedimentation Control

The Contractor shall take all reasonable measures to limit erosion and sedimentation due to the construction activities and shall, in addition, comply with such detailed measures as may be required by the Scope of Work.

Where erosion and/or sedimentation, whether on or off the Site, occurs, rectification shall be carried out in accordance with details specified by the Engineer.

Where erosion and/or sedimentation occur due to the fault of the Contractor, rectification shall be carried out to the reasonable requirements of the Engineer, at the Contractor's cost.

The Contractor shall ensure that the City's storm water system is kept free from sediment arising from the Works.

Any runnels or erosion channels developed during the construction period or during the vegetation establishment period shall be backfilled and compacted, and the areas restored to a proper condition. Stabilisation of cleared areas to prevent and control erosion shall be pro-actively managed by the Contractor. The method of stabilisation shall be determined in consultation with the Engineer.

17.6 Existing Structures

Any adjacent structures that may be affected by work must be considered in the planning process. Precautionary measures must be detailed and applied to prevent damage, uncontrolled collapse of existing structures and/or loss to property and persons during the entire construction phase.

17.7 Confined Space Entry (If Applicable)

The Principal Contractor to prepare a confined space procedure in line with General Safety Regulation (5) OHS Act including Task Specific Risk Assessments, Method Statements and Emergency Procedures.

17.8 Deliveries

The contractor will need to engage the Project Manager to agree delivery times during the day for various activities, preferably at least 24 hours notice.

Delivery of materials and the safe movement of construction vehicles will be always controlled by the Contractor to alleviate any congestion or interference with the north-end delivery yard operations and public delivery roads for access/egress.

Principal Contractor shall ensure vehicle management procedures are in place by way of flagmen control during contractor deliveries.

- No contractor vehicles are to be left unattended during deliveries.
- Existing parking bays, other than what has been agreed for the use by the Contractor, are not for the contractor or construction vehicles.

17.9 Hazardous Chemical Substances (HCS)

The Principal Contractor working with Hazardous chemical substances to obtain copies of all the (MSDS) Material Safety Data Sheets and this to be kept on site in the Health and Safety File. Risk Assessments to be compiled. First Aider to have copies of MSDS.

All hazardous waste shall be disposed of at an authorised landfill site and proof of disposal shall be provided upon request. Employees shall be provided with suitable PPE including Respirators as and when needed. Adequate control measures shall be taken to avoid possible exposure to employees and members of the Public.

17.10 Stacking of Materials

The Principal Contractor shall ensure that there are sufficient appointed stacking supervisors, and all materials and equipment are stacked and stored safely. Double handling of material should be avoided and for this purpose, pallets and other stacking options should be used.

17.11 Removal of Rubble & Debris

The Principal Contractor must ensure the safe removal of debris and rubble from all levels where demolition occurs. A safe work procedure or method statement detailing the removal process and steps to be taken to contain the debris and rubble must be drafted and placed on File.

17.12 Permits

All relevant permits must be obtained from Local Authority (where needed) before any demolition and construction work commences. (Site hoarding permit, demolition permit, way leaves etc.)

17.13 Plant and Machinery

17.13.1 Pressure Equipment Regulations

The Principal Contractor and their contractors shall comply with the Pressure Equipment Regulations and SANS 10087, including:

- Providing competency and awareness training to the operators,
- Providing PPE or clothing,
- Inspect Equipment regularly and keep record of inspections,
- Providing appropriate fire fighting equipment (Fire Extinguishers) on hand.
- Correct storage of cylinders.

17.13.2 Fire Extinguishers and Fire fighting Equipment

The Principal Contractor shall provide adequate, regularly serviced fire-fighting equipment located at strategic points on site, specific to the classes of fire likely to occur. The appropriate

notices and signs must be posted up as required. All fire extinguishers to be handled and inspected by competent persons in compliance with CR 29.

The Principal Contractor to provide an initial Fire Risk Assessment. Note: The Principal Contractor shall ensure that sufficient and suitable storage is provided for all flammable liquids, solids, and gases.

The Principal Contractor shall ensure that sufficient number of workers is trained in the use of Fire Equipment.

17.13.3 *Hired Plant and Machinery*

The Principal Contractor shall ensure that any hired plant and machinery used on site is safe for use. The necessary requirements as stipulated by the OHS Act 85/1993 and Construction Regulations (February 2014) shall apply. The Contractor shall ensure that operators hired with machinery are competent and that certificates are kept on site in the Health and Safety file. All relevant Contractors must ensure the same.

17.13.4 *General Machinery*

The Principal Contractor shall ensure compliance with the amended Driven Machinery Regulations (2015), which include inspecting machinery regularly, appointing a competent person to inspect and ensure maintenance, issuing PPE or clothing, and training those who operate machinery.

17.14 Portable Electrical Tools

The Principal Contractor and their contractors shall ensure that the use of all portable electrical tools follows relevant legislation.

The Contractor shall ensure that all electrical tools, electrical distribution boards, extension leads, and plugs are kept in safe working order. Regular inspections and toolbox talks must be conducted to make workers aware of the dangers and control measures to be implemented e.g., Personal protection equipment, guards, etc.

A competent person to undertake routine/daily inspections and records are kept. Only authorized trained persons to use the tools, the safe work procedures to apply. Awareness training to be carried out and compliance enforced at all times, and PPE and clothing are provided and maintained.

Note: All power tools shall be inspected by the Authorised Operator on a daily basis with proof placed on file.

18. PUBLIC AND SITE VISITOR'S HEALTH AND SAFETY

Both the Client and the Principal Contractor have a duty in terms of the OHS Act 85/1993 to do all that is reasonably practicable to prevent members of the public and site visitors from being affected by the construction activities. Site visitors must be briefed on the hazards and risks they may be exposed to and what measures are in place or should be taken to control these hazards and risks. A record of these inductions must be kept on site in accordance with the Construction Regulations.

Appropriate Nets, Canopies, Hoarding, Fencing, Gantry's, and Crash Decks etc. must be provided to protect members of the public and their vehicles passing / entering the site, in accordance with Construction Regulation 27. Sufficient Safety, direction Signage and Flagmen to be placed to direct traffic near the site.

Principal Contractor to ensure that no unauthorized persons enter the construction area by implementing access control measures / registers.

Site visitors must not be left alone to walk the site but must be accompanied by an employee of the principal contractor.

19. NIGHT WORK

Adequate lighting/illumination to be provided where required with backup generators. Security to be provided as and when needed. All emergency procedures to be in place. Adequate PPE to be provided for all employees e.g., Hi-Viz Vests.

20. WORKING HOURS

Working Hours to be agreed with the Client for reasons that facilities might be in use by end users. Alternative arrangements to be agreed upon in advance to avoid any Health and Safety incidents.

21. OCCUPATIONAL HEALTH

21.1 Social Distancing

The Principal Contractor must arrange the workplace to ensure minimal contact between workers and as far as reasonably practicable ensure that there is a minimum of one and a half metres between workers while they are working, for example, at their workstations. Depending on the circumstances of the workplace or the nature thereof, the minimum distance may need to be longer. Reducing the number of workers present in the workplace at any time in terms by means of rotation, staggered working hours, shift systems or remote working arrangements.

- ❖ Supervisors should consider in their daily planning to avoid close contact with people where possible.

- ❖ It is important that employee representatives are elected and appointed to ensure workers can raise anonymous issues to them instead of discussing site issues in large groups for management to address.
- ❖ It is recommended that traditional contractual site/progress meetings be conducted through online media platforms such as Webex/Skype conference calling etc. instead of grouping on site where possible, provision of sufficient internet services should be available on sites to accommodate this.

21.2 Occupational Hygiene

Exposure of workers to occupational health hazards and risks is common in any work environment, especially in construction. Occupational exposure is a major problem and Principal Contractor must ensure that proper health and hygiene measures are put in place to prevent exposure to these hazards.

The Risk to be looked at includes: Ventilation.

Adequate ventilation / extraction / exhausting in hazardous areas e.g., chemicals/ adhesives / welding / petrol or diesel/ motors running and in confined spaces /basements.

21.3 Noise

Tasks identified where noise exceeds 85 dBA. All reasonable steps to be taken to reduce noise levels at the source. Hearing protection to be used where noise levels cannot be reduced below 85dBA.

Where noise is identified as a hazard the requirements of the NIHL regulations must be complied with and the following must be included / referred to in the Health and Safety Plan:

- Proof of training with regards to these regulations.
- Risk assessment
- Monitoring carried out by an AIA and done according to SABS 083.
- Medical surveillance programme established and maintained for the necessary employees.
- Control of noise by referring to:
 - Engineering methods considered.
 - Admin control (number of employees exposed) considered.
 - Personal protective equipment considered/decided on.
- Describe how records are going to be kept for 40 years.

21.4 Dust

Principal Contractor to ensure that employees working with grinders, drills, etc. are issued with dust masks and dust exposure to be minimized at all times. Suitable measures to be implemented by the Principal Contractor to ensure that members of the public are not detrimentally affected by such activities. Working Area to be fully clad with a Hundred Percent Shade Cloth or anything similar.

21.5 Welfare Facilities

The Principal Contractor to provide at least one sanitary facility for every 30 employees on site, including changing facilities & hand washing facilities. Safe and adequate eating areas must be provided. Waste bins must be strategically placed and emptied regularly. Safe and clean storage areas must be provided for workers to store personal belongings and personal protective equipment.

21.6 Waste Management

Principal Contractor must implement their waste management in line with Environmental Terms and Conditions.

21.7 Alcohol and Other Drugs

The Principal Contractor and their contractors to ensure that no alcohol and other drugs are allowed on site. No person may be under the influence of alcohol or any other drugs while on the construction site. Any person on prescription drugs must inform his/her superior, who shall in turn report this to the Contractor forthwith. Any person suffering from any illness / condition that may have a negative effect on his/her safety performance must report this to his/her superior, who shall in turn report this to the Principal Contractor forthwith.

Any person suspected of being under the influence of alcohol or other drugs must be sent home immediately, to report back the next day for a preliminary inquiry. The Contractor concerned must follow a full disciplinary procedure and a copy of the disciplinary action must be forwarded to the Principal Contractor for his records. No Smoking is allowed on site.

21.8 Hazardous Biological Agents

Covid-19 directives have since been repealed. However the virus is still prevalent, it is for this reason that all contractors like any other Employer is expected to comply with Hazardous Biological Agent Regulations promulgated under the OHS Act 85/1993 and provide control measures as needed. The Principal Contractor and their contractors must therefore determine mitigation measures to minimize risk as far as reasonably practicable, allowing work to continue safely and without harm to all relevant stakeholders, including Clients, Employees, Contractors, Suppliers, Manufacturers and all interested and affected parties.

22. ANNEXURE A- ACKNOWLEDGEMENT OF H & S SPECS

Annexure A: Acknowledgement of Health and Safety Specification

Acknowledgement of Receipt of the Health and Safety Specifications:

I, _____ representing.

_____ Contractor

Have satisfied myself with the content of the construction Health and Safety Specification and shall ensure that the Contractor and its personnel comply with all obligations / requirements in respect thereof.

Signature of Principal Contractor

DATE

Signature of Client Agent

DATE

COMMENTS:

23. ANNEXURE B APPOINTMENT OF PRINCIPAL CONTRACTOR

Appointment of Principal Contractor

IN TERMS, OF

OCCUPATIONAL HEALTH AND SAFETY ACT, ACT 85 OF 1993 & CONSTRUCTION REGULATIONS 2014

CONSTRUCTION REGULATION 5(1)(k)

I, Client Responsible Person,
for do hereby appoint:
..... as the Principal Contractor of Project.

Responsibilities:

- *Prepare a Health and Safety Plan to comply with the requirements of the Construction Regulation 5(1)(b), and in compliance with the Health and Safety Specification for the Project.*
- *Ensure co-operation between all contractors to enable each of those contractors to comply with the provisions of these regulations.*
- *Provide all contractors with the required safety specification for their area of responsibility.*
- *Appoint each contractor in writing in accordance with Construction Regulations.*
- *Ensure implementation of the contractor's health and safety plan.*
- *Stop contractors from working if not in accordance with the client specification.*
- *Provide health and safety information to contractors should their design change.*
- *Ensure all contractors are registered and in good standing with the compensation commissioner.*
- *Ensure contractors submitting tenders have made provision for health and safety during construction.*
- *Ensure risk assessments are conducted & the identified controls are communicated to all employees and visitors.*
- *Ensure Compliance to Occupational Health and Safety Act 85/1993, Construction Regulations 2014, Community Fire Safety Bylaw and Relevant Sans Codes.*

Signature:

Date:

Client / Principal Agent

Acceptance

I,..... hereby accept and acknowledge that I understand the requirements of this appointment.

Signature:

Date:

24. Baseline Risk Assessment

Baseline Risk Assessment for Health and Safety Specification: Upgrade of controls of stage machinery and flying system in the theatre venue Project		
Activity	Hazard	Control Measure
Off-loading of Material/deliveries and	<ul style="list-style-type: none"> Possible load falling Public Safety-potential injuries to workers and members of the public 	<ul style="list-style-type: none"> All work areas to be adequately demarcated-All Activities to be done under supervision. Ensure a spotter is available when needed. Once site has been secured it must be maintained to avoid unauthorised. Site security to be available. Relevant construction signage to be displayed. Contractors to be aware of live services e.g., electrical cables.
	<ul style="list-style-type: none"> Possible Collision/contact with property or stationary vehicles, workers, and members of the public 	<ul style="list-style-type: none"> Driver to be in possession of a valid driver's licence. All notices and signs to be obeyed. Driver to adhere to the speed limits. Employer and Driver to ensure that he is not intoxicated and must be of sober habits.
Carrying of material	<ul style="list-style-type: none"> Possible Contact with fellow employees and results into possible injuries. 	<ul style="list-style-type: none"> Employees to take caution when walking on site. Employees to keep material as close to themselves or structure as possible to avoid possible contact with persons. Ensure your vision is not obstructed. Watch your blind spots and get assistance when carrying heavy and large objects
	<ul style="list-style-type: none"> Possible Falling material and possible foot and body injuries 	<ul style="list-style-type: none"> Operatives to ensure that all material are adequately secured. Appropriate PPE to be worn always. Do not carry material in precarious (dangerous) positions so as to obstruct your vision etc.
	<ul style="list-style-type: none"> Possible Ergonomics/Possible back injuries 	<ul style="list-style-type: none"> Employees to ensure that they use correct bending techniques. Please get assistance when lifting heavy objects.
Working with Hazardous Substances	<ul style="list-style-type: none"> Possible Respiratory problems. 	<ul style="list-style-type: none"> Respirators to be used when spending even short periods of time. Adequate ventilation required. Ensure that all containers are clearly identified when decanting
	<ul style="list-style-type: none"> Dermatitis, Skin burns, Skin sensitization 	<ul style="list-style-type: none"> Avoid contact with the skin as far as reasonably practicable. Use barrier cream if possible.
	<ul style="list-style-type: none"> Possible Eye injuries 	<ul style="list-style-type: none"> Remove clothing that has been contaminated by hazardous substances.
		<ul style="list-style-type: none"> Wear suitable PPE as listed below. Wash hands thoroughly after contact and use a barrier cream.
		<ul style="list-style-type: none"> Follow Safety instructions (MSDS) as indicated by the MSDS.

Storage of Hazardous Substances	<ul style="list-style-type: none"> • Possible Explosion/fires Possible 	<ul style="list-style-type: none"> • Comply with CR 25 & CR 29. Store all Hazardous Substances in the correct categories. Store all flammable material separately. Ensure relevant signage is clearly displayed. Adequate fire extinguishers to be readily available. Fire Risk Assessment to be conducted by a competent person. Hazardous bins to be provided
Working at Heights including but is not limited to Scaffolds, Rope Access and Ladders.	<ul style="list-style-type: none"> • Possible Fall of persons, Possible Death 	<ul style="list-style-type: none"> • Task Specific Method statements and Risk Assessments required as per CR 9. • All work to be done under supervision. • Compliance with Fall Protection Plan. • All exposed to heights to medically fit issued by OHP/OHN. • Scaffolding to be SANS 10085-1:2004 compliant. • Daily inspections to be conducted as per CR 12. PPE to be worn always. • Rope Access work must comply with Construction

		<p>Regulations 18 which includes and not limited to:</p> <ul style="list-style-type: none"> • Competent and appointed Rope Access Supervisors • Competent and licensed rope access operators • The design, selection and use of the equipment and anchors • Life lines to be installed as and when needed and must be secured to a fixed structure • How the roof work was planned/Method Statements. • That the roof workers are competent (trained, experienced, knowledgeable) • Life lines (Proof of Certification) and anchor points (Load Tested) are provided and installed by a competent person and with proof placed on file • That no Roof work is carried during inclement weather or where conditions are hazardous to workers. • Rescue Plan
	<ul style="list-style-type: none"> • Possible Falling Objects / Equipment. Falling/slipping 	<ul style="list-style-type: none"> • As far as reasonably practicable, all equipment to be tied to rope. • No items to be thrown from elevated positions but must be safely lowered. • No persons to work underneath overhead work area or ground. • No work on open structures at heights during inclement weather. • No work on scaffolding during wet conditions/inclement weather.
Scaffold erecting & dismantling	<ul style="list-style-type: none"> • Possible Falling of persons, Collapse of Scaffold structures and damage property and employees. 	<ul style="list-style-type: none"> • Design Drawings required. • Work on scaffolds to be coordinated by appointed scaffold supervisor. • Lanyard to be used when erecting & dismantling scaffolding. (Scaffold erectors) Compliance with SANS 10085-1:2004, CR 12 and CR 16. • All scaffolding to be inspected daily and after inclement weather and findings recorded in a register. • Fully boarded platforms must always be provided. • Only those employees who are authorised may be on the scaffold. • Where safe platforms cannot be erected, safety harnesses are compulsory.

		<ul style="list-style-type: none"> • Guard rails and toe boards compulsory. • PPE required for persons working on scaffolding: safeshoes; hardhats. • Area below to be cordoned off. • Platforms to be cleaned daily. • Only competent erectors to change structure of scaffold. • No overloading of scaffold. PPE used: Safety boots, helmets, overalls.
Working with PowerTools	<ul style="list-style-type: none"> • Possible Contact with moving parts. 	<ul style="list-style-type: none"> • Task Specific Method statements and Risk Assessments required as per CR 9. • Only competent personnel should operate these tools.
		<ul style="list-style-type: none"> • Machines to be checked before use, guards are correctly fitted and work properly.
	<ul style="list-style-type: none"> • Noise above 85DbA 	<ul style="list-style-type: none"> • Employees to be issued with relevant PPE including hearing protection.
	<ul style="list-style-type: none"> • Possible Malfunction of Blade 	<ul style="list-style-type: none"> • Blades should be regularly inspected to ensure they are sharp/good condition
	<ul style="list-style-type: none"> • Possible Back Injuries 	<ul style="list-style-type: none"> • Employees to be trained on proper lifting and bending techniques.
Working with HandTools	<ul style="list-style-type: none"> • Possible Eye injury 	<ul style="list-style-type: none"> • Visual checks must be completed by operatives on tools prior to their use. • Eye protection is to be provided and used whenever work is done using cold chisels or other tools where

		there is risk of flying particles or other pieces of the tool breaking off.
	<ul style="list-style-type: none"> • Possible Injury to hands, feet, and body 	<ul style="list-style-type: none"> • Tools are required to be suitable for the purpose for which they are to be used. • Open bladed knives, screwdrivers, and other sharp tools are to be carried and used so as not to cause injury to the user or others.
	<ul style="list-style-type: none"> • Possible Tripping over tools 	<ul style="list-style-type: none"> • Tools should not be left lying around, they constitute a severe tripping hazard, and they are liable to get damaged.
Lifting Operations	<ul style="list-style-type: none"> • Uncontrolled release of material 	<ul style="list-style-type: none"> • Task Specific Method Statements and Risk Assessments required with proof of communication. • Rescue Plan and task specific Fall Protection Plan required, to be compiled by competent person. • Competent Banksman/Rigger to be readily available
		<ul style="list-style-type: none"> • Banksman/Rigger to have signalling device. • No person to be under suspended load. • No Crane operations when banksman/Rigger is not available or present. • Only appointed banksman/rigger to assist with lifting operations.
Material access to site	<ul style="list-style-type: none"> • Possible Public Safety-potential injuries to workers and members of the public. • Possible multiple, injury to staff. • Possible damage to property. 	<ul style="list-style-type: none"> • Access route to and from the site will be clearly demarcated and identifiable as per the design report rules. • Contractor will make the relevant resources available to carry material to and from site. • Flagman placed to control traffic when delivery trucks enter or leave work area. • Flagman will wear reflective vest. • Traffic management Plan will be in place as per SARTSM Chapter 13. • Signage will be inspected daily.
Traffic accommodation method statement	<ul style="list-style-type: none"> • Getting run down by-passing traffic. • Leaving material in road causing accidents • Mobile plant crossing active road, causing accident. • Signage falling into roadway causing obstruction/accident. 	<ul style="list-style-type: none"> • Workers to work with designated work way. Hi viz vest to always be worn. Look left and right before crossing the road. • Workers and supervisors to ensure all material is kept within working area. Area to be checked before shift ends for material in roadway. • Flagman to be present when crossing or entering active road.

	<ul style="list-style-type: none"> • Placement of signage workers getting hit by on-coming traffic 	
Demolition	<ul style="list-style-type: none"> • Uncontrolled or premature collapse of structure • Dust control (Possible dust inhalation) • Temporary stockpiling of rubble (Overloading) • Possible Damage to existing services 	<ul style="list-style-type: none"> • Competent person appointed in writing to control demolition. • Demolition operation inspected regularly to prevent premature collapse. • Structural engineering survey report obtained before demolition commences. • Existing services to be located and made safe before demolition commences. • Appropriate personal protective equipment issued. • Back propping to engineer's approval • Undertaking to wear signed and wearing enforced. • Wetting of work area. Dust Masks • Get permissible loading from engineer • Use dedicated areas • Way leaves or drawings to be obtained from Engineer/Client. • Mark out of structure. • Approval to be obtained from engineer before demolition commences

Work at Heights/Roof Work including Cladding, Trusses and Pur-lins, Structural, etc.	<ul style="list-style-type: none"> • Possible Fall of persons, • Possible Death 	<ul style="list-style-type: none"> • Task Specific Fall Protection Plan, Risk Assessments and Method Statements required • PC shall comply with CR 9 and CR 10. • All employees shall be in possession of Working at Heights Training issued by an Accredited Service Provider • All work to be done under supervision. • Compliance with Fall Protection Plan. • Rescue kit to be available on site. • PPE to be worn at all times. • Life lines to be installed as and when needed and must be secured to a fixed structure • How the roof work was planned/Method Statements. • That the roof workers are competent (trained, experienced, knowledgeable)
Electrical Installations	<ul style="list-style-type: none"> • Possible Electro-cution, even fatal. Damage to equipment 	<ul style="list-style-type: none"> • Task Specific Method statements and Risk Assessments required as per CR 9. • Competent contractor to be appointed if necessary. • Equipment to be used to detect live/high voltage cables. • Restricted areas to be identified. • All installations must comply with SANS 10142 & the regulations of the OHS Act 85/1993 and Construction Regulation 24 and Electrical Installation Regulations • Toolbox Talks to be conducted on Risk Assessments with declarations / acknowledgement signed daily. • Relevant PPE to be used. • Lockout procedures to be provided where applicable. • Only competent persons to be used with proof of competency to be provided.
		<ul style="list-style-type: none"> • COC must be issued for all electrical installations. • All temporary electrical installations to be inspected at least weekly and prior to use. • All cables to be treated as live

LV, MV and HV Installations	<ul style="list-style-type: none"> • Possible electrocution • Possible multiple injuries • Possible fatalities 	<ul style="list-style-type: none"> • All works to be conducted under supervision Contractor to meet Eskom safety requirements. • Only competent Employees to perform electrical works with proof of competency to be provided. • Relevant PPE to be provided to all employees conducting works. • Lock out procedures to be put in place as and where required.
Upgrade of controls of stage machinery and flying system in the theatre venue	<ul style="list-style-type: none"> • Upgrade of controls of stage machinery and flying system in the theatre venue 	Upgrade of controls of stage machinery and flying system in the theatre venue
Working in Confined Space	<ul style="list-style-type: none"> • Possible Body Injuries, Property Damage, Possible 	<ul style="list-style-type: none"> • The Principal Contractor to prepare a confined space procedure in line with General Safety Regulation (5) OHS Act including Task Specific Risk Assessments, Method Statements and Emergency Procedures. Ensure that all work areas are adequately demarcated. • Ensure that all ducts are adequately secured and that it can take the relevant loads
HVAC installations	<ul style="list-style-type: none"> • Falling of persons and material 	<ul style="list-style-type: none"> • Task Specific Risk Assessments to be provided • Fall arrest equipment must be used when fall prevention is not possible • Safe access to be provided • All ducts to be adequately secured on all levels • Adequate signage and demarcation required as and when needed

	<ul style="list-style-type: none"> • Ergonomics 	<ul style="list-style-type: none"> • Task Specific Risk Assessments to be provided and compliance with CR 7. Ensure that safe access is provided at all times
	<ul style="list-style-type: none"> • Possible re-restrictions while working in ducts 	Task Specific Risk Assessments to be provided and compliance with CR 7. Safe Access Required at all times. Adequate Ventilation and supervision required at all times

Note:

The above list is by no means exhaustive and should not be limited to these activities but must cover all activities that forms part of the said construction work. Each activity must be split down to individual tasks and all associated hazards identified and listed in the risk assessment. This ensures that the critical tasks and subsequent critical hazards are not missed.

All Activities are to be re-assessed by the Principal Contractor and their contractors prior to start of work and must be communicated with all relevant employees with proof placed on file.

NB:

Although some of the work related to health and safety work is mentioned /noted in certain measured items in the bill of quantities it remains the contractor's responsibility to allow in his tender price for all work related to health and safety and the requirements as per this Health and Safety Specification and the OH'S Act 85/1993.

Additional Information/General Notes

1. All work operations shall be limited within site boundary.
2. The roads shall be kept clean at all times and deliveries and vehicle movement will be limited to reduce noise levels or interruption within the area.
3. Principal Contractor to adhere to site speed limits and inform their delivery companies of the same.
4. Where unidentified services are located on site, the contractor is to report this immediately to the principal agent and is to adequately protect these services until identified and the necessary instruction issued by the principal agent.
5. Park all vehicles in designated area as provided by the Client.
6. Avoid loitering.

7. Principal Contractor and their Contractors to only use access routes that has been identified by the Client.
8. Adequate signage and demarcation required.
9. The Principal Contractor and their contractors shall avoid using any of the facilities, unless authorization has been granted in writing from the Client/Principal Agent.
10. Principal Contractor to only work in the areas allocated by the client.
11. Working hours shall be confirmed with the Client.
12. Contractor to provide additional toilet for security.
13. Contractor provide area for contractors staff tea breaks – not allowed to venture all over.
14. All site personnel and workmen must wear presentable, clean and tidy company uniforms, with their required PPE. The name of the contractor's company must be clearly printed on the uniform.
15. Principal Contractor to take into account load shedding schedules when planning and risk assessing all work activities.

Important Note:

The Health and Safety Specification was compiled with the input of all Designers. The Principal Contractor must ensure that continuous monitoring of risk and hazards are conducted.

Compiled by:

Stephan Julius Pr. CHSA/014/2014

Assisted by: Zain Harris

PART 5

BILLS OF QUANTITIES: PREAMBLE

1. This Bill of Quantities forms part of, and must be read in conjunction with the specification.
2. Preliminary and General items are allowed for in Bill no. 1 for each section.
3. No alteration, erasure or addition is to be made in the text of the Bill of Quantities. Should any alteration, erasure or addition be made it will not be recognized but the original working of the Bill of Quantities will be adhered to.
4. The Engineer will check the complete Bill of Quantities and reserves the right to adjust any individual price and to rectify any discrepancy whilst the total tender price as quoted remains unaltered.
5. All quantities may be re-measured on site.

In the event of discrepancies between the drawings, specifications and Bill of Quantities the Representative/Engineer shall decide whether the work as executed shall be re-measured on site or whether re-measurement shall be effected from the working drawings only.

NOTE:

Checking of Quantities

Notwithstanding the fact that the quantities as given in the Bills of Quantities have been measured from scaled drawings, the Contractor shall check all quantities on site before ordering the material, as he will not be paid for excess material after completion of the service. Any allowance for off-cuts shall be made in the unit rates. The final measurements shall be based on the nett installed material.

6. Where alternative prices for items of different manufacture are quoted the lowest alternative price for items according to the specification must be quoted against the relevant item in the Bill of Quantities. The remaining alternative prices must be furnished separately.
7. The unit prices quoted in the Bill of Quantities must include for such small installation materials as are required for the complete installation in accordance with the specification.
8. Should the Bill of Quantities be made available in electronic Excel format, the Tenderer shall be responsible to ensure the correctness of all formulas. The Engineer shall accept no responsibility for any incorrect tender pricing as a result of wrong formulas in the Excel document.

ARTSCAPE THEATRE STAGE MACHINERY: UPGRADING OF STAGE MACHINERY CONTROL DESK AND STAGE CONTROL PANEL

BILL OF QUANTITIES

Item no		Unit	Quantity	Rate	Amount - R
	<u>BILL NO. 1</u>				
	<u>CONTRACTOR PRELIMINARY AND GENERAL</u>				
1	<u>Site Establishment & costs for the duration of the contract</u>				
1.1	Contractor's camp, office, store, workshop & ablutions if required (Note - Client will provide area for an office & storage, existing ablutions may be used)	Month	18		
1.2	Telephone, internet and printing facilities if applicable (Note, Client will have free wi-fi available for use)	Month	18		
1.3	Cost for purchasing& duplicating the General Conditions of Contract for Construction Works 3rd Edition, 2015 (GCC) contract documentation (1 x original, 2 x copies)	Sum			
1.4	Tools & Testing Equipment	Sum			
2	<u>Administration costs for the duration of the contract</u>				
	<u>Staff on site:</u>				
2.1	Supervisory staff	Month	18		
2.2	Clerical staff	Month	18		
2.3	Draughtsman, tracers	Month	18		
2.4	Security staff	Month	18		
2.5	Transport	Month	18		
2.6	Insurance of works	Month	18		
2.7	Third Party Insurance for damage to persons and property	Month	18		
2.8	Cost of sureties	Month	18		
2.9	Financing of retention	Month	18		
2.10	Running cost e.g.. Telephone/data, electricity, cleaning services, printing and photocopy machines, stationary, etc.	Month	18		
2.11	Other				
3	<u>Drawings</u>				
3.1	Net amount for the provision of the desk and control panel fabrication drawings and "AS-BUILT" drawings for the complete installation	Sum			
4	<u>Occupation Health and Safety Act</u>				
4.1	Net amount for compliance to the OHS Act requirements.	Sum			
	TOTAL FOR BILL NO 1 (CARRIED FORWARD TO SECTION SUMMARY)				

<u>Item no</u>		<u>Unit</u>	<u>Quantity</u>	<u>Rate</u>	<u>Amount - R</u>
	<u>BILL NO. 2</u>				
	<u>DETAILED TESTING OF STAGE MACHINES WITH EXISTING CONTROL SYSTEM</u>				
	Test each stage machine with the existing control desk and stage control panel while keeping a detailed record of findings.				
2.1	Test 4 lighting bridges	Sum			
2.2	Test 2 sound barriers	Sum			
2.3	Test the smoke ventilator from the desk and from the stage control panel	Sum			
2.4	Test the safety barrier from the desk and from the stage control panel	Sum			
2.5	Test the 12 point hoists	Sum			
2.6	Test the main curtain from the desk and stage control panel	Sum			
2.7	Test the 32 fly bars and cyclorama bar	Sum			
2.8	Test the 3 orchestra pit lifts	Sum			
2.9	Test the backstage wagon	Sum			
2.10	Test the inner and outer stage revolves	Sum			
	TOTAL FOR BILL NO 2 (CARRIED FORWARD TO SECTION SUMMARY)				

<u>Item no</u>		<u>Unit</u>	<u>Quantity</u>	<u>Rate</u>	<u>Amount - R</u>
	<u>BILL NO. 3</u>				
	Trace and identify the conductors for control circuits in the existing control desk and stage control panel and label accordingly.				
3.1	Desk cubicle 1	Sum			
3.2	Desk cubicle 2	Sum			
3.3	Desk cubicle 3	Sum			
3.4	Desk cubicle 4	Sum			
3.5	Desk cubicle 5	Sum			
3.6	Desk cubicle 6	Sum			
3.7	Desk cubicle 7	Sum			
3.8	Stage control panel	Sum			
	TOTAL FOR BILL NO 3 (CARRIED FORWARD TO SECTION SUMMARY)				

<u>Item no</u>		<u>Unit</u>	<u>Quantity</u>	<u>Rate</u>	<u>Amount - R</u>
	<u>BILL NO. 4</u>				
4.1	Manufacture, test and deliver to site the complete new control desk for mechanist level.	Sum			
4.2	Manufacture, test and deliver to site the complete new control panel for stage level.	Sum			
	TOTAL FOR BILL NO 4 (CARRIED FORWARD TO SECTION SUMMARY)				

[illegible]

<u>Item no</u>		<u>Unit</u>	<u>Quantity</u>	<u>Rate</u>	<u>Amount - R</u>
	<u>BILL NO. 6</u>				
	Install the new control desk on mechanist level cubicle by cubicle. For each cubicle, connect all wiring previously labelled. Install the retained lever potentiometers in the new desk. Test and commission the new desk cubicle by cubicle ensuring that the stage machinery for each cubicle operates correctly. Supply and install a new low level lighting system above the desk. Provide training to Client personnel.				
6.1	Cubicle 1	Sum			
6.2	Cubicle 2	Sum			
6.3	Cubicle 3	Sum			
6.4	Cubicle 4	Sum			
6.5	Cubicle 5	Sum			
6.6	Cubicle 7	Sum			
6.7	Low level lighting system	Sum			
6.8	Provide Client training on the new desk and lighting system per cubicle as the work progresses	No	6		
	TOTAL FOR BILL NO 6 (CARRIED FORWARD TO SECTION SUMMARY)				

Item no		Unit	Quantity	Rate	Amount - R
	<u>BILL NO. 7</u>				
7.1	Removal of existing control panel on stage level. Disconnect all wiring, remove the control panel and transport to a scrapyard. Retain the lever potentiometer.	Sum			
7.2	Install the new control panel on stage level. Connect all wiring previously labelled. Install the retained lever potentiometer in the new control panel. Commission and test all control circuits to ensure the stage machinery is operating correctly. Supply and install a low level lighting system above the control panel.	Sum			
7.3	Provide Client training on the new control panel	No	1		
	TOTAL FOR BILL NO 7 (CARRIED FORWARD TO SECTION SUMMARY)				

<u>SUMMARY PAGE</u>					
ITEM	DESCRIPTION				AMOUNT
1	BILL NO 1 : PRELIMINARY & GENERAL				
2	BILL NO 2				
3	BILL NO 3				
4	BILL NO 4				
5	BILL NO 5				
6	BILL NO 6				
7	BILL NO 7				
8	Provisional amount for unexpected stage machine repairs				R 250 000.00
9	Contingency Sum				R 150 000.00
TOTAL TENDER SUM (EXCLUDING VAT)					

PART 6 – EVALUATION CRITERIA

EVALUATION OF BIDDERS RESPONSE

EVALUATION CRITERIA

Other than the criteria set below, the bidder must demonstrate that he complies fully with the technical requirements as per the specification.

EVALUATION OF BIDDERS RESPONSE

ART 01/2023 EVALUATION CRITERIA

All bid offers received must be evaluated based on the following criteria,

1. Gate 0 – Submission of Standard Bid Documents (SBDs);
2. Gate I -- Compliance to the conditions of bid
3. Gate II – Evaluation Criteria- meeting the minimum threshold of the evaluation criteria (functionality),
4. Gate III – Price and preference points system as specified in the Preferential Procurement Regulations of 2017

6.1 EVALUATION CRITERIA

Evaluation Criteria Item:

80/20 Principal (Gate 2)

	Administrative Requirements/Compliance (Gate 1)	Weight
A.	<p>A1. It will be ascertained whether bids:</p> <ul style="list-style-type: none"> a) Include original tax Clearance certificates b) All standard bidding documents have been properly completed and signed off (SDB1, SBD 3.3 (Pricing), SBD 4, SBD 6.1, SBD 8 and SBD9), and c) Technical Proposal <p>Note: Non- compliance with the Administrative requirements will render your bid non-responsive and will result in disqualification</p>	N/A
B.	Functionality (Gate 2)	100
<p>Previous Relevant Experience of Supplier [submit detailed schedule with project name, brief description, contract value, date of completion]</p>	<p>Bidder's Experience</p> <p><i>Number of similar projects:</i></p> <ul style="list-style-type: none"> • No similar projects.....(0 points) • 1 – 3 Projects.....(10 points) • 4 – 7 Projects. ....(25 points) • 8 –10 Projects .....(40 points) Above 10 Projects. (50 points) 	50

Key Staff Experience [submit CV's of key staff to be directly involved with the project showing qualifications & relevant electrical, mechanical & control systems experience]	Appropriately experienced staff: <ul style="list-style-type: none"> Qualified Technician with +5 years' post qualification relevant electrical experience, registered as Master/Installation Electrician (5 points) Qualified Technician with +5 years' post qualification relevant mechanical experience (5 points) Qualified Technician with +5 years' post qualification relevant control systems and automation experience (5 points) Proof of PLC programming accreditation (5 points) 	20
Local Office / Staff [submit address and contact details of office or key personnel based within a 100km radius from Cape Town CBD]	Local Footprint: <ul style="list-style-type: none"> No .....(0 points) Yes..... (5 points) 	5
Methodology [submit a detailed description of how the project will be executed, clearly listing the approach, design considerations, installation method & programming of the works]	Methodology: <ul style="list-style-type: none"> No understanding of the project or complexities (5 points) Partial understanding of the project or complexities (10 points) Full understanding of the project or complexities (20 points) 	20
Contactable References [submit contact details of previous/current client references for similar projects]	Number of references: <ul style="list-style-type: none"> 0 references.....(0 points) 1 – 2 references..... (2 points) 3 – 5 references.....(5 points) 	5
	Minimum qualification of 70 point on functionality	
	BBBEE and Price (Gate 3)	
	BBBEE	20
	Price	80
	Total	100

Bidders who score less than 70 points of the total points for functionality will be disqualified, and will not be evaluated further. The bids that would have **achieved 70 points or more from the Functionality Evaluation** will be further evaluated on gate III.

Gate 3

All remaining compliant proposals/quotations will be evaluated according to **80/20 preference point system**, as prescribed in the Preferential Procurement Regulations of 2017, where 80 points will be scored for price and the remainder 20 points for the suppliers' broad-based black economic empowerment status level (attach B-BBEE certificate).

Preference Point System	Points Allocation
Price	80
B-BBEE status level of contribution	20
Total Points	100

Scoring the highest points will not result in automatic award of the contract. An oral presentation could be asked for from Bidders and these scores will also be taken into account.

STANDARD BID DOCUMENTS

SBD 3.1

PRICING SCHEDULE – FIRM PRICES (PURCHASES)

NOTE: ONLY FIRM PRICES WILL BE ACCEPTED. NON-FIRM PRICES (INCLUDING PRICES SUBJECT TO RATES OF EXCHANGE VARIATIONS) WILL NOT BE CONSIDERED

IN CASES WHERE DIFFERENT DELIVERY POINTS INFLUENCE THE PRICING, A SEPARATE PRICING SCHEDULE MUST BE SUBMITTED FOR EACH DELIVERY POINT

Name of bidder.....

Bid Number: **ART 01/2023**

Closing Time **13:00pm**

Closing date **17 May 2023**

OFFER TO BE VALID FOR.....150...DAYS FROM THE CLOSING DATE OF BID.

ITEM NO.	QUANTITY	DESCRIPTION	BID PRICE IN RSA CURRENCY ** (ALL APPLICABLE TAXES INCLUDED)
-	Required by:	.....
-	At:	.....
-	Does the offer comply with the specification(s)?		*YES/NO
-	If not to specification, indicate deviation(s)		
-	Period required for delivery	.....
			*Delivery: Firm/not firm
-	Delivery basis	.....

Note: All delivery costs must be included in the bid price, for delivery at the prescribed destination.

**** “all applicable taxes” includes value- added tax, pay as you earn, income tax, unemployment insurance fund contributions and skills development levies.**

***Delete if not applicable**

SBD 4

DECLARATION OF INTEREST

1. Any legal person, including persons employed by the state¹, or persons having a kinship with persons employed by the state, including a blood relationship, may make an offer or offers in terms of this invitation to bid (includes an advertised competitive bid, a limited bid, a proposal or written price quotation). In view of possible allegations of favouritism, should the resulting bid, or part thereof, be awarded to persons employed by the state, or to persons connected with or related to them, it is required that the bidder or his/her authorised representative declare his/her position in relation to the evaluating/adjudicating authority where-

- the bidder is employed by the state; and/or
- the legal person on whose behalf the bidding document is signed, has a relationship with persons/a person who are/is involved in the evaluation and or adjudication of the bid(s), or where it is known that such a relationship exists between the person or persons for or on whose behalf the declarant acts and persons who are involved with the evaluation and or adjudication of the bid.

2. **In order to give effect to the above, the following questionnaire must be completed and submitted with the bid.**

2.1 Full Name of bidder or his or her representative:.....

2.2 Identity Number:.....

2.2 Position occupied in the Company (director, trustee, shareholder², member):

.....

2.3 Registration number of company, enterprise, close corporation, partnership agreement or trust:

.....

Tax Reference Number:

VAT Registration Number:

- 2.4 The names of all directors / trustees / shareholders / members, their individual identity numbers, tax reference numbers and, if applicable, employee / PERSAL numbers must be indicated in paragraph 3 below.

¹"State" means –

- (a) any national or provincial department, national or provincial public entity or constitutional institution within the meaning of the Public Finance Management Act, 1999 (Act No. 1 of 1999);
- (b) any municipality or municipal entity;
- (c) provincial legislature;
- (d) national Assembly or the national Council of provinces; or
- (e) Parliament.

²“Shareholder” means a person who owns shares in the company and is actively involved in the management of the enterprise or business and exercises control over the enterprise.

2.5 Are you or any person connected with the bidder **YES / NO**
presently employed by the state?

2.5.1 If so, furnish the following particulars:

Name of person / director / trustee / shareholder/ member:

Name of state institution at which you or the person
connected to the bidder is employed :

Position occupied in the state institution:

Any other particulars:

.....

.....

.....

2.6 If you are presently employed by the state, did you obtain **YES / NO**
the appropriate authority to undertake remunerative
work outside employment in the public sector?

2.6.1.1 If yes, did you attach proof of such authority to the bid **YES / NO**
document?

(Note: Failure to submit proof of such authority, where
applicable, may result in the disqualification of the bid.

2.6.1.2 If no, furnish reasons for non-submission of such proof:

.....
.....
.....

2.7 Did you or your spouse, or any of the company's directors / trustees / shareholders / members or their spouses conduct business with the state in the previous twelve months?

YES / NO

2.7.1 If so, furnish particulars:

.....
.....
.....

2.8 Do you, or any person connected with the bidder, have any relationship (family, friend, other) with a person employed by the state and who may be involved with the evaluation and or adjudication of this bid?

YES / NO

2.8.1 If so, furnish particulars.

.....
.....
.....

2.9 Are you, or any person connected with the bidder, aware of any relationship (family, friend, other) between any other bidder and any person employed by the state who may be involved with the evaluation and or adjudication of this bid?

YES/NO

2.9.1 If so, furnish particulars.

.....
.....
.....

2.10

Do you or any of the directors / trustees / shareholders / members of the company have any interest in any other related companies whether or not they are bidding for this contract?

YES/NO

2.10.1

If so, furnish particulars:

.....

.....

.....

3.

Full details of directors / trustees / members / shareholders.

Full Name	Identity Number	Personal Income Tax Reference Number	State Employee Number / Persal Number

4 DECLARATION

I, THE UNDERSIGNED (NAME).....

CERTIFY THAT THE INFORMATION FURNISHED IN PARAGRAPHS 2 and 3 ABOVE IS CORRECT.

I ACCEPT THAT THE STATE MAY REJECT THE BID OR ACT AGAINST ME SHOULD THIS DECLARATION PROVE TO BE FALSE.

.....

Signature

.....

Date

.....

Position

.....

Name of bidder

SBD 8**1. DECLARATION OF BIDDER'S PAST SUPPLY CHAIN MANAGEMENT PRACTICES**

1. This Standard Bidding Document must form part of all bids invited.
2. It serves as a declaration to be used by institutions in ensuring that when goods and services are being procured, all reasonable steps are taken to combat the abuse of the supply chain management system.
3. The bid of any bidder may be disregarded if that bidder, or any of its directors have-
 - a. abused the institution's supply chain management system;
 - b. committed fraud or any other improper conduct in relation to such system; or
 - c. failed to perform on any previous contract.
4. **In order to give effect to the above, the following questionnaire must be completed and submitted with the bid.**

4.1	<p>Is the bidder or any of its directors listed on the National Treasury's Database of Restricted Suppliers as companies or persons prohibited from doing business with the public sector?</p> <p>(Companies or persons who are listed on this Database were informed in writing of this restriction by the Accounting Officer/Authority of the institution that imposed the restriction after the <i>audi al-teram partem</i> rule was applied).</p> <p>The Database of Restricted Suppliers now resides on the National Treasury's website(www.treasury.gov.za) and can be accessed by clicking on its link at the bottom of the home page.</p>	Yes	No
4.1.1	If so, furnish particulars:		
4.2	<p>Is the bidder or any of its directors listed on the Register for Tender Defaulters in terms of section 29 of the Prevention and Combating of Corrupt Activities Act (No 12 of 2004)?</p> <p>The Register for Tender Defaulters can be accessed on the National Treasury's website (www.treasury.gov.za) by clicking on its link at the bottom of the home page.</p>	Yes	No

4.2.1	If so, furnish particulars:		
4.3	Was the bidder or any of its directors convicted by a court of law (including a court outside of the Republic of South Africa) for fraud or corruption during the past five years?	Yes	No
4.3.1	If so, furnish particulars:		
4.4	Was any contract between the bidder and any organ of state terminated during the past five years on account of failure to perform on or comply with the contract?	Yes	No
4.4.1	If so, furnish particulars:		

CERTIFICATION

I, THE UNDERSIGNED (FULL NAME).....
 CERTIFY THAT THE INFORMATION FURNISHED ON THIS DECLARATION FORM IS TRUE AND CORRECT.

I ACCEPT THAT, IN ADDITION TO CANCELLATION OF A CONTRACT, ACTION MAY BE TAKEN AGAINST ME SHOULD THIS DECLARATION PROVE TO BE FALSE.

.....
Signature

.....
Date

.....
Position

.....
Name of Bidder

SBD 9

CERTIFICATE OF INDEPENDENT BID DETERMINATION

1. This Standard Bidding Document (SBD) must form part of all bids¹ invited.
2. Section 4 (1) (b) (iii) of the Competition Act No. 89 of 1998, as amended, prohibits an agreement between, or concerted practice by, firms, or a decision by an association of firms, if it is between parties in a horizontal relationship and if it involves collusive bidding (or bid rigging).² Collusive bidding is a *pe se* prohibition meaning that it cannot be justified under any grounds.
3. Treasury Regulation 16A9 prescribes that accounting officers and accounting authorities must take all reasonable steps to prevent abuse of the supply chain management system and authorizes accounting officers and accounting authorities to:
 - a. disregard the bid of any bidder if that bidder, or any of its directors have abused the institution's supply chain management system and or committed fraud or any other improper conduct in relation to such system.
 - b. cancel a contract awarded to a supplier of goods and services if the supplier committed any corrupt or fraudulent act during the bidding process or the execution of that contract.
4. This SBD serves as a certificate of declaration that would be used by institutions to ensure that, when bids are considered, reasonable steps are taken to prevent any form of bid-rigging.
5. In order to give effect to the above, the attached Certificate of Bid Determination (SBD 9) must be completed and submitted with the bid:

¹ Includes price quotations, advertised competitive bids, limited bids and proposals.

² Bid rigging (or collusive bidding) occurs when businesses, that would otherwise be expected to compete, secretly conspire to raise prices or lower the quality of goods and / or services for purchasers who wish to acquire goods and / or services through a bidding process. Bid rigging is, therefore, an agreement between competitors not to compete.

CERTIFICATE OF INDEPENDENT BID DETERMINATION

I, the undersigned, in submitting the accompanying bid:

(Bid Number and Description)

in response to the invitation for the bid made by:

(Name of Institution)

do hereby make the following statements that I certify to be true and complete in every respect:

I certify, on behalf of: _____ that:

(Name of Bidder)

1. I have read and I understand the contents of this Certificate;
2. I understand that the accompanying bid will be disqualified if this Certificate is found not to be true and complete in every respect;
3. I am authorized by the bidder to sign this Certificate, and to submit the accompanying bid, on behalf of the bidder;
4. Each person whose signature appears on the accompanying bid has been authorized by the bidder to determine the terms of, and to sign the bid, on behalf of the bidder;
5. For the purposes of this Certificate and the accompanying bid, I understand that the word “competitor” must include any individual or organization, other than the bidder, whether or not affiliated with the bidder, who:
 - (a) has been requested to submit a bid in response to this bid invitation;
 - (b) could potentially submit a bid in response to this bid invitation, based on their qualifications, abilities or experience; and
 - (c) provides the same goods and services as the bidder and/or is in the same line of business as the bidder has arrived at the accompanying bid independently from, and without consultation, communication, agreement or arrangement with any competitor. However communication between partners in a joint venture or consortium³ will not be construed as collusive bidding.
6. In particular, without limiting the generality of paragraphs 6 above, there has been no consultation, communication, agreement or arrangement with any competitor regarding:
 - (a) prices;
 - (b) geographical area where product or service will be rendered (market allocation)
 - (c) methods, factors or formulas used to calculate prices;
 - (d) the intention or decision to submit or not to submit, a bid;
 - (e) the submission of a bid which does not meet the specifications and conditions of the bid; or
 - (f) bidding with the intention not to win the bid.
7. In addition, there have been no consultations, communications, agreements or arrangements with any competitor regarding the quality, quantity, specifications and conditions or delivery particulars of the products or services to which this bid invitation relates.
8. The terms of the accompanying bid have not been, and will not be, disclosed by the bidder, directly or indirectly, to any competitor, prior to the date and time of the official bid opening or of the awarding of the contract.

³ Joint venture or Consortium means an association of persons for the purpose of combining their expertise, property, capital, efforts, skill and knowledge in an activity for the execution of a contract.

9. I am aware that, in addition and without prejudice to any other remedy provided to combat any restrictive practices related to bids and contracts, bids that are suspicious will be reported to the Competition Commission for investigation and possible imposition of administrative penalties in terms of section 59 of the Competition Act No 89 of 1998 and or may be reported to the National Prosecuting Authority (NPA) for criminal investigation and or may be restricted from conducting business with the public sector for a period not exceeding ten (10) years in terms of the Prevention and Combating of Corrupt Activities Act No 12 of 2004 or any other applicable legislation.

.....
Signature

.....
Date

.....
Position

.....
Name of Bidder

NATIONAL TREASURY GENERAL CONDITIONS OF CONTRACT (NT GCC)

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General Conditions of Contract

1. Definitions

1. The following terms must be interpreted as indicated:
 - 1.1 “Closing time” means the date and hour specified in the tender documents for the receipt of Tenders.
 - 1.2 “Contract” means the written agreement entered into between the purchaser and the supplier, as recorded in the contract form signed by the parties, including all attachments and appendices thereto and all documents incorporated by reference therein.
 - 1.3 “Contract price” means the price payable to the supplier under the contract for the full and proper performance of his contractual obligations.
 - 1.4 “Corrupt practice” means the offering, giving, receiving, or soliciting of anything of value to influence the action of a public official in the procurement process or in contract execution.
 - 1.5 "Countervailing duties" are imposed in cases where an enterprise abroad is subsidized by its government and encouraged to market its products internationally.
 - 1.6 “Country of origin” means the place where the goods were mined, grown or produced or from which the services are supplied. Goods are produced when, through manufacturing, processing or substantial and major assembly of components, a commercially recognized new product results that is substantially different in basic characteristics or in purpose or utility from its components.
 - 1.7 “Day” means calendar day.
 - 1.8 “Delivery” means delivery in compliance of the conditions of the contract or order.
 - 1.9 “Delivery ex stock” means immediate delivery directly from stock actually on hand.
 - 1.10 “Delivery into consignees store or to his site” means delivered and unloaded in the specified store or depot or on the specified site in compliance with the conditions of the contract or order, the supplier bearing all risks and charges involved until the goods are so delivered and a valid receipt is obtained.
 - 1.11 "Dumping" occurs when a private enterprise abroad market its goods on own initiative in the RSA at lower prices than that of the country of origin and which have the potential to harm the local industries in the RSA.

- 1.12 "Force majeure" means an event beyond the control of the supplier and not involving the supplier's fault or negligence and not foreseeable. Such events may include, but is not restricted to, acts of the purchaser in its sovereign capacity, wars or revolutions, fires, floods, epidemics, quarantine restrictions and freight embargoes.
- 1.13 "Fraudulent practice" means a misrepresentation of facts in order to influence a procurement process or the execution of a contract to the detriment of any bidder, and includes collusive practice among Bidders (prior to or after Tender submission) designed to establish Tender prices at artificial non-competitive levels and to deprive the bidder of the benefits of free and open competition.
- 1.14 "GCC" means the General Conditions of Contract.
- 1.15 "Goods" means all of the equipment, machinery, and/or other materials that the supplier is required to supply to the purchaser under the contract.
- 1.16 "Imported content" means that portion of the tender price represented by the cost of components, parts or materials which have been or are still to be imported (whether by the supplier or his subcontractors) and which costs are inclusive of the costs abroad, plus freight and other direct importation costs such as landing costs, dock dues, import duty, sales duty or other similar tax or duty at the South African place of entry as well as transportation and handling charges to the factory in the Republic where the goods covered by the Tender will be manufactured.
- 1.17 "Local content" means that portion of the tender price, which is not included in the imported content provided that local manufacture does take place.
- 1.18 "Manufacture" means the production of products in a factory using labour, materials, components and machinery and includes other related value-adding activities.
- 1.19 "Order" means an official written order issued for the supply of goods or works or the rendering of a service.
- 1.20 "Project site," where applicable, means the place indicated in tender documents.
- 1.21 "Purchaser" means the organization purchasing the goods.
- 1.22 "Republic" means the Republic of South Africa.
- 1.23 "SCC" means the Special Conditions of Contract.
- 1.24 "Services" means those functional services ancillary to the supply of the goods, such as transportation and any other incidental services, such as installation, commissioning, provision of technical assistance, training, catering, gardening, security, maintenance and other such obligations of the supplier covered under the contract.
- 1.25 "Supplier" means the successful bidder who is awarded the contract to maintain and administer the required and specified service(s) to the State.

- 1.26 “Tort” means in breach of contract.
- 1.27 “Turnkey” means a procurement process where one service provider assumes total responsibility for all aspects of the project and delivers the full end product / service required by the contract.
- 1.28 “Written” or “in writing” means hand-written in ink or any form of electronic or mechanical writing.

2. Application

- 2.1 These general conditions are applicable to all Tenders, contracts and orders including Tenders for functional and professional services (excluding professional services related to the building and construction industry), sales, hiring, letting and the granting or acquiring of rights, but excluding immovable property, unless otherwise indicated in the tender documents.
- 2.2 Where applicable, special conditions of contract are also laid down to cover specific goods, services or works.
- 2.3 Where such special conditions of contract are in conflict with these general conditions, the special conditions must apply.

3. General

- 3.1 Unless otherwise indicated in the tender documents, the purchaser must not be liable for any expense incurred in the preparation and submission of a Tender. Where applicable a non-refundable fee for documents may be charged.
- 3.2 Invitations to Tender are usually published in locally distributed news media and on the municipality/municipal entity website.

4. Standards

- 4.1 The goods supplied must conform to the standards mentioned in the tender documents and specifications.

5. Use of contract documents and information inspection

- 5.1 The supplier must not, without the purchaser’s prior written consent, disclose the contract, or any provision thereof, or any specification, plan, drawing, pattern, sample, or information furnished by or on behalf of the purchaser in connection therewith, to any person other than a person employed by the supplier in the performance of the contract. Disclosure to any such employed person must be made in confidence and must extend only so far as may be necessary for purposes of such performance.
- 5.2 The supplier must not, without the purchaser’s prior written consent, make use of any document or information mentioned in GCC clause 5.1 except for purposes of performing the contract.

- 5.3 Any document, other than the contract itself mentioned in GCC clause 5.1 must remain the property of the purchaser and must be returned (all copies) to the purchaser on completion of the supplier's performance under the contract if so required by the purchaser.
- 5.4 The supplier must permit the purchaser to inspect the supplier's records relating to the performance of the supplier and to have them audited by auditors appointed by the purchaser, if so required by the purchaser.

6. Patent Rights

- 6.1 The supplier must indemnify the purchaser against all third-party claims of infringement of patent, trademark, or industrial design rights arising from use of the goods or any part thereof by the purchaser.
- 6.2 When a supplier developed documentation / projects for the municipality / municipal entity, the intellectual, copy and patent rights or ownership of such documents or projects will vest in the municipality / municipal entity.

7. Performance security

- 7.1 Within thirty (30) days of receipt of the notification of contract award, the successful bidder must furnish to the purchaser the performance security of the amount specified in SCC.
- 7.2 The proceeds of the performance security must be payable to the purchaser as compensation for any loss resulting from the supplier's failure to complete his obligations under the contract.
- 7.3 The performance security must be denominated in the currency of the contract or in a freely convertible currency acceptable to the purchaser and must be in one of the following forms:
- (a) a bank guarantee or an irrevocable letter of credit issued by a reputable bank located in the purchaser's country or abroad, acceptable to the purchaser, in the form provided in the tender documents or another form acceptable to the purchaser; or
 - (b) a cashier's or certified cheque
- 7.4 The performance security will be discharged by the purchaser and returned to the supplier not later than thirty (30) days following the date of completion of the supplier's performance obligations under the contract, including any warranty obligations, unless otherwise specified.

8. Inspections, tests and analyses

- 8.1 All pre-tender testing will be for the account of the bidder.

- 8.2 If it is a Tender condition that goods to be produced or services to be rendered should at any stage be subject to inspections, tests and analyses, the bidder or contractor's premises must be open, at all reasonable hours, for inspection by a representative of the purchaser or organization acting on behalf of the purchaser.
- 8.3 If there are no inspection requirements indicated in the tender documents and no mention is made in the contract, but during the contract period it is decided that inspections must be carried out, the purchaser must itself make the necessary arrangements, including payment arrangements with the testing authority concerned.
- 8.4 If the inspections, tests and analyses referred to in clauses 8.2 and 8.3 show the goods to be in accordance with the contract requirements, the cost of the inspections, tests and analyses must be defrayed by the purchaser.
- 8.5 Where the goods or services referred to in clauses 8.2 and 8.3 do not comply with the contract requirements, irrespective of whether such goods or services are accepted or not, the cost in connection with these inspections, tests or analyses must be defrayed by the supplier.
- 8.6 Goods and services which are referred to in clauses 8.2 and 8.3 and which do not comply with the contract requirements may be rejected.
- 8.7 Any contract goods may on or after delivery be inspected, tested or analysed and may be rejected if found not to comply with the requirements of the contract. Such rejected goods must be held at the cost and risk of the supplier who must, when called upon, remove them immediately at his own cost and forthwith substitute them with goods, which do comply with the requirements of the contract. Failing such removal the rejected goods must be returned at the suppliers cost and risk. Should the supplier fail to provide the substitute goods forthwith, the purchaser may, without giving the supplier further opportunity to substitute the rejected goods, purchase such goods as may be necessary at the expense of the supplier.
- 8.8 The provisions of clauses 8.4 to 8.7 must not prejudice the right of the purchaser to cancel the contract on account of a breach of the conditions thereof, or to act in terms of Clause 22 of GCC.

9. Packing

- 9.1 The supplier must provide such packing of the goods as is required to prevent their damage or deterioration during transit to their final destination, as indicated in the contract. The packing must be sufficient to withstand, without limitation, rough handling during transit and exposure to extreme temperatures, salt and precipitation during transit, and open storage. Packing, case size and weights must take into

consideration, where appropriate, the remoteness of the goods' final destination and the absence of heavy handling facilities at all points in transit.

- 9.2 The packing, marking, and documentation within and outside the packages must comply strictly with such special requirements as must be expressly provided for in the contract, including additional requirements, if any, and in any subsequent instructions ordered by the purchaser.

10. Delivery and documents

- 10.1 Delivery of the goods and arrangements for shipping and clearance obligations must be made by the supplier in accordance with the terms specified in the contract.

11. Insurance

- 11.1 The goods supplied under the contract must be fully insured in a freely convertible currency against loss or damage incidental to manufacture or acquisition, transportation, storage and delivery in the manner specified.

12. Transportation

- 12.1 Should a price other than an all-inclusive delivered price be required, this must be specified.

13. Incidental Services

- 13.1 The supplier may be required to provide any or all of the following services, including additional services, if any:
- (a) performance or supervision of on-site assembly and/or commissioning of the supplied goods;
 - (b) furnishing of tools required for assembly and/or maintenance of the supplied goods;
 - (c) furnishing of a detailed operations and maintenance manual for each appropriate unit of the supplied goods;
 - (d) performance or supervision or maintenance and/or repair of the supplied goods, for a period of time agreed by the parties, provided that this service must not relieve the supplier of any warranty obligations under this contract; and
 - (e) training of the purchaser's personnel, at the supplier's plant and/or on-site, in assembly, start-up, operation, maintenance, and/or repair of the supplied goods.

13.2 Prices charged by the supplier for incidental services, if not included in the contract price for the goods, must be agreed upon in advance by the parties and must not exceed the prevailing rates charged to other parties by the supplier for similar services.

14. Spare parts

- 14.1 As specified, the supplier may be required to provide any or all of the following materials, notifications, and information pertaining to spare parts manufactured or

distributed by the supplier:

(a) such spare parts as the purchaser may elect to purchase from the supplier, provided that this election must not relieve the supplier of any warranty obligations under the contract; and

(b) in the event of termination of production of the spare parts:

(i) advance notification to the purchaser of the pending termination, in sufficient time to permit the purchaser to procure needed requirements; and

(ii) following such termination, furnishing at no cost to the purchaser, the blueprints, drawings, and specifications of the spare parts, if requested.

15. Warranty

15.1 The supplier warrants that the goods supplied under the contract are new, unused, of the most recent or current models, and that they incorporate all recent improvements in design and materials unless provided otherwise in the contract. The supplier further warrants that all goods supplied under this contract must have no defect, arising from design, materials, or workmanship (except when the design and/or material is required by the purchaser's specifications) or from any act or omission of the supplier, that may develop under normal use of the supplied goods in the conditions prevailing in the country of final destination.

15.2 This warranty must remain valid for twelve (12) months after the goods, or any portion thereof as the case may be, have been delivered to and accepted at the final destination indicated in the contract, or for eighteen (18) months after the date of shipment from the port or place of loading in the source country, whichever period concludes earlier, unless specified otherwise.

15.3 The purchaser must promptly notify the supplier in writing of any claims arising under this warranty.

15.4 Upon receipt of such notice, the supplier must, within the period specified and with all reasonable speed, repair or replace the defective goods or parts thereof, without costs to the purchaser.

15.5 If the supplier, having been notified, fails to remedy the defect(s) within the period specified, the purchaser may proceed to take such remedial action as may be necessary, at the supplier's risk and expense and without prejudice to any other rights which the purchaser may have against the supplier under the contract.

16. Payment

16.1 The method and conditions of payment to be made to the supplier under this contract must be specified.

16.2 The supplier must furnish the purchaser with an invoice accompanied by a copy of

the delivery note and upon fulfilment of other obligations stipulated in the contract.

16.3 Payments must be made promptly by the purchaser, but in no case later than thirty (30) days after submission of an invoice or claim by the supplier.

16.4 Payment will be made in Rand unless otherwise stipulated.

17. Prices

17.1 Prices charged by the supplier for goods delivered and services performed under the contract must not vary from the prices quoted by the supplier in his Tender, with the exception of any price adjustments authorized or in the purchaser's request for Tender validity extension, as the case may be.

18. Variation orders

18.1 In cases where the estimated value of the envisaged changes in purchase does not vary more than 15% of the total value of the original contract, the contractor may be instructed to deliver the goods or render the services as such. In cases of measurable quantities, the contractor may be approached to reduce the unit price, and such offers may be accepted provided that there is no escalation in price.

19. Assignment

19.1 The supplier must not assign, in whole or in part, its obligations to perform under the contract, except with the purchaser's prior written consent.

20. Subcontracts

20.1 The supplier must notify the purchaser in writing of all subcontracts awarded under these contracts if not already specified in the Tender. Such notification, in the original Tender or later, must not relieve the supplier from any liability or obligation under the contract.

21. Delays in the supplier's performance

21.1 Delivery of the goods and performance of services must be made by the supplier in accordance with the time schedule prescribed by the purchaser in the contract.

21.2 If at any time during performance of the contract, the supplier or its subcontractor(s) should encounter conditions impeding timely delivery of the goods and performance of services, the supplier must promptly notify the purchaser in writing of the fact of the delay, its likely duration and its cause(s). As soon as practicable after receipt of the supplier's notice, the purchaser must evaluate the situation and may at his discretion extend the supplier's time for performance, with or without the imposition of penalties, in which case the extension must be ratified by the parties by amendment of contract.

21.3 The right is reserved to procure outside of the contract small quantities or to have minor essential services executed if an emergency arises, the supplier's point of

supply is not situated at or near the place where the goods are required, or the supplier's services are not readily available.

21.4 Except as provided under GCC Clause 25, a delay by the supplier in the performance of its delivery obligations must render the supplier liable to the imposition of penalties, pursuant to GCC Clause 22, unless an extension of time is agreed upon pursuant to GCC Clause 22.2 without the application of penalties.

21.5 Upon any delay beyond the delivery period in the case of a goods contract, the purchaser must, without cancelling the contract, be entitled to purchase goods of a similar quality and up to the same quantity in substitution of the goods not supplied in conformity with the contract and to return any goods delivered later at the supplier's expense and risk, or to cancel the contract and buy such goods as may be required to complete the contract and without prejudice to his other rights, be entitled to claim damages from the supplier.

22. Penalties

22.1 Subject to GCC Clause 25, if the supplier fails to deliver any or all of the goods or to perform the services within the period(s) specified in the contract, the purchaser must, without prejudice to its other remedies under the contract, deduct from the contract price, as a penalty, a sum calculated on the delivered price of the delayed goods or unperformed services using the current prime interest rate calculated for each day of the delay until actual delivery or performance. The purchaser may also consider termination of the contract pursuant to GCC Clause 23.

23. Termination for default

23.1 The purchaser, without prejudice to any other remedy for breach of contract, by written notice of default sent to the supplier, may terminate this contract in whole or in part:

(a) if the supplier fails to deliver any or all of the goods within the period(s) specified in the contract, or within any extension thereof granted by the purchaser pursuant to GCC Clause 21.2;

(b) if the supplier fails to perform any other obligation(s) under the contract; or

(c) if the supplier, in the judgement of the purchaser, has engaged in corrupt or fraudulent practices in competing for or in executing the contract.

23.2 In the event the purchaser terminates the contract in whole or in part, the purchaser may procure, upon such terms and in such manner, as it deems appropriate, goods, works or services similar to those undelivered, and the supplier must be liable to the purchaser for any excess costs for such similar goods, works or services. However, the supplier must continue performance of the contract to the extent not terminated.

24. Antidumping and countervailing duties and rights

24.1 When, after the date of Tender, provisional payments are required, or anti-dumping or countervailing duties are imposed, or the amount of a provisional payment or antidumping or countervailing right is increased in respect of any dumped or subsidized import, the State is not liable for any amount so required or imposed, or for the amount of any such increase. When, after the said date, such a provisional payment is no longer required or any such anti-dumping or countervailing right is abolished, or where the amount of such provisional payment or any such right is reduced, any such favourable difference must on demand be paid forthwith by the supplier to the purchaser or the purchaser may deduct such amounts from moneys (if any) which may otherwise be due to the supplier in regard to goods or services which he delivered or rendered, or is to deliver or render in terms of the contract or any other contract or any other amount which may be due to him.

25. Force Majeure

25.1 Notwithstanding the provisions of GCC Clauses 22 and 23, the supplier must not be liable for forfeiture of its performance security, damages, or termination for default if and to the extent that his delay in performance or other failure to perform his obligations under the contract is the result of an event of force majeure.

25.2 If a force majeure situation arises, the supplier must promptly notify the purchaser in writing of such condition and the cause thereof. Unless otherwise directed by the purchaser in writing, the supplier must continue to perform its obligations under the contract as far as is reasonably practical, and must seek all reasonable alternative means for performance not prevented by the force majeure event.

26. Termination for insolvency

26.1 The purchaser may at any time terminate the contract by giving written notice to the supplier if the supplier becomes bankrupt or otherwise insolvent. In this event, termination will be without compensation to the supplier, provided that such termination will not prejudice or affect any right of action or remedy, which has accrued or will accrue thereafter to the purchaser.

27. Settlement of Disputes

27.1 If any dispute or difference of any kind whatsoever arises between the purchaser and the supplier in connection with or arising out of the contract, the parties must make every effort to resolve amicably such dispute or difference by mutual consultation.

27.2 If, after thirty (30) days, the parties have failed to resolve their dispute or difference by such mutual consultation, then either the purchaser or the supplier may give notice to the other party of his intention to commence with mediation. No mediation in respect

of this matter may be commenced unless such notice is given to the other party.

28. Limitation of Liability

28.1 Should it not be possible to settle a dispute by means of mediation, it may be settled in a South African court of law.

28.2 Notwithstanding any reference to mediation and/or court proceedings herein,
(a) the parties must continue to perform their respective obligations under the contract unless they otherwise agree; and
(b) the purchaser must pay the supplier any monies due the supplier for goods delivered and / or services rendered according to the prescripts of the contract.

28.3 Except in cases of criminal negligence or wilful misconduct, and in the case of infringement pursuant to Clause 6;
(a) the supplier must not be liable to the purchaser, whether in contract, tort, or otherwise, for any indirect or consequential loss or damage, loss of use, loss of production, or loss of profits or interest costs, provided that this exclusion must not apply to any obligation of the supplier to pay penalties and/or damages to the purchaser; and
(b) the aggregate liability of the supplier to the purchaser, whether under the contract, in tort or otherwise, must not exceed the total contract price, provided that this limitation must not apply to the cost of repairing or replacing defective equipment.

29. Governing language

29.1 The contract must be written in English. All correspondence and other documents pertaining to the contract that is exchanged by the parties must also be written in English.

30. Applicable law

30.1 The contract must be interpreted in accordance with South African laws, unless otherwise specified.

31. Notices

31.1 Every written acceptance of a Tender must be posted to the supplier concerned by registered or certified mail and any other notice to him must be posted by ordinary mail to the address furnished in his Tender or to the address notified later by him in writing and such posting must be deemed to be proper service of such notice

31.2 The time mentioned in the contract documents for performing any act after such aforesaid notice has been given, must be reckoned from the date of posting of such notice.

32. Taxes and duties

- 32.1 A foreign supplier must be entirely responsible for all taxes, stamp duties, license fees, and other such levies imposed outside the purchaser's country.
- 32.2 A local supplier must be entirely responsible for all taxes, duties, license fees, etc., incurred until delivery of the contracted goods to the purchaser.
- 32.3 No contract must be concluded with any bidder whose tax matters are not in order. Prior to the award of a Tender SARS must have certified that the tax matters of the preferred bidder are in order.
- 32.4 No contract must be concluded with any bidder whose municipal rates and taxes and municipal services charges are in arrears.

33. Transfer of contracts

- 33.1 The contractor must not abandon, transfer, cede assign or sublet a contract or part thereof without the written permission of the purchaser

34. Amendment of contracts

- 34.1 No agreement to amend or vary a contract or order or the conditions, stipulations or provisions thereof must be valid and of any force unless such agreement to amend or vary is entered into in writing and signed by the contracting parties. Any waiver of the requirement that the agreement to amend or vary must be in writing, must also be in writing.

35. Prohibition of restricted practices

- 35.1 In terms of section 4 (1) (b) (iii) of the Competition Act No. 89 of 1998, as amended, an agreement between, or concerted practice by, firms, or a decision by an association of firms, is prohibited if it is between parties in a horizontal relationship and if a bidder (s) is / are or a contractor(s) was / were involved in collusive bidding.
- 35.2 If a bidder(s) or contractor(s), based on reasonable grounds or evidence obtained by the purchaser, has / have engaged in the restrictive practice referred to above, the purchaser may refer the matter to the Competition Commission for investigation and possible imposition of administrative penalties as contemplated in section 59 of the Competition Act No. 89 of 1998.
- 35.3 If a bidder(s) or contractor(s) has / have been found guilty by the Competition Commission of the restrictive practice referred to above, the purchaser may, in addition and without prejudice to any other remedy provided for, invalidate the bid(s) for such item(s) offered, and / or terminate the contract in whole or part, and / or restrict the bidder(s) or contractor(s) from conducting business with the public sector for a period not exceeding ten (10) years and / or claim damages from the bidder(s) or contractor(s) concerned.