



prasa


PASSENGER RAIL AGENCY
OF SOUTH AFRICA

TECHNICAL SPECIFICATIONS

VOLUME 4

Request For Tender for The Appointment of Contractor for
The Construction of Durban Yard Lifting Shed and Associated
Buildings Project

BID NO.: HO/PGC/DMP/516/06/2026

TECHNICAL SPECIFICATIONS REQUEST FOR TENDER: Request For Tender for The Appointment of Contractor for The Construction of Durban Yard Lifting Shed and Associated Buildings Project	
BID NO.: HO/PGC/DMP/516/06/2026	

DOCUMENT TREE

The following documents form part of this contract.

Volume 1

- PRASA Request for Tender Volume 1
 - SBD 5

Volume 2

- PRASA Volume 2: Tender Form C
- BOQ
 - SBD 6.1 (Duplicated in both Volumes)
 - Contract Data: Information provided by the Contractor (included in Volume 3)

Volume 3

- FIDIC General Conditions of Contract
 - “The Conditions of Contract comprise the “General Conditions”, which form part of the “Conditions of Contract for Construction for Building and Engineering Works Designed by the Employer” Second Edition 2017, reprinted 2022 with amendments, published by the Fédération Internationale des Ingénieurs-Conseils (FIDIC), obtainable from www.FIDIC.org.”
- FIDIC Particular Conditions of Contract
 - Part A: Contract Data
 - Part B: Special Provisions

Volume 4 (This Document)

- Technical Specifications
 - General
 - Architectural
 - Structural Engineering
 - Civil Engineering
 - HVAC Installation
 - Wet Services Installation
 - Fire Protection
 - Fire Sprinkler Installation
 - Drainage Installation
 - Lift Installation
 - Electrical Installation

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- ICT Installation
- Safety

Volume 5

- Drawing Lists – All applicable disciplines
- Drawings (Electronic copies)

Volume 6

- Site Data and Items of Reference
 - Fire Sprinkler Equipment Schedule
 - Fire Services Equipment Schedule
 - Mechanical Building Services Equipment Schedule
 - Wet Services Equipment Schedule
 - Geotechnical Factual Report
 - Geotechnical Interpretive Report
 - Contractors Camp Site and Occupation Plan
 - Environmental Management Plan

Volume 7

- Applicable Standards
 - List of Applicable Standards

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1 TECHNICAL SPECIFICATIONS

Where Specifications are of a general nature and/or applicable to the works of other Technical Disciplines, the specifications below shall be deemed to be applicable to those disciplines as well.

Where the sub-paragraphs below reference specific FIDIC clauses, the sub-paragraph shall be read in conjunction with the respective FIDIC General Conditions and as amended in the Special Conditions, as the case may be.

2 PROJECT AND SITE INFORMATION

2.1 Description of Site

The project is located in Durban, in the jurisdiction of eThekweni Municipality. The lifting shed is in the existing PRASA Durban Yard, between Durban Train Station and Moses Mabhidla Train Station. The area can be accessed from Masabalala Yengwa Avenue. The approximate coordinates of the site are as follows:

- 29°49'53.12"S 31° 1'41.07"E. or -29.831858, 31.028306

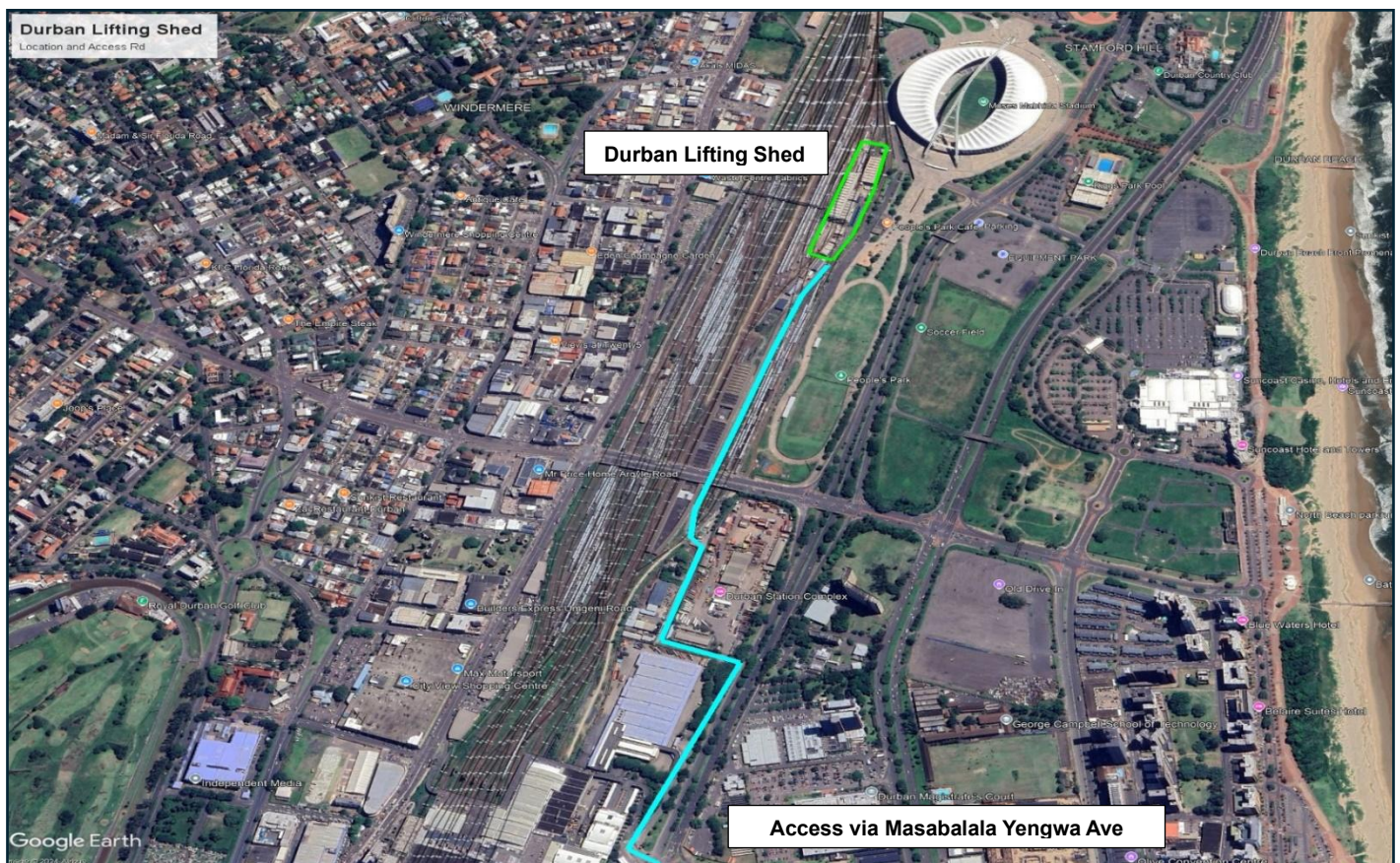


Figure 1: Locality Plan

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3 SCOPE OF WORK

The works to be constructed under this contract are shown on the drawings and described in the project specification. This contract involves the Upgrading and Extension of Durban Yard Lifting Shop and supporting facilities in the KwaZulu Natal Province. The Works may be briefly described as comprising the following but not limited to:

- Extension and alteration to the lifting shed.
- Provision of Warehouse storage spaces.
- Provision of Gibela Offices.
- Provision of a Chemical storage facility.
- Provision of a waste collection/ separation area.
- Provision of a Windscreen Test Facility.
- Civil Engineering Infrastructure.
- Related Electrical, Mechanical, Electronic and Fire requirements.
- Associated ancillary works and services.
- Occupational, Health and Safety compliance.
- Environmental compliance and management including site rehabilitation.

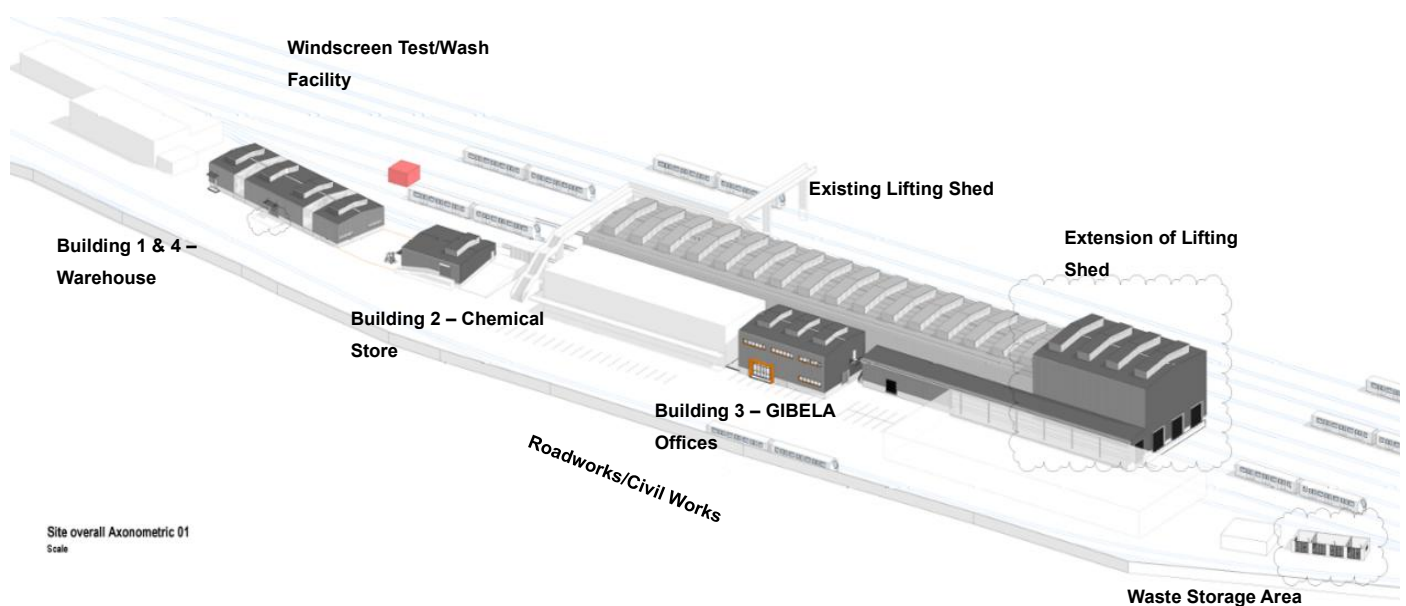



Figure 2: Schematic of the Lifting Shed Facility

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3.1 Description of the Scope of Work

Area	Scope Element
3.1.1 Lifting Shed Alterations, Refurbishment and Extensions	
Lifting Shed Extension	The Lifting Shed will be extended by 30m to the North towards Moses Mabhida Stadium. The existing northern gable wall of the shed will be demolished with new access doors provided along the gable end of the new extension. The height of the roof in the extension will be raised to ensure the lifting of locomotives is achievable. The strength of the floor will handle the operation of maintaining locomotives. Structures to support the existing 10T cranes and new 55T cranes will be constructed.
Bogie Storage Line	Bogie Storage Line: The 'training line' between the tip top building and lifting shed will be used as the bogie storage line. Level access will be provided from the lifting shed to the bogie storage line.
Bogie Turntables	Bogie Turntables: 2 no. Bogie turntables will be provided to provide access from line 3 to the bogie storage line. A new transverse rail line will connect the Bogie Turntables, traversing across Line 1 and Line 2.
Inspection Pits	The existing Inspection Pits on Line 2 & 3 will be demolished. New Inspection Pits will be constructed throughout the length of the shed on Line 2 & Line 3, including new rails. Inspection Pits to have trafficable, removable pit covers. Inspection pits will include new rails, drainage systems and lighting. The Inspection Pit on Line 1 will be refurbished.
Drop Pit	The drop pit running perpendicular to the inspection pits will be extended to pass beyond Line 1
Shed Floor	The shed floor over line 2 and line 3 will be demolished and re-constructed with new floor finishes. The Shed floor in the facility of line 1 will be refurbished.

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Access Platforms	Access Platforms: Fixed Access platforms will be installed on the western end (adjacent to shed wall) on Line 3.
Refurbish Existing Shed	The Roof and Cladding to the Existing Shed will be replaced. The floor, where not being disturbed by construction activities is to be patched made good. The steel structure is to be refurbished (treated and painted).
Lifelines	A lifeline will be provided over all Lines. Grey Lifting Jacks will be relocated.
Train Pre-Warning	A pre-warning signal including safety signage to be provided.
Cranes	The existing 10T cranes are to traverse through the extension of the shed.
3.1.2 Refurbishment and Re-purposing Existing Buildings	
Building 1 & 4	Building 1 & 4 will be converted into a warehouse. A connection between the two buildings will be constructed to combine the two buildings.
	The floor will be reconstructed to accommodate the loading of a fully laden forklift.
	The existing buildings will be completely refurbished including roof sheeting, doors, the provision of functional facilities and finishes.
	Racking and shelving will be provided.
Building 2	Building 2 will be converted to a Chemical Store: Both ground and first floors are to be used for chemical storage. The building shall comply to all necessary functional and mandatory building regulations applicable for the storage of chemicals.
	The floor will be reconstructed to accommodate the loading of a fully laden forklift.
	The existing building will be completely refurbished including roof sheeting, doors, the provision of all functional facilities and finishes.
	Shelving and mobile waste trolleys will be provided.

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Building 3	Building 3 will be re-purposed to offices for GIBELA in accordance with the accommodation schedule provided by GIBELA.
	The building will consist of a ground and first floor with a reception area, boardrooms, training room, open plan offices, server room as per the concept layout.
	The existing building will be completely refurbished including roofsheeting, the provision of all functional facilities, partitioning, and finishes.
Bogies Storage: Building Works	The bogie storage area will have a new covered roof consisting of a steel structure with cladding to match the lifting shed.
Sundry Items	Sundry items include Bird Proofing, Signage & Branding, Back-up Power Supply, Benches to washroom.
External Works	A Waste Collection Area will be provided on the north end of tip-top building for general waste, hazardous waste, and valuable scrap metal.
	The Windscreen Wash Facility will be located on the Southern side of the Lifting Shed on Line 3. The Windscreen test facility will be similar to that of the GIBELA Dunnottar facility.
	Bulk Potable Water Supply, Stormwater Drainage and Sewer Services will be provided to all buildings to meet the demand requirements.
	Roadworks and Parking will be modified to incorporate the requirements derived from the new facility. Associated siteworks including demarcation fencing, functional landscaping and shade net covers will be provided.
	A Plant / Generator Room will be constructed to house the pumps/generator and other plant required for the sprinkler system and/or back-up power supply.
	Rubble and Defunct Equipment will be removed and disposed off-site.

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3.1.3 Mechanical & Fire Services Installation

	The Lifting Shed, Warehouse, Chemical Store and Office Building will comply with all regulations relating to HVAC, Fire and Wet Services
Internal Drainage Systems	Internal Drainage Systems will be provided for the drainage of contaminated substances with the lifting shed pits. Existing drainage systems will be upgraded were necessary and new drainage systems will be installed to cater for the upgraded works.
Internal Water Systems	Storage and reticulation of Potable Water will be provided for the entire site including the installation of new and upgrade of existing systems.
HVAC Systems	Heating, Ventilation and Airconditioning will be provided for all facilities, including the provision of new and upgrading of existing systems were appropriate.
Fire Protection and Suppression	Fire systems will comply with Fire Regulations. A new Sprinkler System will be installed in the Lifting Shed and Warehouse including the provision for the storage of water, booster pumps etc.
Compressed Air	Compressed Air included the provision of a new compressor and reticulation of compressed air will be provided.
Lift Installation	A lift has been included in the GIBELA offices to facilitate Universal Access to the first floor.

3.1.4 Electrical and Electronic Services Installation

Electrical Supply & Reticulation	The existing electrical supply to the facility will comply with the demand. Low Voltage and General Power will be reticulated and distributed to all buildings, including the provision of Shore Supply to the Lifting Shed.
Lighting	Lighting will be provided in all new buildings including the inspection pits. External lighting, fixed to the buildings will be provided.


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Electronic Systems & Wireways	Provision will be made for wireways for all Electronic Systems.
Lightning Protection System	Lightning Protection to the buildings will be provided.
Fire Alarm System	A fire alarm system will be provided.
Security System	A CCTV system will be provided throughout the site including the infrastructure for a fibre link.
Server and Licensing	Allowance is provided for the provision of ICT Server and licensing thereof.
Access Control System	Access Control Systems will be provided in all buildings with magnetic lock systems activated by electronic fingerprint reader,
Public Announcement	A public announcement system consisting of horn speakers, ceiling mount speakers, paging stations, and digital power amplifiers will be provided.

3.1.5 Scope of Work for Section 1: Line 2

Section 1: Line 2 includes the following:

- i. All work relating to the demolition and re-construction of the Inspection Pit
- ii. All drainage related to the Inspection Pit and surrounding area.
- iii. All electrical installations
- iv. Installation of the rail line.
- v. Installation of Lifeline.
- vi. The Drop Pit across Line 1.
- vii. The shed floor from Line 1 to Line 3
- viii. The Contractor shall ensure unrestricted access of line 2 from the contractors site camp on the Southern End of the shed to allow trains to enter and leave the shed.
- ix. Relocation of hoarding, if necessary.
- x. Any ancillary work required for the operation of Line 2

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4 GENERAL SPECIFICATIONS

4.1 Care and Supply of Documents

[Reference FIDIC General Conditions of Contract for Construction Clause 1.8]

All Contractor's documents that are supplied in electronic format are to be in PDF format, stored on an external hard drive, with latest revisions. The external hard drive shall be reviewed monthly to ensure that documentation is up to date.

4.2 Compliance with Laws

[Reference FIDIC General Conditions of Contract for Construction Sub-clause 1.13]

In terms in 1.13 (c) the contractor shall supply all documents required for the obtaining of the construction work permit, within 14 days of letter of appointment.

4.3 Right of Access to the Site


[Reference FIDIC General Conditions of Contract for Construction Sub-clause 2.1]

While the Contractor will have access to the entire site from the Commencement Date, the following constraints will apply. The Contractor shall account for these constraints when programming the works. The items described below shall be read in conjunction with drawing number J42000_06-MDK-MP-SW-ZZ-DR-AR-0002REVA: Contractor Camps and Site Occupation Plan (Volume 6).

4.3.1 Site Camp (Areas shown in Yellow)

The Contractor will have access to the Northern and Southern ends of the Rail Yard for to be used as a Site Camp and Material Storage Area. The Contractor's Offices will preferably be located on the Northern end of the Yard. Access to the Southern End of the Yard from the Roadway may at times be restricted. Should the contractor access the site camp from the Southern End, care should be taken when crossing over rail lines which will be in use.

Should the Contractor deem the area made available by the Employer to be inadequate or unsuitable for the Contractor's particular needs, then the Contractor shall be at liberty to make his own arrangements with the owners of other sites which he considers are better suited to his needs; provided always that the use by the Contractor of any area other than that made available to him by the Employer shall be subject to the prior written approval of the Engineer, which approval shall not be unreasonably withheld; and provided further that the Contractor shall have no claim against the Employer in respect of any costs incurred by him, either directly or indirectly in consequence of utilising any area other than that made available to him by the Employer, and which costs exceed those costs allowed for by the Contractor in his Tender.

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4.3.2 Existing Lifting Shed Extension (Gridline A to S)

The contractor shall have access to the Existing Lifting Shed for the duration of the construction period. However, the contractor shall be required to complete the works for line 2 including the floor space on both sides of the line within 365 days of the commencement date. The Contractor shall ensure unrestricted access of line 2 from the contractors site camp on the Southern End of the shed to allow trains to enter and leave the shed.

The Contractor shall allow access to the Service Provider for the installation of the Lifting Jacks on Line 3. The Contractor shall allow access to the Service Provider for the installation of the Bogie Mover. The Contractor shall also allow these Service Providers to be accommodated within the contractors site camp and stockpile area as required. These Service Providers will be on site when the works on Line 3 is nearing completion.

The works to the Shed structure and roof over the Red Area can be undertaken as deemed fit by the contractor. However, the Contractor shall ensure that the section over Line 2 is fully covered by the time, Line 2 is Taken Over.

The Employer will operate an overhead crane over the entire shed area. The overhead crane will be from time to time in operation throughout the contract duration. The Contractor and Engineer shall agree on the methods of working so as to ensure the safety of all personnel and equipment during the operation of the crane. No additional costs and EOT will be due to the Contractor as a result of accommodating the operation of the crane.


Line 1 will be occupied by the Employer throughout the contract duration. All work on, adjacent and above, Line 1 and on the Shed structure will be undertaken during occupation conditions, or non-operational time, i.e., weekends, after hours or during window periods when occupation of the operational zone is provided. Notwithstanding this scenario, the work is anticipated to be completed within the contract duration therefore no additional costs and EOT will be due to the Contractor as a result of this scenario. Line 1 will be hoarded-off from the remaining sections of the Shed. The Hoarding shall be maintained in good order, to the satisfaction of the Engineer for the entire contract duration.

The construction of the 'Drop Pit' which is perpendicular to the Inspection Pit on Line 1 will take place within the 1st 3 months from the commencement date. Hoarding shall be installed at the commencement of work in this area and removed once the Part is taken over.

The Contractor shall ensure that when replacing the roof covering, no section of the roof shall be exposed for extended periods and during rain.

4.3.3 Building 3 – Office Block

The Contractor will have access to building 3 from the commencement date. However, building 3 is currently occupied as a training centre. The Contractor shall not undertake any

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work on building 3 that affects the operations of the training centre until the Contractor provides alternate accommodation for the relocation of the Training Centre and all occupants and activities of the Training Centre have been relocated.

4.3.4 Roadways and PRASA Staff Parking Area

The Contractor shall ensure that PRASA staff and other users of the facility are accommodated during the construction of the roadworks, parking area, associated civil works, all electrical works and the construction of the Fire Tank area always.

4.3.5 Thoroughfare

The Contractor will ensure thoroughfare of the access road on the Eastern End of the facility is always maintained.

4.4 Site Data and Items of Reference

[Reference FIDIC General Conditions of Contract for Construction Sub-clause 2.5]

Refer to Volume 6: Site Data and Items of Reference for the following:

J42000-B-06-05-GEO-REP-0001-00 - Geotechnical Factual Report

J42000-B-06-05-GEO-REP-0002-00 - Geotechnical Interpretive Report

4.5 Employer-Supplied Materials and Employer's Equipment

[Reference FIDIC General Conditions of Contract for Construction Sub-clause 2.6]

No materials or equipment will be supplied by the Employer. The Contractor shall, for purposes of this contract, provide all required materials and equipment.

4.6 Contractor's Documents

[Reference FIDIC General Conditions of Contract for Construction Sub-clause 4.4]

4.7 Training


[Reference FIDIC General Conditions of Contract for Construction Sub-clause 4.5]

4.7.1 Training may be required to be provided by the specialist subcontractor for:

- Bogie Mover
- Bogie Turntable
- ICT
- Fire Installation
- Other Mechanical installations and equipment as necessary

The costs for training shall be included in the Accepted Contract Amount.

4.7.2 Implementation of the Contract Skills Develop Goals (CSDG)

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- a) Compliance with the CIDB Standard: The Contractor shall comply with the Standard for Developing Skills through Infrastructure Contracts (Government Gazette No. 48491, 28 April 2023) for the applicable class of construction works.
- b) CSDG for the applicable class of works: For Combined Civil Engineering and General Building (CE & GB) contracts, the minimum Construction Skills Development Goal (CSDG) is 0.375% of the Tender Sub-total (as per Table 2 of the Standard / CIDB Practice Guide).
- c) The contractor shall ensure that CSDG will be achieved in accordance with the Standard and any Engineer instructions issued under the contract.

4.8 Health and Safety Obligations

Reference FIDIC General Conditions of Contract for Construction Sub-clause 4.8]

Refer to Item [Health and Safety](#) specifications in this document.

4.9 Quality Management and Compliance Verification Systems

Reference FIDIC General Conditions of Contract for Construction Sub-clause 4.9]

Refer to Item [Quality Assurance](#) of this document. The Contractor shall also be responsible to submit Quality Management and compliance documentation in a form acceptable to the Engineer.

4.10 Transport of Goods

Reference FIDIC General Conditions of Contract for Construction Sub-clause 4.16]

The Contractor shall, give a Notice to the Engineer not less than 21 days before the date on which any Plant, or a major item of other Goods will be delivered to the Site.

4.11 Protection of the Environment

Reference FIDIC General Conditions of Contract for Construction Sub-clause 4.18]

Refer to Item [Health and Safety](#) specifications in this document.

4.12 Temporary Utilities


Reference FIDIC General Conditions of Contract for Construction Sub-clause 4.19]

Refer to Item 2.22.1 [Site Establishment](#), of this document.

4.13 Health and Safety of Personnel

[Reference FIDIC General Conditions of Contract for Construction Sub-clause 6.7]

Refer to Item [Health and Safety](#) specifications in this document.

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4.14 Key Personnel

[Reference FIDIC General Conditions of Contract for Construction Sub-clause 6.12]

The Following key resources are required.

- Construction Manager
- Site Agent
- General foreman
- Health and safety officer
- Mechanical specialist

4.15 Inspection

[Reference FIDIC General Conditions of Contract for Construction Sub-clause 7.3]

Inspecting. Testing and measurement shall be undertaken as stated in this technical specification and as instructed by the Engineer.

4.16 Programme


[Reference FIDIC General Conditions of Contract for Construction Sub-clause 8.3]

A level 5 Programme shall be prepared in Microsoft Project software. The Contractor shall submit a detailed programme within fourteen (14) days of the acceptance of the tender as stipulated in the FIDIC Contract.

The programme shall be updated monthly, for discussion at the monthly progress (site) meeting, to indicate planned versus actual progress. The Engineer shall review submissions and provide comments within 14days of having received such submission from the Contractor. If, in the opinion of the Engineer, the project is behind planned progress, the Engineer shall have the right to request the Contractor to reorganize his work in a manner which will ensure an acceptable programme. Claims for additional payment to meet any costs incurred due to such reorganisation will not be accepted.

Should the Contractor wish to work outside normal working hours (as defined in the Contract Data) for any reason, he shall first seek permission to do so from the Engineer. Attending to emergency situations or making-safe the Works are exempt from requiring prior approval, but notification shall still be sent to the Engineer.

The Contract period shall include all Saturdays, Sundays, non-working days (public holidays), special non-working days, as well as an allowance for anticipated inclement weather during normal working hours. The programme shall be agreed between the Employer and the Contractor.

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Refer to Item 2.3 [Right of Access to the site](#), of this document for information regarding the sequence of the works.

4.17 Advance Payment

[Reference FIDIC General Conditions and Special Conditions Sub-Clause 14.2]

Advance payment will only be considered for specialist items namely:

- Lifts,
- Cranes
- Bogie Turntables,
- ICT servers and associated equipment

A maximum amount of 80% of the cost of the item will be considered for an advance payment. Payment will be based on invoices from suppliers. Advance payment guarantees in the form of a bank guarantee will be required for the full value of the advance payment.

All other terms and conditions as per the FIDIC General Conditions sub-clause 14.2 shall apply.

4.18 Drawings

The drawings issued to Contractors as part of the Tender Document must be regarded as provisional and preliminary for the Contractor's benefit to generally assess the scope of the work. The drawings issued separately for tender purposes are listed in Volume 5.


The work shall be carried out in accordance with the latest available revision of the drawings to be issued by the Engineer for construction. At commencement of contract, the Engineer shall deliver to the Contractor one sets of the construction drawings and any instructions required for the commencement of the works.

From time to time thereafter during the progress of the works, the Engineer may issue further drawings or revisions for construction purposes as may be necessary for adequate construction and completion of the works and defects correction.

The Contractor will be required to mark up one complete set of prints of the construction drawings with as-built information and submit these to the Engineer at the end of construction, prior to issue of the Taking-Over Certificate.

4.19 Design Procedures

All statutory requirements shall be taken into consideration.

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4.20 Construction/ Execution Details

4.20.1 Site Establishment

4.20.1.1 Services and Facilities Provided by the Employer

Water Source

A potable water supply is available in the vicinity of the Site. Should the Contractor wish to utilise such water supply, he/she shall be responsible for making his own arrangements with the responsible water supply authority for the supply of all water that he may require from such reticulation network for construction purposes as well as for domestic consumption.

If so, required by the responsible water supply authority, the Contractor shall further be responsible, at his own cost, for making or otherwise providing metered connections to the available services at the positions specified by the water authority, as well as for the removal of such connections on completion of the Contract.

The Contractor shall further, at his own expense, be responsible for providing all necessaries for procuring, storing, transporting and applying water required for the execution of the Contract, including but not limited to all piping and other plant and equipment, as well as for all work and superintendence associated therewith. All water provided by the Contractor for construction purposes shall be clean, free from undesirable concentrations of deleterious salts and other materials and shall comply with any further relevant specifications of the Contract. The Contractor shall, whenever reasonably required by the Engineer, produce test results demonstrating such compliance.

No guarantee is offered or given by the Employer that the existing available reticulated water supply will necessarily be adequate for the Contractor's purposes.

All charges as may be levied by the responsible water supply authority in respect of water consumed by the Contractor shall be for the Contractor's account and payment to the Contractor in respect thereof shall, in accordance with the provisions of subclause, be deemed to be included in the sums tendered by the Contractor for the various items listed in the Bill of Quantities, as well as in the rates tendered by the Contractor for the various other items listed in the Bill of Quantities which require the consumption of water.

The Contractor shall, when reasonably required by the Engineer, produce documentary proof that all amounts as may have become due and payable by the Contractor to the responsible water authority have been promptly paid in full.

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An electrical power supply is available in the vicinity of the Site. Should the Contractor wish to avail himself of such supply, he shall, in accordance with the provisions of relevant subclause, and at his own cost, be responsible for making his own arrangements with the responsible electricity supply authority for the supply of all electrical power he may require from such reticulation network for construction purposes as well as for domestic consumption

The Contractor shall, at his own cost, will be responsible for making metered connections to the available services at the positions specified by the electricity supply authority, as well as for the removal of such connections on completion of the Contract.

No warranty is offered or given by the Employer that the existing available reticulated electrical power supply will necessarily be adequate for the Contractor's purposes nor that its supply is in any way guaranteed.

All charges as may be levied by the responsible electricity authority in respect of electricity consumed by the Contractor shall be for the Contractor's account and payment to the Contractor in respect thereof shall, in accordance with the provisions of subclause, be deemed to be included in the sums tendered by the Contractor for the various items listed in the Bill of Quantities, as well as in the rates tendered by the Contractor for the various other items listed in the Bill of Quantities which require the consumption of electricity.

The Contractor shall, when reasonably required by the Engineer, produce documentary proof that all amounts as may have become due and payable by the Contractor to the responsible electricity supply authority have been promptly paid in full.


Facilities Provided by the Contractor

The Contractor's camp site

The Contractor shall be as required to fulfil his obligations under the contract. If the Employer can make any specific site available to the Contractor, such site will be pointed out to the Contractor by the Employer. The Contractor may, if he prefers to have a site camp and storage yard location other than that identified by the Employer, suggest an alternative location to the Employer, subject to approval by the Employer.

Facilities for the Engineer

The Contractor shall provide on the Site, for the duration of the Contract and for the exclusive use of the Engineer and/or his Representative (as applicable), the various facilities described hereunder. All such facilities shall be provided promptly on the commencement of the Contract and failure on the part of the Contractor to provide any facility required in terms of

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this specification shall constitute grounds for the Engineer to withhold payment of the Contractor's tendered items until the facility has been provided or restored.

The following are typical facilities to be provided:

- Office accommodation
- Site meeting venue
- Contract nameboards
- Survey equipment and assistants
- Electricity supply for the Engineer

4.20.1.2 Storage And Laboratory Facilities

The Contractor is to provide the facilities indicated in the Schedule of Quantities. Storage areas are to be contained within the Contractor's designated, fenced off construction camp(s).

4.20.1.3 Other Facilities and Services


The Contractor is responsible for the provision of all necessary temporary facilities which are not provided by the Employer, including power, water, telecommunications, security services, medical, fire protection, sanitation and toilets and solid waste disposal.

The Contractor shall make his own provisions for the collection, storage and disposal of all construction waste (i.e. whether it be in the camp or on the construction site); all in conformance with the Environmental Management Plan and with approval of the Engineer, the Local Authority and the Environmental Officer (Refer to Volume 6). Payment for the clearing, loading, transport, dumping fees and any other requirement or costs incurred shall be included in the scheduled rates.

The Contractor shall provide suitable and adequate portable chemical latrines for his employees and his sub-contractors. Latrines shall be maintained by the Contractor in a clean and sanitary condition to the Engineer's satisfaction. The use of latrines shall be enforced and fouling of the site will not be tolerated.

4.20.2 Advertising Rights

The Contractor shall not publish, or cause to be published, any papers, articles or information relating to this project, nor permit any advertising mentioning the subject of this Contract, nor display, or permit to be displayed, any advertisements on the Site, or elsewhere, in connection with this Contract, without the prior permission, in writing, of the Employer. The Contractor shall be responsible for the observance of this Sub-clause by his employees and by his Sub-Contractors.

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4.20.3 Notice Boards

The Contractor is to provide notice boards as indicated in the Schedule of Quantities, the layout of which is to match the template issued in the Tender Document.

The boards are to be erected at locations approved by the Engineer. The Engineer reserves the right (at no cost to the Employer) to have any sign, notice or advertisement moved to another location, or to have such removed from the site entirely, should such signs, notices or advertisements prove in any way unsatisfactory, or an inconvenience or danger to the public.

These boards are to be maintained for the duration of the Contract. Any damage to the boards shall be repaired within fourteen (14) days of a written instruction issued by the Engineer.

The notice boards and supporting structures are to be removed fourteen (14) days prior to the issue of the Final Approval Certificate

4.20.4 Security

The Contractor may be exposed to criminal actions, including theft and vandalism, and shall make all his own necessary security arrangements for the duration of the Contract.

The Contractor shall be responsible for taking all reasonable measures to ensure that effective access control and integrity of the site perimeter fence is maintained for the full duration of construction.

4.20.5 Permits and Way Leaves

While the Engineer is responsible for obtaining all the necessary wayleaves, permissions and permits and site access certificates applicable to working near any existing services or other infrastructure on Site, the Contractor is responsible for abiding by the safety and other conditions imposed by such wayleaves, permissions, permits and site access certificates.


The Contractor shall ensure that all wayleaves, permissions and permits (furnished by the Engineer) are kept on site and are available for inspection by the relevant services authorities on demand.

4.20.6 Alterations, Additions, Extensions and Modifications to Existing Works

The Contractor is to satisfy himself as to the dimensional accuracy, alignment, levels and setting out of existing structures or components thereof to ensure compatibility with the proposed works. Any concerns are to be raised timeously with the Engineer.

4.20.7 Inspection of Adjoining Properties

Where the works encroach or adjoin public and private property with the potential to cause damage to existing structures and properties, the Contractor is to inspect properties with the presence of property owners and representatives of local authorities.

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Photographic records and written permissions are to be obtained prior to commencing with the works and said records supplied to the Engineer or Engineer's Representative

4.20.8 Survey Control and Setting out of the Works

The Contractor shall take special precautions to protect all permanent survey beacons or pegs such as benchmarks, regardless of whether such beacons or pegs were placed before or during the execution of the Contract. Pegs which have, in the opinion of the Engineer, been disturbed due to the negligence of the Contractor, will be replaced at the Contractor's cost by a registered land surveyor at his own cost.

Before commencement of work, the Contractor shall liaise with the Engineer to establish and verify the position and level of benchmarks. The Contractor shall record the exact position of all erf pegs on a marked-up print of the site. The contractor shall satisfy himself with the accuracy thereof and immediately bring any discrepancies to the attention of the Engineer.

4.20.9 Site Maintenance

During progress of the work and upon completion thereof, the Site of the Works shall be kept and left in a clean and orderly condition. The Contractor shall store materials and equipment for which he is responsible in an orderly manner and shall keep the Site free from debris and obstructions.

4.20.10 Extension of Time Due to Abnormal Rainfall


The Contractor is to provide and correctly install a rain gauge and maximum/minimum thermometer at the construction camp. The Contractor shall record and keep a record of the daily rainfall and maximum/minimum temperatures and supply the data to the Engineer daily. Readings are to be recorded daily at 08:00 unless otherwise agreed to by the Engineer.

Regardless of the cause of any delay an extension of time will only be considered if it can be shown that the activity delayed is on the critical path indicated on the Works Programme.

No extension of time will be granted in respect of any delays attributed to normal climatic conditions. Normal Climatic Conditions shall be deemed to include normal rainfall and associated wet conditions and materials, strong winds and extremes of temperature. However, if delays to critical activities exceed the number of working days for each month, then abnormal climatic conditions shall be deemed to exist, and an extension of time shall be granted in accordance with the provisions of that Sub-clause.

4.20.11 Access to Employer's Facilities

The Contractor shall organise the work to cause the least possible inconvenience to the Employer and properties adjacent to or affected by the work, shall always provide and allow pedestrian and vehicular access to properties within or adjoining or affected by the area in which he is working.

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4.20.12 Construction in Restricted Areas

Working space may be restricted. The construction method used in these restricted areas largely depends on the Contractor's Plant. Notwithstanding, measurement and payment will be strictly according to the specified cross-sections and dimensions irrespective of the method used, and the rates and prices tendered will be deemed to include full compensation for any difficulties encountered by the Contractor while working in restricted areas. No extra payment or any claim for payment due to these difficulties will be considered

4.20.13 Temporary Works

The Contractor for this project is aware of that he/she will be working on site with an existing infrastructure, the pricing by the Contractor is considered to include all costs for temporal works for ensuring that there is minimal effect to the infrastructure during construction. This include all possible option for the Contractor which will be approved by the Project Engineer and the Client which might include temporal bypass and protection of existing services.


The Contractor shall, as relevant:

- The Contractor shall supply, install and maintain temporary fencing on both sides of the working area and around the perimeter of all agreed additional working areas during construction for prevention of unauthorised access and shall remove on completion of the works.
- Provide temporary drainage works, temporary pumps and other equipment as might be necessary for the protection, draining and dewatering of the works.
- Temporary water connections for site offices, storage sheds and latrines
- Safety and security of the Contractors temporary works shall be at the Contractor's discretion, but always in accordance with stipulated Occupational Health and Safety requirements.
- The camp shall be adequately guarded during or outside working hours
- Include the works required to locate, verify and protect existing services within the works area
- Be such to ensure no or limited interruption to vehicular and pedestrian traffic

The Contractor shall note that no stockpiling of materials, plant, excavated materials or any other construction related infrastructure shall be allowed in locations that may interfere with the operations of the Employer.

4.20.14 Methods And Procedures

The Works shall be executed in terms of the various and applicable specifications, the general Health and Safety Specifications and subsequent Health and Safety Plan, the Conditions of Contract as well as the various clauses within the Scope of Work.

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Where requested in writing by the Engineer, the Contractor shall submit Method Statements for constructing specific aspects of the Works. Such work shall not be started until the Contractor receives approval of the Method Statement in writing from the Engineer.

4.20.15 Environment

The Contractor shall comply with the Construction Environmental Management Plan. The Environmental Control Officer shall liaise directly with the Contractor on general environmental matters. Where such matters affect construction works, the Environmental Control Officer will be required to address such concerns with the Engineer.

The Contractor is required to progressively and systematically finish and tidy the work as it proceeds. This will be monitored against the latest approved programme. The Engineer shall have the right to not certify full payment of particular scheduled items where such items are largely complete, but finishing and tidying is deemed still outstanding.

Under no circumstances shall spoil, rubble, materials or equipment be allowed to unnecessarily accumulate on Site. If, in the opinion of the Engineer, this is occurring, the Engineer shall have the right to make an allowance for the estimated cost of rectifying the above by reducing particular measured quantities from claims being processed for payment.

Burning of any materials on site will not be allowed.

4.20.16 Variations and additional works

Corrections, comments, amendments or approval of shop drawings and samples are not to be assumed as acceptance of variations in the cost of work.

Should such approval, comments, etc, in the opinion of Contractor, involve additional cost, the Contractor shall notify the Engineer in writing within 7 days of receipt of such approval, comments, etc. In the event of notification of additional costs not reaching the Engineer within 7 days, no claims for such additional costs will be entertained.

Variations in costs shall be calculated in accordance with the labour and material rates, indicated by the Contractor in the Bill of Quantity.


4.20.17 Closing in of work

The Contractor shall give the Engineer due notice of inspections required. No work shall be closed in without it having been inspected and approved by the Engineer.

Failure by the Contractor to request the Engineer to carry out inspections may result in the Contractor bearing the cost for uncovering of concealed work and subsequent making good.

4.20.18 Danger notices

The Contractor is to allow for all danger notices in terms of the relevant regulations.

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4.20.19 Format of Communications

All contractual communication shall be in writing. The Contractor shall, for the full duration of the Contract Period, supply and maintain the following documentation:

- Site Diary and Instruction Book.
- Safety File containing all relevant safety data.
- Quality Control file containing all quality control/assurance forms and records.
- One full set of Contract Drawings and documents.
- Latest revision of the Construction Programme.

The above-mentioned shall be kept on Site and shall always be accessible to the Engineer.

4.20.20 Management Meetings

Formal project meetings will be held on site in the Engineer's office (or similar suitable office). Representatives of the Employer, Engineer and Contractor will be required to attend. The representatives are to have the necessary authority in respect of aspects such as planning and health and safety. The Contracts Manager and Construction Manager (Site Agent) are required to attend all such meetings.

The Contractor shall attend the following meetings during the Contract:

- Monthly site meetings, on Site or as called by the Engineer, from the commencement of the Works until the issue of the Taking-Over Certificate (or where necessary as determined by the Engineer).
- Monthly technical meetings called by the Engineer (or where necessary as determined by the Engineer).
- Meetings during the Defects Notification Period called by the Engineer (only if warranted)
- The following reports shall be submitted by the Contractor before the monthly Site Meetings:
 - Progress Report
 - Updated Programme vs Baseline Programme
 - Updated cashflow projection.
- The cost of these requirements shall be included in the rates tendered for Time Related Items.

4.20.21 Daily Records


The Contractor is required to keep daily records of resources (people and construction equipment) as well as of work performed on the site. A signed copy of the previous day's record must be provided to the Engineer daily.

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Information relating to construction equipment shall be recorded in the Daily Site Diary. In addition, the Contractor shall deliver to the Engineer, monthly, a detailed schedule of construction equipment presents on the site for that month. Full particulars are to be recorded, identifying each piece of equipment, including whether the equipment is in working order or out-of-order. This schedule is to be submitted by the first day of the month following the month to be reported.

4.20.22 As Built Drawings

The contractor shall be responsible for the preparation of as-built drawings.

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5 QUALITY ASSURANCE

The successful Contractor will be deemed to have included for the supply, delivery, hoisting, erecting, commissioning, testing, handing over in a complete working order, ready for immediate use, as well as the subsequent maintenance for a period of twelve months, of all plant and equipment, necessary for the successful completion of the installation as described in this specification and on the accompanying drawings, schedules and BOQs.

Ensure that the construction, materials and finishes of all equipment are suitable for the location, climatic and operating conditions to which the installation shall be exposed.

Ensure that the whole installation complies with all relevant standards.

If any clause or statement is not possible or conflicts with the drawings and other information, the Contractor is to immediately bring this to the attention of the Engineers.

5.1 Quality Plans and Control

The Contractor is required to have in place, and follow, an approved Quality Assurance System for the execution of this Contract. To this end, the Contractor shall submit his proposed Quality Management System (QMS) to the Engineer for approval along with up-front documentation required within 28 days of the commencement date. The QMS shall include the Contractor's proposed Quality Control which shows how conformance to the QMP is to be documented.


In addition to this, the Contractor is required to follow the Engineers Site Quality Control procedures which entails the following:

- Contractor's submission of Request for Inspection of Work.
- Engineer's signing-off of 'hold points' at each stage of the work (thereby authorising the Contractor to proceed with the next stage of the work).

This may take several iterations should the Engineer require further work before signing-off. Work may not proceed on the next stage until the previous stage has been signed-off.

Claims for items of completed work for each interim Payment Certificate will not be certified for payment where the required signoffs have not been obtained.

No claims for extension of time, nor any other form of compensation, will be entertained for delays in receiving the Engineer signoffs on 'hold points' where, in the opinion of the Engineers, insufficient notice has been given to inspect and approve the Works. The default notice required is 48 hours.

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The Contractor shall submit copies of all his conformance documentation to the Engineer monthly and proof of recent calibration of all measuring devices that are to be used.


5.2 Workmanship and Quality Control

The onus to produce work that conforms in quality and accuracy of detail to the requirements of the Specifications and Drawings rests with the Contractor, and the Contractor shall, at his own expense, institute a quality control system and provide suitably qualified and experienced Site Agents, Foremen, Surveyors, Materials Technicians, other technicians and technical staff, together with all transport, instruments and equipment to ensure adequate supervision and positive control of the Works at all times.

The cost of supervision and process control, including testing and mix designs carried out by the Contractor, will be deemed to be included in the rates tendered for the related items of work.

The Contractor's attention is drawn to the provisions of the various Standardized Specifications regarding the minimum frequency of testing required. The Contractor shall, at his own discretion, increase this frequency where necessary to ensure adequate control.

On completion and submission of every part of the work to the Engineer for examination and measurement, the Contractor shall furnish the Engineer with the results of the relevant tests, mix designs, measurements and levels to demonstrate the achievement of compliance with the Specifications.

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6 TECHNICAL SPECIFICATIONS – ARCHITECTURAL


All details and specifications can be obtained from the Architectural Drawings.

The work shall be carried out in accordance with the Contract Drawings which will be issued to the successful Contractor, and which will form part of the Contract Documentation.

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All details and specifications can be obtained from the Structural Drawings.

The work shall be carried out in accordance with the Contract Drawings which will be issued to the successful Contractor, and which will form part of the Contract Documentation.

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8 TECHNICAL SPECIFICATIONS – CIVIL ENGINEERING

8.1 Variations and Additions to Requirements of Standardised SANS 1200 Specifications: General, Civil and Structural Works

NOTE: Numbering in the Project Specifications corresponds with the numbering of clauses in the Standard Specifications (SANS 1200).

Contractors must make provision for all the relevant Project Specification requirements to be included when calculating the prices of the various items in the schedule of quantities.

In the event of any discrepancy between a part or parts of the Standard or Particular Specifications and the Project Specification, the Project Specification shall take precedence. In the event of a discrepancy between the Specifications, (including the Project Specifications) and the drawings and / or the Bill of Quantities, the discrepancy shall be resolved by the Employer’s Agent before the execution of the work under the relevant item.

In certain clauses the standard, standardized and specifications allow a choice to be specified in the project specifications between alternative materials or methods of construction and for additional requirements to be specified to suit a particular contract. Details of such alternative or additional requirements applicable to this contract are contained in this part of the project specifications. It also contains additional specifications required for this particular contract.

The prefix PS indicates an amendment to SANS 1200. The letters and numbers following these prefixes respectively indicate the relevant Standardized Specification and clause numbers in SANS 1200 to which the variation or addition thereunder applies.

8.2 General (SANS 1200A)

8.2.1 PSA 1 Scope


Replace the contents of Subclause 1.1, including the notes, with the following:

“This specification covers requirements, principles and responsibilities of a general nature which are generally applicable to civil Engineering construction and building works contracts, as well as the requirements for the Contractor’s establishment on the Site.”

8.2.2 PSA 2 Instructions by The Engineer

Add the following to this Clause:

Site instructions by the Engineer, addressed to the Contractor at his office on the site, will be numbered consecutively and will be deemed to have been received by the Contractor’s Representative unless a break in the sequence of numbers is brought to the notice of the Engineer in writing immediately.

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All instructions shall be in writing failing which they shall not constitute an instruction of the Engineer or his delegated assistant.

8.2.3 PSA 3 Materials

8.2.3.1 PSA 3.1 Quality

Add the following to this Clause:

Where a material to be used in this Contract is specified to comply with the requirements of a SABS Standard Specification, and such material is available with the official SABS mark, the material used shall bear the official mark.

The Contractor shall submit in good time, before any construction commences, to the Employer's Agent on site, samples of all materials intended to be incorporated into the works. The samples shall be accompanied by results of tests undertaken by an approved independent laboratory on the samples in question on behalf of the Contractor and at his cost, before consideration by the Employer's Agent

The Employer's Agent, during construction, will take independent samples from stockpiles of proposed construction materials on site and from the completed works. Approval will not be granted for samples delivered by the Contractor directly to the Employer's Agent's office. The Contractor shall be responsible for the cost of all failures on test samples and control testing.

All pipes, fittings and materials used in the Works, must bear the official standardisation mark of Standards South Africa where applicable. The mark on a pipe shall be visible from above after the pipe is laid.

Rubber articles, including pipe insertion or joint rings shall be stored in a suitable shed and kept away from sunlight, oil or grease.

Large items not normally stored in a building shall be neatly stacked or laid out on suitable cleared areas on the Site. Grass or vegetation shall not be allowed to grow long in the storage areas and the material shall be kept free of dust and mud and shall be protected from stormwater. Pipes shall be handled and stacked in accordance with the manufacturer's recommendations, special care being taken to avoid stacking to excessive heights and placing over hard objects. PVC pipes shall be protected from direct sunlight by suitable covers.

Every precaution shall be taken to keep cement dry and prevent access of moisture to it from the time it leaves the place of manufacture until it is required for use on the Site. Cement is to be used on a first in/first out basis. Bags of cement which show any degree of hydration and setting shall be removed from the site of the Works and replaced at the Contractor's own expense. Any cement older than six weeks is to be removed from site.

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Materials shall be always handled with proper care. Under no circumstances may materials be dropped from vehicles. Large pipes or large plant shall be lifted or lowered only by means of suitable hoisting equipment.

Where propriety materials are specified, it is to indicate the quality or type of materials or articles required, and where the terms “or other approved” or “or approved equivalent” are used in connection with proprietary materials or articles, the Contractor is to supply with their tender the name of the manufacturer and supporting documentation that show that the materials or articles comply with the relevant specifications. It is understood that the approval shall be at the sole discretion of the Employer and the Employer’s Agent.

Irrespective of any approval granted by the Employer’s Agent or the Employer, the Contractor shall be deemed responsible for quality of all materials used for construction and their specified performance.

8.2.4 PSA 4 Construction Equipment**8.2.4.1 PSA 4.1 Silencing of Plant**

Replace the contents of Subclause 4.1 with the following:

“The Contractor’s attention is drawn to the applicable regulations pertaining to noise and hearing conservation, framed under the Occupational Health and Safety Act, 1993 (Act No 85 of 1993) as amended

The Contractor shall always and at his own cost, be responsible for implementing all necessary steps to ensure full compliance with such regulations, including but not restricted to the provision and use of suitable and effective silencing devices for pneumatic tools and other plant which would otherwise cause a noise level in excess of that specified in the said regulations.


Where appropriate, the Contractor shall further, by means of temporary barriers, effectively isolate the source of such noise to comply with the said regulations.”

8.2.4.2 PSA 4.2 Contractor’s Offices, Stores and Services

Add the following paragraph before the existing first paragraph in Subclause 4.2:

“The Contractor’s buildings, sheds and other facilities erected or utilised on the Site for the purposes of the Contract shall be fenced off and shall contain all offices, stores, workshops, testing laboratories, toilet facilities, etc. as may be required by the Contractor. The facilities shall always be kept in a neat and orderly condition.

No personnel may reside on the Site. Only night-watchmen may be on the Site after hours.”

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Delete “and first-aid services” in the second paragraph of Subclause 4.2 and add the following:

“The Contractor shall provide on the Site and in close proximity to the actual locations where the work is being executed, one toilet per 10 workmen, which toilets shall be effectively screened from public view and their use enforced. Such toilets shall be relocated from time to time as the location of the work being executed changes, so as to ensure that easy access to the toilets is maintained.

The Contractor shall, where applicable, make all necessary arrangements and pay for the removal of night soil.”

8.2.5 PSA 5 Construction

8.2.5.1 PSA 5.1 *Setting Out of the Works*

Add the following to this Clause:

The Contractor shall be fully responsible for the setting out of the works, and where labour intensive work is specified, for the setting out of the daily construction tasks.

The Contractor, within two (2) weeks after the site has been handed over to him, is to ascertain the correctness of all pegs and benchmarks. Any discrepancy shall immediately be reported in writing to the Employer’s Agent. Any costs or subsequent costs arising from discrepancies which had not been reported to the Employer’s Agent, within the period, shall be the sole responsibility of the Contractor.

Tender drawings shall not be used for construction purposes.


8.2.5.2 PSA 5.2 *Watching, Barricading, Lighting and Traffic Crossings*

Add the following to this Clause:

The Contractor shall employ competent watchmen to guard the Works both by day and night.

From the time any portion of the Works commences, until the Completion of the Works and the issue of the Certificate of Completion of the Works, the Contractor shall be responsible for protecting the property of the Employer and all persons having business on the Site from anything dangerous or likely to cause damage or injury. The Contractor shall take all practical precautions to avoid nuisance or inconvenience to the owners or occupiers of properties near to the Site and to the public generally whilst carrying out the Works and shall always keep the Site clean and in a safe and satisfactory condition.

Temporary traffic signs shall be erected when work is being done within and adjacent to roadways. The number and layout of the traffic signs shall comply with the Site Manual entitled “Safety at Roadworks in Urban Areas”, as published by the Department of Transport

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The Contractor shall control all access to the site, for authorised persons only, and shall ensure that the approved conditions of the Health and Safety Management Plan are adhered to.

8.2.5.3 PSA 5.3 *Protection of Existing Structures*

Replace “Machinery and Occupational Safety Act, 1983 (Act No 6 of 1983)” with “Occupational Health and Safety Act, 1993 (Act No 85 of 1993), as amended”.

8.2.5.4 PSA 5.4 *Protection of Overhead and Underground Services*

Replace the heading and the contents of Subclause 5.4 with the following:

8.2.5.5 “PSA 5.4 *Location and Protection of Existing Services*

PSA5.4.1 *Location of existing services*

Before commencing with any work in an area, the Contractor shall ascertain the presence and actual position of all services which can reasonably be expected by an experienced and competent contractor to be present on, under, over or within the Site.

Without in any way limiting his liability in terms of the General Conditions of Contract in relation to damage to property and interference with services, the Contractor shall, in collaboration with the Employer’s Agent, obtain the most up-to-date plans as are available, showing the positions of services existing in the area where he intends to work.

Neither the Employer nor the Employer’s Agent offers any warranty as to the accuracy or completeness of such plans and because services can often not be reliably located from plans, the Contractor shall ascertain the actual location of services depicted on such plans by means of careful inspection of the Site.

Thereafter, the Contractor shall, by the use of appropriate methodologies, carefully expose the services at such positions as are agreed to by the Employer’s Agent, for the purposes of verifying the exact location and position of the services. Where the exposure of existing services involves excavation to expose underground services, the further requirements of Subclauses 4.4 and 5.1.2.2 of SANS 1200 D (as amended) shall apply.

The aforesaid procedure shall also be followed in respect of services not shown on the plans, but which may reasonably be anticipated by an experienced Contractor to be present or potentially present on the site.

All services, the positions of which have been determined as aforesaid at the critical points, shall henceforth be designated as 'known services' and their positions shall be indicated by the Contractor on a separate set of drawings, a copy of which shall be furnished to the Employer’s Agent without delay.

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As soon as any service which has not been identified and located as described above is encountered on, under, over or within the site, it shall henceforth be deemed to be a known service and the aforesaid provisions pertaining to locating, verifying and recording its position on the balance of the site shall apply. The Contractor shall notify the Employer's Agent immediately when any such service is encountered or discovered on the Site.

Whilst he is in possession of the Site, the Contractor shall be liable for all loss of, or damage as may occur to

- known services, anywhere along the entire lengths of their routes, as may reasonably be deduced from the actual locations at which their positions were verified as aforesaid, due cognizance being taken of such deviations in line and level which may reasonably be anticipated, and
- any other service which ought reasonably to have been a known service in accordance with the provisions of this clause,

The Contractor shall also be liable for consequential damage in regard to (a) and (b), whether caused directly by the Contractor's operations or by the lack of proper protection.

No separate payment will be made to the Contractor in respect of his costs of providing, holding available on the Site and utilising the said detecting and testing equipment, nor for any costs incurred in preparing and submitting to the Employer's Agent the Drawings as aforesaid. These costs shall be deemed included in the Contractor's other tendered rates and prices included in the Contract.

Payment to the Contractor in respect of exposing services at the positions agreed by the Employer's Agent and as described above will be made under the payment items (if any) as may be provided for in the respective sections of the specifications pertaining to the type of work involved."


8.2.5.6 PSA 5.10 Record Drawing Information

Add the following clauses:

As the Works are progressing, the Contractor shall mark on a special set of drawings, all as-built details and submit them to the Employer's Agent's Representative for approval. No extra payment shall be made for preparation of these as-built plans.

All valves, chambers and the like shall be co-ordinated together with their invert and cover/ground levels on the as-built drawings.

The Certificate of Completion shall only be issued once all the as-built information has been received and verified by the Employer's Agent.

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8.2.6 PSA 7 Testing

8.2.6.1 PSA 7.1 *Testing Principles*

Add the following to this Clause:

When giving notice, the Contractor shall provide the Employer's Agent with the results of the check testing indicating that the work is to specification. The Employer's Agent shall be given 48 hours' notice of when testing or inspections are required.

The Employer's Agent may from time to time carry out his own check tests on the work performed by the Contractor. Should such check tests show that the Contractor's control testing be such that the quality of the Contractor's work can be called into question, then the Employer's Agent may order further check tests to be carried out on work already completed. All costs associated with such check tests shall be for the Contractor's account, as also the costs of any other check test whose results to not comply with the specification.

Failure by the Contractor to notify the Employer's Agent or to provide the required information or, where specified, to perform the required test, will be grounds to exempt the Employer from payment for the associated work and for all subsequent work which would be affected by the failure of the Work to be tested.

The Employer's Agent will be under no obligation to the Contractor to perform the tests. If the Employer's Agent elects not to perform a particular test after notification by the Contractor, the Contractor will be issued with a written instruction to proceed with the relevant works without the acceptance test being performed.


Nothing contained in this clause will relieve the Contractor of any responsibilities under the specification or in any way limit the tests, which the Employer's Agent may call for or perform in terms of the specification. The Contractor shall make allowance for testing procedures in his construction programme.

Where the Employer's Agent is called to witness certain control tests, such as the pressure testing of a pipeline, and the results of such tests do not comply with the specifications, then the Employer reserves the right to recover costs for the Employer's Agent's presence at the unsuccessful test from the Contractor.

8.2.6.2 PSA 7.2 *Approved Laboratories*

Add the following to this clause:

Acceptance testing shall be done by a laboratory selected by the Employer's Agent. The Employer's Agent requires twenty-four hours' notice from the Contractor in order to perform the relevant acceptance test.

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All acceptance testing by the Employer’s Agent shall be paid for by the Contractor. The costs of such tests which meet the specification requirements will be reimbursed to the Contractor in the monthly payment certificate. This payment shall consist of a billed amount plus the tendered mark-up. A Provisional Sum has been provided in the Schedule of Quantities to allow for the cost of such testing.

The Contractor shall make allowance for testing procedures in the construction programme.

8.2.7 PSA 8 Measurement and Payment

8.2.7.1 PSA 8.5 Sums Stated Provisionally by Employer’s Agent

Replace the penultimate sentence of Sub-clause 8.5 to read:

"The percentage rate for (b) (2) above shall cover the Contractor's overheads, charges and profit on the work covered by the sums provisionally stated for (b) (1) above. Payment will be made based on the sums actually paid for such work, exclusive of VAT."

8.2.7.2 PSA 8.8.4 Existing Services


The tendered rate shall further cover the cost of backfilling the excavation with selected material compacted to 90% Mod. AASHTO density, keeping the excavation safe, and taking care that the services are not damaged in any way. The rate shall include for all negotiations with the authorities, notification to all affected parties and any other requirement to protect and complete the work.

Add the following clauses:

8.2.7.3 PSA 8.9 Survey Control and Setting out of Work.....Unit: sum

Before commencement of work, the Contractor is to liaise with the Employer’s Agent to establish exactly the status of all survey pegs. If any pegs are missing, he shall immediately inform the Employer’s Agent in writing.

On completion of the Contract the pegs that have been unavoidably disturbed will be replaced by the Employer. Pegs which have, in the opinion of the Employer’s Agent, been disturbed due to the negligence of the Contractor will be replaced by a registered Land Surveyor at the Contractor’s cost.

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8.3 PSC Site Clearance (SANS 1200C)

8.3.1 PSC 3 Materials

8.3.1.1 PSC 3.1 *Disposal of Material*

Add the following:

Unless otherwise ordered by the Employer's Agent, the Contractor shall dispose of material resulting from clearing and demolition operations at a site to be determined by the Contractor. Such a site shall have the approval of the Employer's Agent, the Local Authority and the Environmental Control Officer.

All transport costs shall be included in the rates tendered for site clearance.

8.3.2 PSC 5 Construction

8.3.2.1 PSC 5.1 *Areas to be cleared and grubbed*

Add the following:

"Unless otherwise indicated by the Employer's Agent, clearing and grubbing are limited to the entire site and if requested by the Employer's Agent the spoil areas. The Contractor may proceed with clearing and grubbing after the handing over of the site. Measurement and payment for clearing and grubbing shall only occur for areas as required in writing by the Employer's Agent."

Substitute the last paragraph with the following:


"The Contractor shall program his work in such a manner that re-clearing will not be necessary. The cost of re-clearing shall be borne by the Contractor."

8.3.2.2 PSC 5.8 *Demolition of Structures*

Add the following new Sub-Clauses:

PSC 5.8.1 *Removal and Re-Erection of Structures*

Where the Contractor is directed to dismantle structures to facilitate construction and thereafter to re-erect the same structures, the structure shall be erected at the same location, or such other location as may be required by the owner within the same property, using the same or similar materials as those set aside when removing the structure. The acceptance of the work by the Engineer and certification for payment shall be subject to the Contractor submitting to the Engineer documentary evidence of the owner's satisfaction that the re-erected structure the over-riding consideration being that it shall be in a condition no worse than that pertaining prior to its removal.

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The tendered rates shall include for the provision of a detailed photographic and written record of the structures before dismantling commences and following re-erection.

8.4 PSC 8 Measurement and Payment

8.4.1 PSC 8.2 Scheduled Items

PSC 8.2.1 Clear and grub

Replace the first line with the following:

“The area designated by the Employer’s Agent to be cleared and grubbed will be measured in square metres to the nearest square metre.”

PSC 8.2.10 Amend the description of 8.2.10 to read:

Remove topsoil to depth ordered by the Employer’s Agent and stockpile and maintain.

Add the following items in Subclause 8.2:

8.4.2 PSC 8.3 Removal and Re-Erection of Structures (New Sub-Clause)


Separate payment will be made for removing and re-erecting structures in the manner specified in PSC 5.8.1 above as scheduled and including for the costs of photographic and written records.

8.4.3 PSC 8.4 Demolition of Building Structures (New Sub-Clause)

Separate payment will be made for demolishing structures as scheduled and including for the cost of removal of rubble to an approved spoil site, backfilling any excavations and compacting to 90% mod AASHTO and shaping the ground level in line with the natural terrain.

8.4.4 PSC 8.5 Demarcation Fencing (New Sub-Clause)

Payment will be made per linear metre of temporary fencing installed in the manner specified in PSC 5.9 above, and the rate shall include for maintaining such fencing in good condition, including daily surveillance and repair, throughout the duration of construction and removal on completion of the works.

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8.5 PSD Earthworks (SANS 1200D)

8.5.1 PSD1 Scope (CLAUSE 1.1)

Where it is required that the earthworks be carried out using labour intensive methods, the first sentence shall read "This specification covers earthworks carried out by hand, or where so permitted in terms of the Project Specification, by restricted plant usage."

8.5.2 PSD2 Definitions (CLAUSE 2.3)

Replace the definition for "Specified density" with the following:

"Specified density: The specified dry density expressed as a percentage of modified AASHTO dry density."

8.5.3 PSD 3 Materials

8.5.3.1 PSD 3.1.1 Method of Classifying

Add the following:

"The class in which any material to be excavated falls, other than 'soft or intermediate excavation', shall be agreed upon between the Employer's Agent and the Contractor prior to excavation commencing.

The Contractor shall immediately inform the Employer's Agent when the class of the material being excavated changes to such an extent that it falls into a different class for further excavation. Failure on the part of the Contractor to advise the Employer's Agent in good time shall entitle the Employer's Agent, at his discretion, to reclassify such excavated material."

8.5.3.2 PSD 3.1.2 Classes of Excavation

Replace Sub-clauses 3.1.2 (a), (b) and (c) with the following:


All material encountered in any excavations for any purpose including restricted excavations will be classified as follows:

- Excavation in all materials,
- Extra-over excavation in all materials for excavation in hard rock by one of three means: blasting, excavator-mounted hydraulic breaker and splitting using expansive chemical grouts. The method to be employed for excavation in hard rock shall be as agreed with the Employer's Agent on Site.

Other earthworks

Non-plastic sandy material from excavations shall be used in the following order:

- As selected granular material for pipe bedding.
- As blanket and backfill to pipe trenches.
As backfill to structures.

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- As spoil stockpiled in selected areas indicated by the Employer's Agent.

The Contractor shall employ selective methods of excavation in order to preserve uncontaminated topsoil and material suitable for backfill, embankments, pipe bedding and selected granular material.

8.6 PSD 5 Construction

8.6.1 PSD 5.1.1 Safety

8.6.1.1 PSD 5.1.1.1 Barricading and Lighting

Add the following:

Demarcation of the pipeline construction servitude will be by means of wooden stakes. These stakes will be at least 1m high, painted white and placed at least every 15m on either side of the linear feature, in all areas where works are occurring. The stakes shall be moved as required as the project progresses

The Contractor shall also supply, install and maintain temporary fencing on both sides of the working area (servitude) and around the perimeter of all agreed additional working areas during construction for prevention of unauthorised access and shall remove on completion of the works. The fencing shall comprise 2m high Bonnox 4 x 4 Mesh fencing, Bonnox pattern 1972/4, with straining posts and straining wires as required and according to supplier's directions and with mesh spacing not exceeding 100mm in both the vertical and horizontal directions. Chevron tape shall be interwoven in a zig zag pattern from the top to the bottom of the fence thereby clearly marking off the working area.


Gates shall be provided by the Contractor at all points as required for construction access purposes. The Contractor shall be held responsible for the control of access at these gates at all times as well as to the worksite during removal and re-erection of fencing. No other opening in the fence shall be permitted and the Contractor shall be responsible for monitoring the fencing on a daily basis and repairing any such opening within the same day that it is detected. Notices in two official languages (English and iSiZulu) shall be attached to the fence where appropriate to indicate that the site is for personnel employed on the Contract only and that unauthorised entry is forbidden.

8.6.1.2 PSD 5.1.1.2 Safeguarding of Excavations

Replace "Machinery and Occupational Safety Act PSD" with "Occupational Health and Safety Act, 1993 (Act 85 of 1993, as amended in 2014)".

8.6.1.3 PSD 5.1.2.3 Protection of cables

Replace Subclause 5.1.2.3 with the following:

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8.6.1.4 “PSD 5.1.2.3 Protection During Construction

Further to the requirements of Subclause 5.4.2 of SANS 1200 A (as amended), major excavating equipment and other plant shall not be operated dangerously close to known services. Where necessary, excavation in close proximity to known services shall be carefully carried out with suitable hand tools, excluding picks wherever their use could damage the services. No additional payment will apply to such more difficult work.

Should any service not being a known service be discovered or encountered during the course of the Contract, the Contractor shall, in addition to complying with the requirements of Subclause 5.4.2 of SANS 1200 A (as amended), immediately notify the Employer’s Agent thereof and implement such measures as will prevent damage of such service or, if it was damaged in the course of discovery, will prevent and minimise the occurrence of any further damage occurring.”

8.6.2 PSD 5.1.3 Stormwater and Groundwater

Add the following to this Clause

The Contractor shall provide, operate and maintain sufficient pumping equipment, pipes and other equipment on site as may be necessary to dispose of stormwater and groundwater for the proper execution of the Works.

8.6.3 PSD 5.1.4.1 Dust nuisance

Add the following to this Clause:

The Contractor is responsible for dust control and is liable for all claims that may result from dust nuisance on all parts of the site and surrounding areas at all times, from the date of handing over of the Site, to the completion date of the Contract.


The Contractor shall plan the Works accordingly and shall use sufficient water or other methods to keep the level of dust to a minimum. This shall be done in consultation with the Employer’s Agent and to the Employer’s Agent’s approval. The Contractor must make allowance for the above in the rates tendered for excavation.

8.6.4 PSD 5.1.4.3 Excavated Material not to Endanger or Interfere

Add the following to this Clause:

All surplus material and unsuitable material not required for backfilling shall be disposed of at suitable sites to be located by the Contractor. All such sites shall require the approval of the Employer’s Agent, the Local Authority, the Environmental Control Officer and local community. No additional payment will be made for the transportation of such material.

Dumping shall proceed in an orderly manner with coarse material placed at the bottom and covered with finer material, where possible. Upon completion of dumping, the material shall

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be shaped to provide free draining surfaces and shall be finished off to the satisfaction of the Employer's Agent.

8.6.5 PSD 5.2.2.1 Excavation for General Earthworks and for Structures

Add the following to paragraph (b):

“When the nature of the material precludes the above procedure, additional excavations shall be carried out to provide working space for the erection of formwork. In general, payment will be made for excavating a working width of 600 mm, but the Contractor may excavate a greater working width at no additional cost to the Employer.”

Replace the first sentence of paragraph (e) with the following:

“Where excavations have been carried below the authorised levels, the Contractor shall backfill such excavations to the correct level with approved gravel compacted to 90% of modified AASHTO density or to the density of the surrounding material, whichever is the higher density. Where excavations for structures have been carried out in hard material, the Employer's Agent may direct that over-excavation be backfilled with weak concrete if there is a danger of settlement or differential settlement of the foundations.

Where the sides of excavations against which concrete is to be cast have been over-excavated or have collapsed partially, the Contractor shall retrim the excavations if necessary and, unless other remedial measures are agreed to by the Employer's Agent, shall cast the concrete for the structure, including the additional concrete that may be required as a result of the over-excavation or partial collapse. The cost of the additional concrete or remedial measures shall be for the Contractor's account.”

Excavations adjacent to existing structures

The contractor shall take precautions to mitigate against the risk of collapse when excavating near or adjacent to existing structures or railway line.


Prior to undertaking these excavations, the Contractor shall immediately inform the Engineer of the risk.

8.6.6 PSD 5.2.3.2 General Backfilling

Add the following to this Clause:

Backfill measured under the various items in the Schedule of Quantities shall be compacted to a density as stipulated in the scheduled item.

Material for backfilling around structures must be selected so that no clay, boulders or rock is used for backfilling within 300 mm of the structure.

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8.6.7 PSD 5.2.4.2 Topsoiling

Add the following to this Clause:

Topsoil shall not be stockpiled higher than 2,0 m. Care shall be exercised to prevent the compaction of topsoil in any way especially by vehicles travelling over such material.

Topsoil shall be placed as directed in Sub-clause 5.2.4.2 on the faces of cut slopes and embankments and other flatter areas, as shown on the drawings or ordered by the Employer's Agent, to a nominal thickness of 100 mm after light compaction. The cut and embankment surface shall be raked or lightly scarified before laying of the topsoil to assist with adhesion between the surfaces.

8.6.8 PSD 5.2.5 Transport for Earthworks

Notwithstanding the contents of clauses 5.2.5.1 and 5.2.5.2, the transport of all earthworks, whether for imported or excavated material, shall be included in the tendered rates for the scheduled items, and no payment will be made for overhaul.

8.7 PSD 7 Testing

8.7.1 PSD 7.2 Taking and Testing of Samples

Replace the contents of this subclause with the following:

"The Contractor shall arrange with the approved independent laboratory engaged by the Contractor in terms of the Project Specifications to carry out sufficient tests on a regular basis as agreed between him and the Employer's Agent to determine whether the degree of compaction, and, where applicable, the quality of materials used, comply with the Specifications and shall submit the results of these tests to the Employer's Agent in a form approved by him.

The compaction requirements for fills shall be deemed complied with when at least 75% of the dry-density tests on any lot show values equal to or above the specified density and when no single value is more than five percentage points below the specified value."

8.8 PSD 8 MEASUREMENT AND PAYMENT

8.8.1 PSD 8.1 Restricted excavation (Subclause 8.1.3)

The provision of working space (see Subclause 8.3.5) will not be measured for payment. Notwithstanding the provisions of Subclause 8.1.3, the Contractor shall make his own allowance for the excavation of any working space required for formwork or other purposes. The rates for restricted excavation shall also cover the costs of providing working space. All restricted excavation will be measured to the net dimensions of concrete floor slabs or other dimensions ordered by the Engineer.

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No extra-over payment will be made for excavation in material classified in terms of Subclause 3.1.2 as intermediate excavation and boulder excavation Class A and Class B. The tendered rate for excavation in all materials shall include for the cost of such excavation. Rock quantities are to be measured and agreed with the Engineer prior to covering else no payment.

8.8.3 PSD 8.3.8 Existing services**8.8.3.1 PSD 8.3.8.1 Location**

Replace item 8.3.8.1 with the following:

8.8.3.2 PSD 8.3.8.1 Hand Excavation for Locating and Exposing Existing Services:


a) In all areas Unit: m³

The unit of measurement shall be the cubic metre of material excavated, measured in place according to the authorised or actual dimensions of the excavation, whichever is the lesser.

The tendered rates shall cover the cost of excavating in all materials by means of hand tools within authorised dimensions and at locations approved by the Employer's Agent in accordance with the requirements of Subclause PSA 5.4.1 for all precautionary measures necessary to protect the services from damage during excavation and backfilling, and for subsequent backfilling and compacting. Compaction of material in all areas except in roadways shall be to 90% of the modified AASHTO density.

The tendered rate for hand excavation in roadways shall include compensation for compacting excavated or selected backfill material to 93% of modified AASHTO density. Reinstating layerworks and surfacing shall be measured and paid for in terms of SANS 1200 DB.

The tendered rates shall also include for keeping excavations safe, for dealing with surface and subsurface water, for removing surplus excavated material from the site, for transporting all material within the free-haul distance, and for supplying adequate supervision during both excavation and backfilling operations."

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8.9 PSDB Earthworks (Pipe Trenches) (SANS 1200DB)

8.9.1 PSDB 3 Materials

8.9.1.1 PSDB 3.1 Selection (Clause 3.7)

Notwithstanding Subclause 3.7, in terms of which the Contractor has a choice regarding methods of selection, the Contractor is required to use selective methods of excavation. The Contractor shall selectively remove and keep separate the sandy material from unsuitable material and place it adjacent to the trench for reuse as backfill, selected fill, selected granular material or for other use as ordered by the Engineer.

Material which, in terms of Subclause 6.2 of SANS 1200 D or Subclause 6.1 or SANS 1200 LB, is too wet from immediate use in the trench (but which is otherwise suitable) will not be regarded as “unsuitable” material and, if so, ordered by the Engineer, the Contractor shall spread such material in a suitable area until it has dried sufficiently for later use. Should the material which is replaced in the trench become too wet again, due to the fact that the Contractor made insufficient provision for the handling and removal of groundwater in accordance with Subclause 5.5 of SANS 1200 A, the Contractor shall replace the material at his own cost with material which is, in the opinion of the Engineer, suitable.

When preparing his programme and construction methods, the Contractor shall make allowance for selective excavation and the handling and drying out of material which is too wet for immediate use.

8.9.2 PSDB 5 Construction

8.9.2.1 PSDB 5.1.3 Accommodation of traffic and access to properties

Replace the semicolon and the word and at the end of Subclause 5.1.3(a) with a full stop and replace item (b) with the following:

“b) Where necessary to achieve compliance by the Contractor with his obligations in terms of providing and maintaining pedestrian and vehicular access to areas affected by the works, the Contractor shall construct and maintain to the satisfaction of the Employer’s Agent, such temporary access roads around, and/or steel or timber bridges over excavations in roads, pavements, entrances or accesses to buildings.

Temporary pedestrian access bridges shall be at least 1,2 m wide and temporary access bridges for vehicles shall be at least 3,6 m wide. All temporary access bridges shall be fitted with handrails as well as protective mesh fencing on both sides.

On completion of the work, the Contractor shall dismantle and remove all such temporary constructions and reinstate these areas to their former condition.

Except only where the Employer’s Agent has included in the Bill of Quantities, particular payment items specifically therefore, the Contractor will not be paid directly for the

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construction and maintenance of temporary access roads and/or the provision and maintenance of bridges as aforementioned, and the costs thereof shall be deemed included in the Contractor's tendered rates for excavation."

Add the following new subclause to Subclause 5.1:

8.9.2.2 PSDB 5.1.5 *Removal of existing pipelines*

Where existing pipes have to be removed, they shall be carefully opened up by machine excavation to 300 mm above the pipes after which the whole pipe shall be fully exposed by means of hand excavation. The excavation width shall comply with Subclause 8.2.3.

The pipes shall be removed from the trench in a manner approved by the Employer's Agent and brought to the surface for inspection by the Employer's Agent.

Pipes that are declared suitable for reuse and pipes declared unfit for reuse shall be dealt with in an applicable manner described in the specifications, or on the Drawings or on the Employer's Agent's instructions, as relevant."

8.9.2.3 PSDB 5.4 *Excavation*

The Contractor will be required to do all soft excavations up to 1,0m by hand using as much labour as possible. Under no circumstances will the Contractor be allowed to do excavations by machine at a depth shallower than 1,0m unless specifically agreed with the Engineer.

8.9.2.4 PSDB 5.6 *Backfill***PSDB 5.6.2 *Material for Backfilling***


Further to and notwithstanding the requirements of the Part DB, the following requirements in respect of trench excavation, backfilling and reinstatement shall be adhered to:

It is considered that portion of the excavated material will not comply with the specification for material suitable for backfilling. It will be the Contractor's responsibility to use selective methods of excavation to ensure that this unsuitable material does not contaminate other materials suitable for reuse.

Items have been included in the Bill of Quantities for disposal of unsuitable material and the Contractor's rate for these items should include for loading direct into the transport for disposal to tip without stockpiling on site.

The measurements for excavation shall be the total through length along the centre line of a pipeline measured HORIZONTALLY with deductions for manholes.

In addition, trench depth will be measured vertically on the centre line of the pipeline from the existing ground level to the invert level.

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8.9.2.5 PSDB 5.6.3 Disposal of Soft Excavation Material

All surplus material from excavations for pipework shall be removed from the site, dumped, levelled and spread at the areas as indicated by the Engineer.

When it is not possible to dispose of all surplus excavated materials as specified, the surplus shall be transported to an approved site. Written permission should be obtained should material not be spoiled within the free-haul distance.

8.9.2.6 PSDB 5.6.8 Transport for Earthworks

Notwithstanding the contents of Clause 5.6.8, the transport of all earthworks, whether for imported or excavated material, shall be included in the tendered rates for the scheduled items, and no payment will be made for overhaul.

8.9.3 PSDB 5.9 Reinstatement of Surfaces (Clause 5.9)

- Road Surfaces (Asphalt)

Where excavations for pipe trenches across existing paved roads are specified by the Engineer the Contractor shall stockpile the existing base and sub-base materials. If necessary, the Contractor will be required to supplement the material lost during excavation. The material within 300mm under the finished road level must be stabilized with 3 % cement and compacted to 97% mod. AASHTO density.

- Concrete Surfaces

The Contractor shall repair all concrete surfaces to the original line, depth and level with surface finishes and concrete classes at least to the standard of the existing surfaces.

- Paving

The contractor shall repair all existing paving to the original line and level and surface finishes at least to the standard of the existing finishes and with the same or similar paving.

The Contractor shall remove the existing pavement bricks, clean and stack them for re-use when repairing the paving. Compaction under the paving will be measured under compaction in road reserves and procedures should comply with SANS 1200 DB 5.6.2 and 5.7.2.

8.9.4 PSDB 7 Testing

The Contractor shall carry out process control checks on the compaction of the backfill of trenches across roadways. The frequency of testing shall be such that at least one test shall be carried out for each road crossing and for every lift of backfill material starting from 300mm above the crown of the pipe. The costs of testing shall be deemed to be included in the rates for backfilling of trenches across roadways.

The contents of clause 7.1 shall only apply to trenches in areas not subject to traffic loading.

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The rates for excavation of trenches shall cover all costs of:

- the work listed in Subclause 8.3.2(A) of SANS 1200 DB, irrespective of the method of excavation used,
- limitation in length of open trench,
- barricading and lighting,
- hand and machine excavation
- selection as specified in PSDB
- safeguarding and accommodation of traffic and maintenance of accesses as specified in PSA

8.9.5.2 PSDB 8.3.7 Accommodation of traffic

Replace the heading and contents of item 8.3.7 with the following:

The tendered sum shall, (except where particular items are scheduled to cover particular costs) include full compensation for compliance with the requirements of 5.1.3 of SANS 1200 DB (as amended), including the construction and maintenance of bypasses and the use of existing roads as bypasses during the construction period.

It shall also include full compensation: for the provision, maintenance and removal of all traffic control measures, including temporary traffic signs, road markings, lighting, barricading, flagmen and, where necessary, communications equipment to regulate traffic; for the construction of temporary drainage works; for the maintenance of drainage works; and for arrangements for moving and subsequently reinstating services for the purposes of accommodating traffic, attending to traffic problems and complying with the requirements of the Road Traffic Ordinance and the relevant local authorities.

The tendered lump sum shall not be adjusted in the event of any extension of time for completion being granted by the Employer's Agent in accordance with Clause 5.12 of the General Conditions of Contract.

Payment shall be made in equal monthly instalments over the entire period allowed for completion, provided that where any extension of time for completion is granted, the amount which shall be payable under this item in any subsequent monthly payment certificate shall be the outstanding unpaid amount of the lump sum, divided by the number of months remaining until the due completion date of the Contract, as revised in accordance with the General Conditions of Contract."

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Add the following to DM 3.1:

All in-situ pavement materials shall be classified as soft material for excavation purposes.

8.10.1.2 PSDM 3.2 Classification for Placing Purposes**PSDM 3.2.3 Selected Layers**

Substitute DM 3.2.3 with the following:

Materials used for selected layers shall comply with the requirements of Standard Specification 1200 M.

All imported material underlying the subbase or base of the final road prism, whichever may be applicable, that does not comply with the requirements for lower selected layer or upper selected layer in the respective depth categories, shall be removed and replaced with material complying with the requirements of selected layers, all at the Contractor's expense.

8.10.2 PSDM 4 PLANT**8.10.2.1 PSDM 4.2 Plant for Treatment Below Selected Layer****PSDM 4.2.1 Pneumatic-Tyred Roller**

Pneumatic-tyred rollers shall be of the self-propelled type that is equipped with smooth pneumatic-tyred wheels of the same diameter. The mass of the roller shall be at least 10 tons. All wheels must bear the same mass.

The rollers must be equipped with devices that will be able to keep the wheels wet and clean during operation.

The wheels of the roller shall be arranged in such a way that one pass with the roller will cover the whole width of the machine. The roller must be able to take a tyre pressure of 600 kPa and the minimum allowed working tyre pressure shall be 450 kPa. The maximum difference in pressure between any two wheels shall not be greater than 35 kPa.

8.10.3 PSDM 5 Construction**8.10.3.1 PSDM 5.1 Precautions****PSDM 5.1.2 Accommodation of Traffic**

Add the following to DM 5.1.2:

Bypasses shall be constructed and road signs erected where the free flow of public traffic is restricted. Such bypasses and road signs shall be in accordance with the "CSRA-CUTA:

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Road Traffic Signs Sub-committee; Road Signs Note no 13, the SA Road Traffic Signs Manual" and shall be approved by the Employer's Agent before the commencement of construction.

The Contractor shall be required to submit a Traffic Accommodation Plan prior to commencement of Works.

8.10.3.2 PSDM 5.2 Methods and Procedures**PSDM 5.2.2.3b) Cut to Spoil**

Substitute DM 5.2.2.3(b) with the following:

All surplus and/or unsuitable material shall be removed from the site and disposed of at the spoil site (as described in PSD 5.2.2.3) and shall be shaped to establish a free-draining surface.

PSDM 5.2.2.4 Temporary Stockpiling of Materials

Add the following to DM 5.2.2.4:

The Contractor shall program the works in such a manner that suitable excavated material shall, if practically possible, be placed directly in the appropriate position to ensure that temporary stockpiling is limited to an absolute minimum. No payment shall be made for the temporary stockpiling of material where such material is to be used for backfilling of pipe trenches, except when so ordered in writing by the Eng/PM.

PSDM 5.2.3.3 Treatment of roadbed

- Preparation and compaction of roadbed

Substitute the first paragraph of DM 5.2.3.3(a) with the following:

The roadbed shall be scarified to a depth of 150 mm, watered, shaped and compacted to 90 % of MAASHTO density (100 % for sand), except where otherwise ordered by the Eng/PM.


In clay areas only excavation and shaping to the correct level will be necessary.

The roadbed shall be prepared with an ionic stabiliser at a rate of 0,03 l/m² in layers of 150 mm and 0,02 l/m² in layers of 100 mm before compaction if ordered by the Eng/PM.

The stabiliser must be thoroughly mixed with water.

Measurement and payment shall be made under item PSME 8.3.8(g).

Add the following subclause:

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- In situ preparation of roadbed with eight roller passes

Any part of the roadbed that lies within the selected layer and which, regardless of its density, is suitable according to the Eng/PM's opinion, can be used in situ if so, instructed by the Eng/PM.

If, due to the nature of material, the degree of compaction cannot be controlled by means of in situ density tests, the Employer's Agent may instruct compaction to be done by eight roller passes as specified in PSDM 4.2. The Employer's Agent may further request that the compaction effort be altered by increasing or reducing the number of passes and that payment be amended accordingly.

The surface of the roadbed shall be shaped true in respect of line and level within the tolerances as specified in DM Clause 6. During the shaping of the roadbed, all material that has to be removed and cannot be re-used, shall be disposed of and will be paid for under item PSDM 8.3.7. If necessary, additional material that has been approved by the Employer's Agent shall be imported to meet the required levels.

No strict measurements in connection with soil moisture content will be applied by the Employer's Agent during compaction. The Contractor must however convince the Employer's Agent that all possible efforts have been made to utilise favourable soil moisture conditions. Compaction must be done during periods when the roadbed is not too wet or too dry. The Employer's Agent has full authority to decide whenever conditions are favourable for compaction and may at any stage instruct the Contractor to water the roadbed at the Contractor's expense if he, in the Eng/PM's opinion, neglected to satisfy the above-mentioned requirements.

8.10.3.3 PSDM 5.2.5 Selected Layer

Add the following to DM 5.2.5:

The Employer's Agent may, depending on the quality of the in-situ material, order the omission of one or both of the selected layers. To determine the number of selected layers, if any, the Employer's Agent may order the Contractor to dig test holes with maximum dimensions of 1,5 m x 1,5 m and 1,0 m deep at positions indicated by the Eng/PM, before construction commences.

The Contractor shall backfill all test holes with selected material and compact it to 95 % of Mod AASHTO density, after the Employer's Agent has taken samples and profiled the holes.

8.10.3.4 PSDM 5.2.9 Shaping and Compacting below Selected Layer

Each portion of the roadbed below the selected layer which, by virtue of its inadequate natural density, is directed by the Employer's Agent to be compacted by means of a pneumatic-tyred roller, shall be prepared by shaping where necessary, and each such portion shall be

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compacted by means of at least eight complete passes by a pneumatic-tired roller. One pass shall consist of the complete area being systematically passed in the longitudinal direction so that each pass overlaps the previous by half.

8.10.4 PSDM 6 Tolerances**8.10.4.1 PSDM 6.5 Dimensions and Level Control**

The Contractor shall submit to the Eng/PM, in a form acceptable to the Eng/PM, records of dimension and level control, prior to requesting the Employer's Agent to carry out any routine inspections.

8.10.5 PSDM 7 Testing**8.10.5.1 PSDM 7.2 Process Control**

Amend Table 1 of DM 7.2 as follows:

Substitute "2 000 m²" with "1 500 m²", "1 500 m²" with "1 200 m²" and "5 000 m²" with "3 000 m²".

8.10.5.2 PSDM 7.3 Routine Inspection and Testing

Substitute DM 7.3.2 with the following:

No density shall be less than the specified minimum density for the relevant layer.

The cost of all routine testing done by the Eng/PM, and of which the results do not comply with the specified minimum requirement for the material, shall be borne by the Contractor and will be subtracted from the monthly payment certificates.

8.10.5.3 PSDM 8 Measurement and Payment**PSDM 8.3.3 Preparation of roadbed-**

Substitute DM 8.3.3(b)(1) and (2) with the following:

b) Preparation of in situ roadbed in:

1) Intermediate material Unit: m³

Add the following subclauses:

(c) In situ preparation of roadbed with eight rollers

passes (pneumatic roller) Unit: m²

The unit of measurement is in square metres of roadbed which has been treated with eight roller passes.

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The rate shall cover the costs of shaping, watering and compacting all as specified in PSDM 5.2.3.3(c). The removal, disposal, transport and replacing of materials will be paid under the appropriate items.

(d) Variations in compaction effort (pneumatic roller) Unit: m2. pass

The unit of measurement is the surface on which the variation is applicable multiplied by the amount with which the compaction effort was reduced or increased as instructed by the Employer's Agent.

If there is a change in compaction effort, as instructed by the Eng/PM, the Contractor will be paid as for the standard effort, except that the amount as calculated above will be subtracted or added in the appropriate item.

This rate shall include full compensation for supervision, labour, machines, construction equipment, fuel, material and additional costs necessary for the completion of the process.

PSDM 8.3.4 Cut to fill, borrow to fill

Substitute "90 %" in DB 8.3.4 with "90 % (100 % for sand)" and "road prism" with "road prism and borrow pits".

Add the following:

Separate items will be scheduled for fill in the road prism, fill on spoil areas and fill on erven (where a minimum density for such spoil material is required by the Eng/PM) and fill from the road prism, fill from the site and fill from commercial sources.

The rate for fill from commercial sources shall, in addition to the requirements of DM 8.3.4, cover the cost of the location of the source, complying with all the applicable precautions as set out in DM 5.1, obtaining the material, selection and transport from the source to the point on the road where it is to be used.

(for hand excavation see SANS 1200 D.)

PSDM 8.3.5 Selected Layer Compacted to 93 % of MOD AASHTO Density

Substitute "93 % of Mod AASHTO density" in the heading of DM 8.3.5 with "93 % (100 % for sand) of Mod AASHTO density".

Add the following to DM 8.3.5:

Separate items will be scheduled for lower and upper selected layers as well as for material from the site of works and from commercial sources. The rate for selected layers from commercial sources shall, in addition to the provisions of DM 8.3.5, allow for locating the source, complying with all the applicable precautions as set out in DM 5.1, obtaining the

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material, selection and transport from the source to the point on the road where it is going to be used. No payment shall be made for the removal and replacement of unsuitable imported material.

PSDM 8.3.7 Cut to Spoil or Stockpile From

Add the following to DM 8.3.7:

Payment for temporary stockpiling shall be made under DM 8.3.11, only if so, instructed in writing by the Eng/PM.

(For hand excavation see SANS 1200 D.)

PSDM 8.3.12 Overhaul

Substitute DM 8.3.12 with the following:

The provisions of clause D 8.3.6 shall apply mutatis mutandis.

PSDM 8.3.17 Trim, Shape and Compact Sidewalks

The area to be trimmed is the unsurfaced area from the back side of the kerbs to the boundary of the road reserve, or such wider area necessitated by the road prism.

Measurement and payment for the above shall be restricted to areas ordered in writing by the Eng/PM.

The rate shall cover the cost of trimming and shaping the sidewalks to the lines, levels and dimensions as shown on the drawings, the cost of acquiring additional material to compensate for any material lost due to weather or other reasons, and of the compaction of any loose or disturbed material to 90 % of MOD AASHTO density (100 % for sand).

PSDM 8.3.19 Removal of Unsuitable Material

The volume measured for payment is the volume of unsuitable material, removed on written instruction of the Employer's Agent in accordance with clause DM 5.2.3.2, below the level of the initial roadbed.

The rate is extra-over Item PSDM 8.3.7 and covers all additional costs in respect of the removal and spoil of unsuitable material, as well as all additional costs in respect of the backfilling thereof. Payment for backfilling shall be made either under PSDM 8.3.4 or PSDM 8.3.5, whichever may be applicable.

Payment shall differentiate between the areas of the unsuitable material, as measured on the initial roadbed, in increments as scheduled.

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The quantity is the number of reference marks installed in streets on positions indicated by the Eng/PM.

The rate shall cover the cost of supplying, excavation, removal of surplus material, installation to the standards as shown on the drawings, backfilling with material that comply with the requirements of the relevant pavement layers, compacting to the specified minimum density for the relevant pavement layers and for the reinstatement of the bituminous surface with 30 mm asphalt.

PSDM 8.3.21 Existing Services that Adjoin Excavation for Streets

The provision of items DB 8.3.5(a) and DB 8.3.5(b) shall apply mutatis mutandis.

PSDM 8.3.22 Existing Services Intersecting Excavation for Streets

The quantity is the number of each service, as indicated in the Bill of Quantities, that intersect the excavation for streets.

Separate items will be provided for the depth increments as scheduled.

The rate for the crossing of services below the level of the roadbed, measured to the top of the service, covers all additional costs in respect of excavation, irrespective of the method, the protection and ensuring of the continuous functioning thereof and the cost of all repair work and/or subsequent costs arising from damage to the service and all other incidentals arising for this activity.

The rate for services that are not fully covered by the roadbed shall, in addition to the above-mentioned requirements, cover all additional costs in respect of excavation and backfilling with material as required for the relevant pavement layer as well as for compacting to the specified minimum density of the relevant pavement layer.

Services with a depth of cover of more than 500 mm shall not be measured and paid for.

PSDM 8.3.23 Shaping of Stormwater Channels adjoining Streets

The rate is an extra-over item PSDM 8.3.4 and shall be all inclusive for labour, material and equipment to shape stormwater channels according to the dimensions and grades as shown on the drawings and compaction to 90 % of MOD AASHTO density (100 % for sand). The placing of the gravel layer shall be measured in item PSDM 8.3.24.

PSDM 8.3.24 Construction of Gravel Layer in Stormwater Channels

There will be differentiated between material from the stockpile and that from the borrow pits. The rate shall be all inclusive for labour, material and equipment necessary for construction,

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selection, transport, off-loading and placement according to the specified slopes and dimensions as shown on the plans, as well as for compaction to 93 % of MOD AASHTO density.

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Add the following to this Sub-clause:

The only type of cement to be used for concrete structures shall be ordinary Portland cement to SABS 471.

8.11.1.2 PSGA 3.2.2 Storage of Cement

Add the following to this Sub-clause:

Cement which has been damaged in any way or which has been stored on site for a period exceeding three months shall be condemned and removed from site.

8.11.2 PSGA 5 Construction**8.11.2.1 PSGA 5.2 Formwork**

Add the following to this Sub-clause:

The finish of exposed concrete surfaces of concrete structures shall be "smooth" as detailed in (b) of Sub-clause 5.2.1.

8.11.2.2 PSGA 5.4.1.5 Strength Concrete (Subclause 5.4.1.5)

Add the following to this Sub-clause:

The concrete to be used for anchor blocks, benching and mass concrete, 15/19 MPa concrete.

8.11.2.3 PSGA 5.4.3 Mixing (Subclause 5.4.3)

Add the following to this Sub-clause:

All mix proportions for strength concrete shall be subject to the approval of the Engineer, but such approval shall not relieve the Contractor of his responsibilities in terms of the Contract. The proposed mix designs shall be submitted to the Engineer prior to the commencement of concreting operations. Changes in plant, aggregate or mix proportions shall only be made with the prior approval of the Engineer.

Unless otherwise specifically agreed to by the Engineer, all concrete shall be produced at the site of construction. If the use of ready mixed concrete is allowed, such concrete shall be in accordance with the requirements of the Specifications.

Unless otherwise indicated or directed by the Engineer, all foundation surfaces, excluding surface beds and brick wall foundations, shall be covered with a blinding layer before reinforcement is placed, in accordance with the details shown on the drawings or as indicated by the Engineer. All foundation surfaces shall be inspected and approved by the Engineer

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before blinding layers or other concrete is placed. All shuttering and fixed reinforcement must also be inspected and approved by the Engineer before commencing concreting. At least 48 hours' notice is required by the Engineer in respect of all such inspections.

The Contractor shall prepare two trial mixes for each grade of concrete specified in the Works no later than 1 month prior to the commencement of casting of concrete on the Works. The aggregates and plant, as erected and approved on the Site, shall be utilised for this purpose. The Contractor shall make and test six 150 mm concrete cubes for each of the trial mixes. Three cubes of each trial mix shall be tested at 7 days and the remaining three tested at 28 days.

8.11.2.4 PSGA 5.4.8 Concrete Surfaces

Add the following to this Sub-clause:

Except where otherwise specified or indicated, all exposed unshattered concrete surfaces shall, immediately after placing of the concrete, be levelled and shall be floated after the surface has set sufficiently. Floating shall be performed in one direction and float marks shall be parallel and of good appearance. Under no circumstances must it be relied upon to finish-off the exposed unshattered concrete surfaces with a separate cement-sand screed.

Where a wood floated concrete surface is shown on the Drawings or directed by the Engineer, hand floating of the surface shall first be completed and after the hand floated surface has hardened sufficiently, steel floating shall be performed to produce a dense, uniform surface free of any marks.

8.11.3 PSGA 6 Tolerances**8.11.3.1 PSGA 6.4 Permissible Deviations**

Add the following to this Sub-clause:

Degree of Accuracy II shall apply to all structures except those using 15MPa concrete where Degree of Accuracy III shall apply.

8.11.4 PSGA 8 Measurement and Payment**8.11.4.1 PSGA 8.1 Measurement and Rates****PSGA 8.1.2 Reinforcement**

Substitute the first paragraph of GA 8.1.2 with the following:

Reinforcement shall be measured and paid for by mass. Valuation of variations shall not be applicable.

No allowance shall be made for individual reinforcement bar sizes.

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8.11.4.2 *PSGA 8.2 Scheduled Formwork Items*

PSGA 8.2.3 Narrow Widths

Substitute GA 8.2.3 with the following:

No payment shall be made for narrow widths.

8.11.4.3 *PSGA 8.3 Scheduled Reinforcement Items*

PSGA 8.3.2 High-tensile Welded Mesh

Substitute GA 8.3.2 with the following:

Welded mesh shall be measured and paid for by mass.

8.11.4.4 *PSGA 8.4 Scheduled Concrete Items*

PSGA 8.4.1 Prescribed Mix Concrete

Add the following to GA 8.4.1:

The rate for installation of concrete slabs shall include for the compaction of the in-situ material to 90 % of MOD AASHTO density.

8.11.4.5 *PSGA 8.9 Weepholes*

The rate for installation of weepholes as shown on the drawings shall include all material, plant and labour.

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Substitute the first sentence of L 3.1 with the following:

Types and classes of pipes shall be as scheduled in the Bill of Quantities.

8.12.1.2 PSL 3.10 Valves**PSL 3.10.1 Gate Valves**

All gate valves shall comply with the requirements of SANS 664 and shall be suitable for a working pressure of 1,6 MPa. All gate valves must be supplied with a square spindle nut, suitable to be used with a valve key.

Gate valves up to 110 mm dia shall have spigot ends or be plain ended. The direction for opening and closing shall be permanently displayed on the valves. Valves shall have non-rising spindles.

8.12.2 PSL 4 Plant**8.12.2.1 PSL 4.3 Testing**

Add the following to L 4.3

The Contractor must ensure that the test equipment is in good order and that it is calibrated.

8.12.3 PSL 5 Construction**8.12.3.1 PSL 5.9 Lifting and Relaying of Existing Pipes**

Add the following to L 5.9:

Existing water pipes at certain points shall be lifted and relayed deeper in the same position. The Contractor must make timeous arrangements with the local authority or service provider when working on, or in the vicinity of, these pipes.

8.12.4 PSL 7 Testing**8.12.4.1 PSL 7.3 Standard Hydraulic Pipe Test****PSL 7.3.1 Test Pressure and Time of Test**

Add the following to L 7.3.1.1:

Pipes shall not be tested against isolating valves. Special blank flanges or end caps, fully anchored, shall be provided for testing.

Substitute L 7.3.1.2 with the following:

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The test pressure for field testing shall be 1.5 times the rated maximum working pressure of the pipe.

Substitute L 7.3.1.3 with the following:

The test pressure applied according to L 7.3.1.2, must, with allowance for any level differences along the pipeline, be such that the pressure at any point in the pipeline will be at least 1.25 times and not more than 1.5 times the rated working pressure of the pipe.

8.12.5 PSL 8 Measurement and Payment**8.12.5.1 PSL 8.2 Scheduled Items****PSL 8.2.3 Extra-Over 8.2.1 for the Supplying, Fixing and Bedding of Valves**

Add the following to L 8.2.3:

Valves are measured and paid for per item, complete with the inclusion of the cutting of pipes, couplings, extra excavation and all extra material and labour that is required, including tees, fittings, isolating valves (e.g. under air valves), complete as shown on the drawings. Flanged distance pieces shall be included in the rate for fire hydrants.

PSL 8.2.11 Anchor/Thrust Blocks and Pedestals

Anchor and thrust blocks shall be measured per cubic metre of concrete and the tendered rate shall include for all formwork and reinforcement (where specified) for the required dimensions. The tendered rate shall also include full compensation for all plant, materials and incidentals required for constructing these thrust blocks and pedestals.

PSL 8.2.14 Manholes

Add the following to L 8.2.14:

Overflow boxes and pipe outlets shall, as in the case of manholes, be measured and paid for per number and shall be all inclusive as shown on the drawings.

PSL 8.2.16 Cut into and Connect to Existing Mains


The cutting into existing mains shall be measured by the number of each type and diameter of pipe cut into.

The tendered rate shall include full compensation for all arrangements with the relevant authorities, isolating the main, cutting into the main to accommodate the connecting fitting, dewatering, excavating, removing of excess material, taking steps to prevent the ingress of soil, stones and other material into the main as well as all material and labour to connect the pipe.

PSL 8.2.17 Control Valves

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The rate for control valves shall cover the costs for the provision and installation of as described on the drawings. The rate shall also include all cutting of pipes, testing and putting into operation of the control valve. Distinction shall be made between different diameters.

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8.13 PSLB Bedding (Pipes) (SANS 1200LB)

8.13.1 PSLB3 Materials

8.13.1.1 PSLB3.1 *Selected granular and selected fill materials (Clauses 3.1 and 3.2)*

These materials shall not be used for the bedding of pipes. Materials used for bedding shall comprise silty sand, used in accordance with the details shown on the drawings.

Silty sand shall be free from vegetation and from lumps and stones of diameter exceeding 30mm and shall be obtained from the trench excavations or other necessary excavations on the site, on the approval of the Engineer.

8.13.1.2 PSLB3.3 *Bedding*

The type of bedding to be used shall be in accordance with the details shown on the drawings.

8.13.1.3 PSLB3.4.1 *Selection from trench excavation*

Suitable selected bedding material will generally be available from trench excavations along the route.

8.13.2 PSLB5 Construction

8.13.2.1 PSLB5.1 *Trench Width*

Trenches in general shall not exceed the widths that conforms to the requirements of Subclause 5.2 of SANS DB. If trenches exceed the specified width the Contractor shall be liable for the cost of any over break.

8.13.3 PSLB8 Measurement and Payment

8.13.3.1 PSLB8.2.2 *Supply only Bedding by Importation*

All haulage will be considered as free haul except where prior written permission was given for overhaul by the Engineer.

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Add a new Clause:

Pipes shall be uPVC Class 34 (Heavy Duty), and fittings shall be fitted with spigot and socket rubber ring joints and shall comply with the requirements of SANS 791.


8.14.1.2 PSLD3.5 Manholes, Chambers, Etc.

Manholes, chambers and the like shall be constructed of the materials as shown on the Drawings and not as shown in the Figures contained in SANS 1200LD.

8.14.2 PSLD5 Construction**8.14.2.1 PSLD5.1 Manholes, Chambers, Etc.**

Add a new Clause:

Manholes shall be constructed in accordance with eThekweni Municipality Standard Details as shown on the Drawings.

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8.15 PSLD7 Testing

8.15.1 PSLD7.2 Testing and Acceptance/Rejection Criteria

8.15.1.1 PSLD7.2.1 Air Test

Add a new Clause:

Prior to any air or water test, the interior of each pipeline section between two points of access shall be inspected throughout its length with a mirror and a source of light, so that when looking into the pipe at one point of access (with the aid of the mirror if necessary) and placing the light source at the other point of access, a full circle appears to the observer and the pipe section shall be seen to be unobstructed.

All pipeline sections, which fail to pass this test, shall be cleaned, re-laid, or repaired and re-tested as before by the Contractor, to the satisfaction of the Engineer, all at the Contractor's expense.

8.15.1.2 PSLD7.2.6 Watertightness of Manholes

Add a new Clause:

The Contractor shall on completion but before backfilling of a manhole test the manhole for water tightness. This shall be accomplished by filling the manhole to below cover frame with water. All pipes connecting to manhole must be blocked during this test.

The manhole must be left standing for one hour so that absorption of water can take place. After the hour water must be added to original level and be left standing for one more hour. The water level may not drop more than 20mm within the hour.

The Contractor shall be responsible for removing the water, after the test, by means of an approved method. The Contractor will be paid for the testing of the water tightness of manholes at the rate per manhole quoted by him in the schedule of Quantities. The rate for the testing of manholes shall cover the cost for all plant, labour and material required for compliance with the above. The cost of rectification work and retesting of manholes that have failed the test shall be to the Contractor's account.


The Engineer may at any time choose to test certain or specific manholes

8.15.2 PSLD8 Measurement and Payment

8.15.2.1 PSLD8.2.3 Manholes

Add the following:

The rate for manholes will include for excavation, benching, sewer temporal bypass/handling of the existing flow, water tightness test of the manhole and finishing inside the manhole. No additional payment will be made for any special pieces or fittings or handling of the existing sewer flow.

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The rate must include for coverage of parts of pipes casted into manholes with concrete and backfilling with selected material around manholes as well as frames and covers as specified in the Schedule of Quantities. The depth of the manhole shall be measured from the cover level to invert level in the middle of the manhole.

8.15.2.2 PSLD8.2.3 *Connection to Existing Sewer and House Connections*

Add the following:

An amount must be included for connection to existing sewers. This amount must include for all materials, labour and earthworks for the completion of connections. Where manholes are to be used for this purpose, manhole structures will be measured separately.

The tendered rate shall cover all labour, machinery, equipment and material for breaking into existing manholes, for new connections, for the provision of pipes at the newly constructed access, for decommissioning of old connections, for the water proofing of pipes, for the demolishing and rebuilding of existing benching and gutters if necessary to fit with existing, the removal of all excess materials and the backfilling around manholes with selected material.

The rate shall cover the handling of existing flow in existing pipes as well as labour during nighttime if necessary.

Property connections shall not be out of service for more than 8 hours, unless otherwise agreed in writing with the property owner or occupier. If this is not possible, temporary connections are to be made at convenient locations as approved by the Employer's authorized representative.

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In addition to the specifications as set out in this Clause, pipes for storm water drains shall be reinforced interlocking concrete pipes.

8.16.1.2 PSLE3.4 Manholes, Catch Pits and Accessories**PSLE3.4.5 General (Clause 3.4.5)**

Add the following Clause:

Manholes and Catch pits: General


All structures shall not be plastered and be in face or clinker brickwork with the bricks conforming to the relevant SABS standards. All concrete work shall be 25MPa strength

8.16.2 PSLE 5 Construction**8.16.2.1 PSLE 5.1.3 Unsuitable Founding Conditions**

Substitute "90 % of AASHTO maximum density" in LE 5.1.3 with "90 % of AASHTO maximum density "

8.16.3 PSLE 8 Measurement and Payment (Clause 8)**8.16.3.1 PSLE8.2.8 Supply and Install Manholes and Catch pits (Clause 8.2.8)**

Notwithstanding the provisions of this Clause, the rates tendered for supply and installation shall cover all additional excavation, backfilling and disposal of surplus material over and above that measured for trench excavations. The rate shall also cover the cost of providing all equipment and materials necessary to seal the manhole covers with bitumen.

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9 TECHNICAL SPECIFICATIONS – HOT AND COLD-WATER INSTALLATION

9.1 General Requirements for wet services Subcontractor

This specification covers the supply, install, clean, test and commission the complete above hot and cold-water generation and reticulation system. All work shall be carried out to the complete satisfaction of the client and engineers.

All equipment shall meet the performance criteria as detailed in this specification, and the relevant schedules and drawings. All equipment is to be priced as per the DRAWINGS, SCHEDULES and BOQs but options on equal and approved suppliers and equipment can be provided.

The design of the water system shall be to meet the requirements of SANS 10252-1 and the Building Regulations SANS 10400. The water system shall supply clean potable cold water as well as hot water to each of the fixtures as required. The water will be free of contamination and will be free flowing as required.

The water system shall be installed that dangerous or harmful chemicals or substances could permeate up the system and potentially poison the main municipal supply.

The Hot Water and Hot water Generation systems shall be installed to minimise heat and loss as well as minimise energy use. Timer control shall be used on all heating equipment and will be set to allow efficient management of hot water production and electrical use.

All Hot and Cold-water pipework will be insulated, especially external pipework. Internally the pipework insulation will be foil faced with the required labelling. Externally the pipework insulation will be clad in galvanised steel insulation cladding. This will also be labelled.

The water system shall be installed using the minimum pipework, fittings and accessories necessary to carry and supply water to all sanitary appliances, fixtures, etc. quickly, quietly and with freedom from nuisance or risk to health.

All pipelines shall be identified in accordance with Building Regulations.

Pipework shall be installed true and supported in accordance with SANS 10252-1 and the manufacturer's recommendations. Special care should be paid when installing exposed pipework.

9.2 Subcontractor Responsibility and System Coordination

The Contractor shall be responsible for the supply, installation, testing, commissioning and free maintenance during the guarantee period of the installation detailed in this Specification and on the accompanying drawings, schedules and BOQs.

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The Wet Services Subcontractor shall provide all materials, equipment, labour and services necessary for the complete, safe and efficient operation of the wet services installations in accordance with the intent of this Specification, the Drawings, Schedules and any other formally issued documentation.

This specification and accompanying layouts, schedules and BOQs detail the requirements of the Contractor in terms of the Wet Services installation.

Coordination of the relevant elements of the installation that interface with the various other installations (HVAC, Power, Lift, etc.) is the responsibility of the Wet Services Subcontractor.

Due to the nature of this Construction Project, the Contractor is to liaise with the Principal Contractor to ensure all interfacing elements have been priced for and if not, provide the Principal Contractor with the relevant details to allow these to be priced for.

Specific areas (but not limited to) to verify:

- Fixtures, Fittings and Sanitaryware: This is to be provided in the Architectural package.
- Power Supply to all Isolators required for the Wet Services Plant and Control Systems: This is to be supplied by the electrical subcontractor.
- Concealment of pipework and equipment Required: This is to be provided in the Architectural package.
- Builders work Required: This is to be provided by the civil/structural subcontractor.

Should any of these and any other requirements be lacking, the Contractor is to inform the Principal Contractor, who will inform the Client.

9.3 Exclusions and Free Issue Items

The following although associated with the Wet Services installation will be provided free of charge by others. This is subject to the above requirements for coordination and pricing:

9.3.1 Builders Work Items

These items should be provided by the Principal Contractor. The Wet Services Contractor is to verify this is the case. The Contractors responsible for producing and coordinating the builders' work drawings required to inform the Principal Contractor of the requirements.

- Provision of openings in walls, floors and roofs during initial building construction only.
- Building in of pipe sleeves and steel frames (provided by the Wet Services Contractor) for the passage of pipes, and other built-in equipment. This includes the provision and fixing of any hardwood frames.
- Supply and installation of all access doors and panels to plant areas and shafts for installation and maintenance.

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- Sealing of holes in walls and floors around pipes.
- Where cables or pipes pass through holes in floors, walls or partitions which are fire barriers, the openings shall be sealed by the builder with vermiculite plaster or other approved non-flammable equivalent for the full thickness of the floor or wall.
- Painting of walls and ceilings in the plantrooms.

9.3.2 Electrical Contractor's Item

These items should be provided by the Electrical Subcontractor. The Wet Services Contractor is to verify this is the case:

Supply of the required 1/3 phase, 230/400 Volt, 50 Hz electrical supplies to the drainage plant. The Electrical Contractor will install an isolator adjacent to the equipment required and the Wet Services Contractor shall terminate and connect the required equipment supplies to the terminals of the isolator provided.

9.3.3 Fixtures and Fittings

These items should be provided by the Principal Contractor. The Wet Services Contractor is to verify this is the case:

Supply all water dependant fixtures, fittings and sanitaryware for installation by the Wet Services Contractor.

9.3.4 List of Free issue elements to Principal Contractor for review

In line with the above requirements, the wet services contractor is to issue a list of all the expected free issue items to the Principal Contractor to ensure these are picked up.

This list is to also form part of the wet services contractors Submission.


9.3.5 Omissions

Not all equipment for the successful completion of the project will have been described in the specification. Where this is the case, the contractor must follow accepted good practice of a high standard to the satisfaction of the Engineer.

9.3.6 Additional Documentation

This section of the specification relates to the manufacture, delivery to site and installation of the above ground foul drainage and ventilation pipes. To ensure a fully coordinated installation, this Specification is to be read in Conjunction with all of the following documents:

- Relevant Section of the Project or system BOQ
- Architects Layouts

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9.3.7 Schedule of Technical Particulars

The applicable equipment schedule details the base requirements for several of the items that will be purchased. The Schedules may also contain Blank Areas that indicate the additional information required to be provided by the Wet Services Subcontractor. This additional information as well as the duty point information must be provided as a detailed specification sheet from the manufacturer.

9.3.8 General Specification

9.3.8.1 General Description

The purpose of the Water Supply system is to provide clean potable cold water as well as hot water to each of the fixtures as required. The water will be free of contamination and will be free flowing as required.

This specification covers the supply, delivery, installation, testing, commissioning and handing over of the complete Cold and Hot Water as specified below and as indicated on the drawings and schedules, which form part of this specification. All the work shall be carried out to the complete satisfaction of the Client and Consulting Engineer.


The drawings indicate the sizes of pipes and the manner in which the various systems of piping are to be run.

All pipes, fittings or any materials used shall be new, suitable for the said operating and test pressures and conform to the specification.

9.3.9 Principal items of work

Principal items of work include, but are not limited to, the supply and installation of:

- Hot water generation and storage installation utilising heat pumps and storage vessels where required
- Hot and Cold-Water Pipework Installation and Reticulation.
- Water Supply to AC systems and other systems as required
- All control panels and monitoring equipment necessary for the complete working of the system.
- All necessary supports, hangers, brackets and accessories to complete the installations.
- All necessary equipment to full install and complete the system.
- Commissioning and testing of the installations.
- Provision of maintenance for 12 months after the main contract works completion and final handing over of the entire building to the client.

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9.3.10 Design Parameters

Cold Water storage will provide 48 hours of backup water use. The water will then be boosted into the building at 4.5 bar.

Hot water storage will provide a reheat period of 1.5 to 2 hours of diverse water supply based on usage assumptions and probability of use.

The Hot and Cold-water installation will comply with all the requirements of the following:

Document Number	Document description
SANS 204	Energy efficiency in building
SANS 10400	The application of the National Building Regulations
SANS 10252-1	Water Supply installation in buildings
SANS 460:2009	Copper and copper alloy tubing
SABS 046	Copper tube manufacturing code of practice
SANS 10140	Identification colour marking
OHS ACT	Occupational Health and Safety Act No 85 of 1993 (as amended), including Regulations

Table 9-1 SANS Hot and Cold-Water Installation

9.3.11 General System Requirements

9.3.11.1 Cold Water

The cold-water system will be supplied from the municipal water supply. This water supply will be taken from the connection point and run into the building/tank location by the Civil Contractor, where it will be taken further by the Wet Services Contractor.

The cold-water system will be a storage-based system that will have a storage tank. The municipal supply will feed the storage tank, and a booster set will then take water from the storage to the buildings.

The water supply will be metered. Check meters will be installed on each building supply as well as major water use areas.

Pipework will be surface fixed if located within non-visible public areas – for example: in the roof structure, below sink counters and behind bulkheads, in risers, etc, generally pipework should run within service and back of house zones and push through to the required areas where possible. Where chasing can be avoided, it is to be avoided.

Cold water will be supplied to all fixtures and fittings that require potable water. This will generally be fed from the ceiling void above down to the fitting or fixture.

All pipework not running in the final room of supply will be insulated.

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The hot water generation systems will be fed from the cold-water system and will comprise a heat pump hot water generation using electric generation as backup where possible. These systems will combine to heat the water in storage vessels located as indicated.

Each Heat Pump will be directly connected to the requisite storage system and will pull water from the geyser to heat it up. The heat pump will circulate the water via its own internal water shunt pump. The heat pump controls will turn the heat pump on and off based on the temperature in the geyser.

The Hot Water pipework will follow the same requirements as the cold water in terms of running pipework. All hot water pipework will be insulated.

9.3.11.3 B01 – Warehouse

Standard water supply will be installed to the ablutions and showers in the warehouse. The water supply to the building will have a water meter located as the pipe exits the ground and before it enters the space.

Hot water will be provided by a geyser with a heat pump as the primary heat source. The geyser will have an electric element to provide backup.

9.3.11.4 B02 – Chemical Store

The water supply to the building will have a water meter located as the pipe exits the ground and before it enters the space. A bib tap will be located above each of the gullies and a water supply to each of the eye wash station will be installed.

The plumbing contractor will install the eye wash units.

9.3.11.5 B03 - Offices

The new toilet and bathroom layout will be a standard water installation and will connect into the existing water supply system. The water supply will have a new water meter installed in an appropriate location.

Hot water will be provided by a geyser with a heat pump as the primary heat source. The geyser will have an electric element to provide backup.

9.3.11.6 B05 – Lifting Shop

The lifting shop has an existing water supply that will be maintained. Old and broken fittings will be replaced, and new fittings will be installed in the extension. In general water points will be installed in the extension. These will feed down from the ring at high level and have bib tap or client specified tap above floor.

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Water System Extension

The existing water main will be kept live for the construction of the new extension and will be propped up as required. The new line will be installed in the extension and will be tested prior to the connection to the existing line. Once the new line has been connected the existing “back wall”: section will be removed. The new and existing line will have a new isolation valve installed in each corner.

9.3.11.7 *Window Washer*

The window washer will have a new water supply that will run from the site mains below the tracks to the new location. At this location, the following will be installed.

- New water storage tank
- New booster set that will run the pressurised water to the nozzles
- Pipework and nozzles on washer to PRASA Spec
- Control panel for system and booster
- Supply to tank from site mains with water meter.

9.3.11.8 *Waste Area*

The waste area has 3 separate waste holding spaces. Each will need a water point. A bib tap will be installed in each of the areas.

A single metered supply will run to the area and will then supply to each waste space.

9.3.11.9 *Investigations*

A series of test pits will need to be dug to ascertain the quality and sometimes the direction and size of the supply below ground.

9.3.12 General Equipment Requirements

9.3.12.1 *Hot Water Storage Tanks*

Hot water storage vessels will be used to store hot water for the building. The units will be installed with several inlets and outlets:

- Hot Water Outlet
- Hot Water Generation inlet
- Hot Water Generation outlet
- Cold Water Connection and Drain Valve
- Recirculation inlet if required.

The storage vessels will be rated to 6 bar minimum to ensure it can withstand the water supply pressure. Temperature and pressure relief valves will be installed at each storage vessel. PRVs will also be installed on the water inlet to each geyser to limit pressure fluctuations.

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All storage vessels will have a temperature sensor for the control of the heat generation systems.

Where a storage vessel is electrically heated only, the storage vessel's element will have a time clock (on the storage vessel or mounted in the DB at the breaker) that can be set to ensure the geyser only operates when needed.

9.3.12.2 Heat Pump

The heat pumps will be located as indicated on the layouts and as close as is practicable to the storage vessel.

The heat pump will have a supply pump that will pull water from the base of the geyser, pushing it through the heat pump and shunting the warm water back into the hot water vessel.

The heat pumps will be controlled using their own proprietary controllers and control equipment. The controllers must be capable of having time and temperature set points.

9.3.12.3 Cold Water Storage Tanks

The cold-water storage tank will be installed in the indicated location and will be impervious to the ingress of rainwater and other elements. The tank/s will be installed on a plinth as required.

A fine mesh screen will be installed of the air inlet (that faces down) to prevent bugs and any other creatures to enter the system.

The tank will be installed with the following:

- Overflow Pipe
- High level indicator pipe / overflow warning pipe.
- Drain valve
- Mechanical Water level indicator – clear pipe connected to the top of the sampling tap.
- Sampling Tap
- Temperature indicator
- Inlet pipe with mechanical float valve shut-off
- Outlet to booster – With Vortex Inhibitor

9.3.12.4 Water Supply Booster

The booster will be located near the tanks and will be large enough to supply the full diversified load of the building with a backup as well. The booster will be a multiple pump unit with one pump acting as standby. The system will rotate the pumps on a weekly basis to ensure even wear.

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The booster will be a packaged unit and will be supplied with all the required pumps, vibration mounts, valves, pressure accumulator to manage pressure fluctuations and control panel to manage the pumps. Power will be supplied by the electrical contractor.

The booster will be supplied with its own standard control panel that will provide constant pressure control once the flow rate and required pressure have been set. The booster will provide the maximum required flow and pressure with the standby pump turning on once pump one reaches 90% duty. The standby pump will engage if necessary.

9.3.12.5 Water Meters

A primary supply check meter will be installed to allow the verification of the municipal supply. Water Meters will be supplied to every major supply area.

Meters will be class c or d to ensure a high level of accuracy.

Meters will be installed in areas and in orientations where they can be easily read. Meters will be installed with pulsed output and read switch/Meter interface unit to allow connection to an automatic metering system.


9.3.12.6 Fixtures and Fittings

All Fixtures and fittings (free issue by others) as well as connections to each fixture will be installed by the Wet Services Contractor to the Architects Requirements. Water connections and installation will be completed but is not limited to the following:

- Kitchen Sinks, Cleaners Sinks
 - a. Sinks will have (unless otherwise shown) separate hot and cold-water connections as well as separate taps.
- Wash hand basins
 - a. These will have separate connections, but the tap unit will have an integral mixing valve.
- WC and WC Cisterns
 - a. Single cold-water connection
- Urinals and Urinal Cisterns (should these be supplied)
 - a. Single cold-water connection
- Standpipes
 - a. Single cold-water connection

All fixtures and fittings form part of the Architectural Package and details of the fittings must be obtained by the Contractor to verify connection types and requirements.

The Contractor will also be responsible for the installation of any control elements to be installed in line with the fixture and fittings. This will generally be PIR detection systems for

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tap and flush operations but may be other systems. The Contractor is to verify this with the Principal Contractor.

9.3.12.7 Valves

Valves will be required as per the schematics and layouts as well as the following not indicated:

- All branch pipework to have isolation valve at TEE-OFF (this includes both the branch and the main run.
- All major supply areas are to have pressure reducing valve to ensure the area pressure does not rise above 4 bar.
- All major sets of plant will be protected using strainers
- All major equipment will have isolation valves before and after the equipment to ensure this can be removed without affecting the rest of the system.
- All Pumps will be protected using flexible connectors, isolation valves, strainers, pressure relief valves, drain valves, etc.
- All Valves to be PN10 minimum, PN16 preferable

9.3.13 Pipelines

Generally, the following pipework materials will apply, unless detailed or specified otherwise.

9.3.13.1 Copper pipes

Copper pipes for domestic water and gas supply must comply with SANS 460, class 0 for water or gas supply above ground, and class 2 or 3 for water or gas supply below ground. Fittings must be copper-based capillary solder or compression fittings to comply with SABS 1067. Join copper pipes as follows:


- Cut pipe end square, ream, remove burrs and size if required
- Clean bore of fitting and pipe with a ring brush or fine emery paper.

9.3.13.2 Galvanised Steel

Galvanised will only be used where specifically stated. This is generally confined to all major supply pipework above ground.

Galvanised Steel pipes and fittings shall be manufactured in accordance with SANS. The tubes shall be straight, smooth, of true cylindrical bore and free from all flaws.

The pipes and fittings shall be joined by screw fit or flanged connection to suit the pipework material and/or the fitting being connected to. Generally, connections will be flanged for all pipes 50mm in diameter or greater with screwed connections for smaller pipes.

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9.3.13.3 HDPE

HDPE water pipes will be used for all major runs below ground. Pipes 50Ø or smaller must run in the ground inside a smooth bore sleeve of appropriate size to ensure pipe can be replaced.

HDPE pipes and fittings shall be manufactured in accordance with SANS. The tubes shall be straight, smooth, of true cylindrical bore and free from all flaws.

The pipes and fittings shall be joined by screw fit or flanged connection to suit the pipework material and/or the fitting being connected to.

9.3.13.4 Multi-layered Plastic Pipe

ALL Pipework except where expressly stated will be of this type of pipe. This is generally referring to all hot water pipework and all cold-water pipework.

These pipes comprise multiple layers of HDPE, Aluminium and PEX-Xb. These pipes and fittings shall be manufactured in accordance with SANS and EN ISO 21003. The tubes shall be straight, smooth, of true cylindrical bore and free from all flaws.

The pipes and fittings shall be joined by agreed and manufacturers recommended connection to suit the pipework material and/or the fitting being connected to.

9.3.14 Pipe Routes

Ensure pipe routes are shortest practicable, with the minimum number of bends, unless indicated otherwise.

9.3.15 Pipe Expansion


Where possible, expansion shall be taken up at the bends. Expansion bellows of an approved type shall be provided where necessary on long straight runs. Slide supports and anchors shall be provided at suitable positions to control pipe movement. The specified cold pull shall be provided to give the required pretension at the expansion bellows and bends. The complete installation shall be in accordance with the manufacturer's recommendations.

Pipe Expansion is the responsibility of the Wet Service Contractor.

9.3.16 Fixing and Jointing

Hot and cold-water Pipes will be supported as follows (or as per manufacturer's minimum recommendation – whichever is more robust):

Size of pipe	Spacing for Horizontal (m)	Spacing for Vertical (m)
15-28	1.8	2.4
35-42	2.4	3.0
54	2.7	3.0

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76-133	3.0	3.6
159	3.6	4.2

Table 9-2 Pipe Sizes

Install pipes, fittings and accessories in accordance with Building Regulations and manufacturer's recommendations.

Where horizontal pipes are installed in excess of 300 mm from the soffit of the supporting slab adequate supports shall be provided to prevent lateral movement.

Install adequate restraint couplings to ensure that the system is capable of withstanding all likely accidental static water pressures.

9.3.17 Accessories

9.3.17.1 Thermal Insulation / Lagging

Provide and install pipe insulation to pipework where required which would be prone to heat loss to the formation of condensation or to prevent freezing. All insulated pipes are to be labelled to aid identification. Labels shall be provided at a maximum of 3 m centres. Arrows will also be used to show flow direction

All Hot Water Piping shall be insulated with flame retardant pre-formed pipe sections. This shall be foil faced glass wool, Foil Faced Mineral wool or closed cell insulation type that meets the requirements of the table below.

ALL insulation will have an ODP of 0 in accordance with green star building guidelines.

The insulation thickness shall be as follows:


Thermal Conductivity Pipe Diameter Insulation Thickness

Thermal Conductivity	Pipe Diameter	Insulation Thickness
(W/mK)	(mm)	(mm)
<0.034	up to 40	25
<0.034	50 to 100	32

Table 9-3 Insulation Thickness

Joints shall be sealed by means of tape, glue or a proprietary jointing system, in accordance with the manufacturer's recommendations.

All joints, bends, valves and other fittings shall be insulated. The thickness of the insulation shall not be less than the associated pipes. Adhesive shall be used where necessary, in accordance with the manufacturer's recommendations.

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For smaller size pipes with slow bends the insulation can be drawn around the bend. For larger pipes (40 mm & above) with short radius bends, standard or segmented bends shall be used, in accordance with the manufacturer's recommendations.

9.3.17.2 *Metal Cladding*

All insulation on Hot Water and cold-water Piping installed externally, in service risers and in Plant Rooms shall be protected with 0.4 mm thick galvanised steel sheet metal cladding, which shall be applied directly over the insulation.

The cladding shall be secured by means of removable and re-usable stainless-steel bands every 330 mm. Self-tapping screws will not be accepted. No dents or damage to the sheet metal cladding will be accepted.

NOTE:

A sample of the lagging and cladding to be used is to be submitted to the engineer for approval before placing the orders for these items.

9.3.18 **General Site Wiring and Controls**

9.3.18.1 *Site Wiring*

The contractor shall be responsible for all field wiring between the Wet Services plant and the electrical supply breaker / isolator (supplied by electrical contractor).

Generally, field wiring shall be carried out in PVC SWA LSF cable. Cable will run neatly in either conduit or it will be securely strapped to adequately size cable trays with ½ rated insulated earth wires.

All cable trays, cable trunking, conduit, accessories and supports shall be galvanised.

No fixing to plant and piping will be allowed without the approval of the Engineer.

9.3.18.2 *Controls*

Generally, all equipment will be supplied with a dedicated factory installed controller and will be commissioned and set to run on its own.

This will include Heat Pump and Geyser.

Each panel will require power, and the Wet services contactor will liaise with the electrical installer to ensure this power is proved.

All wiring from the pale to the plant will be installed by the wet services contractor.

9.3.19 **Builders work.**

The contractor shall be responsible for providing all small openings in brick walls for pipework etc. and for providing the necessary flashing, support brackets for pipework ductwork etc.

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The contractor shall be responsible for providing all Builder's Work Drawings for the work to be carried out by the Principal / Structural Contractor. Full details of all large openings for pipework in the roofs, slabs and brick walls, details of concrete bases, etc are to be included on these drawings which are to be submitted to the Engineer for approval in good time to comply with building program.

The Wet services subcontractor shall also check the positions and sizes of all these openings, bases, etc provided by the Principal / Structural Contractor.

The Principal Contractor shall provide all waterproofing and making good.

9.3.20 Fire Safety

Provide and install protection of openings and fire stopping in accordance with the Building Regulations.

Provide and install on all plastic pipework passing through fire compartment floors or walls an intumescent fire sleeve in accordance with Building Regulations. The fire sleeve shall have a fire rating compatible with the floor, wall or cavity barrier to which it is fitted.

All services penetrations shall be fire sealed.

The subcontractor shall identify, on drawings, where his services penetrate floor slabs and fire barriers and furnish these to the Main Contractor.

The Builder will caulk in all services.


Once services have been caulked in a specialist contractor other than the Wet Services Subcontractor shall apply intumescent paint to cables, ducts, piping etc. where such passes through floor slab and fire barriers.

Before requesting the Engineer to carry out an inspection the contractor shall satisfy himself that all penetrations relating to his installation have been caulked and fire sealed with intumescent paint.

9.3.21 Earthing and Bonding

All new metal pipework systems shall be continuity bonded and tested to ensure earth continuity. These shall all be tied into the buildings main earthing system, whether it is rebar or other system being employed.

Carry out equi-potential bonding and tests of the foul drainage system (above ground) to prove the effectiveness of the earthing system. All tests shall be fully recorded and included within the operating and maintenance manuals.

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9.3.22 Workmanship

Prevent entry of foreign matter into any part of system by sealing openings during construction. Fit all access covers and cleaning eyes as work proceeds. Failure to undertake this will result in the requirement for CCTV inspections to be carried out to the entire system, to prove that the system is free from debris.

Handle, store and securely fix all products and accessories in accordance with manufacturer's recommendations.

All pipework and fittings shall be properly cleaned, where necessary following completion of the installation.

9.3.23 Labelling and Marking

All items of equipment and plant shall be labelled. All labels shall be in English. Labels shall be of engraved aluminium be securely fixed by screws or rivets. Lettering shall be in block capitals in a minimum size of 8mm.

All Pipework will be labelled as per the table below

Water	Specific Label/ Marking
All pipework to have a band of colour 100mm wide on the pipework every 6 metres and 500mm from where the pipe enters or exits the space with an arrow showing direction of flow	
Potable Water / Main water supply	100mm wide brilliant green band
Hot Water Pipework	100mm wide brilliant green band with 50mm wide crimson band in the middle
Heat Pump Water Pipework	100mm wide brilliant green band with 50mm wide orange band in the middle

Table 9-4 Water Labelling and Markings

9.3.24 Testing and Commissioning

Testing and commissioning shall be undertaken in line with the CIBSE commissioning codes as well as below. This is in line with the green star rating specification

The Wet Services Subcontractor shall be responsible for testing and commissioning of the complete plant and allow for inspections by the Engineer as required.

After the Wet Services Subcontractor has completed his testing and commissioning and is satisfied that the plant is ready for the Taking-Over Inspection he shall notify the Engineer so that the Taking-Over Inspection can be arranged.

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The subcontractor shall submit to the engineer a complete commissioning schedule at least 1 month before commissioning commences. The commissioning schedule shall contain all commissioning activities, all equipment to be tested and all variables of all equipment to be checked. The following tests and measurements are to be included and recorded:

9.3.25.1 Mechanical Tests and Measurements

- Capacity of the systems.
- Operation of control, safety and alarm devices.
- Noise levels.
- Any other tests that may be required for the particular system.

9.3.25.2 Electrical Tests and Measurements

- Full load amps and volts.
- No load amps and compare with rated no load amps.
- Any other tests which may be required for this particular system.

9.3.25.3 Commissioning is to be carried out as follows:

All water piping shall be hydraulically tested as specified and the results recorded. The Engineer or Clerk of Works shall witness the tests.

The Wet Services Subcontractor shall provide all the necessary equipment to carry out the tests. Pipes shall be tested in sections as the work progresses and before finishes are applied or pipes are covered. The completed steam and water piping / systems shall be tested as a whole just prior to final acceptance by the Engineer.

All instruments used for testing shall be calibrated by an approved authority before testing commences.

All pipes and water storage tanks are to be flushed with clean water just prior to acceptance by the Engineer for Taking-Over.

After flushing all pipes and water storage tanks are to be sterilized with clean water and chlorine (HTH) just prior to acceptance by the Engineer for Taking-Over.

9.3.25.4 Pressure Testing

The water pressure tests are to be carried as follows:

- All pipework is to be pressure tested before isolating valves and tap outlets are fitted. These tests are to be in 1800 kPa (18 Bar). The pressure is to be held for 20 minutes without further pumping and no leaks are permitted.

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- All pipework with joints to be buried in walls or behind tiles is to be tested before covering with plaster or tiles. Where possible joints are to be avoided where pipes are buried in walls or behind tiles.
- Pipework should be tested in sections as to ensure that an acceptable standard of workmanship is being maintained as work progresses.
- Thereafter the complete installation is to be tested as in before fitting the valves and taps.
- All pipes are to be flushed with clean water before fitting the valves and taps.
- After pressure testing and flushing is accepted, valves and taps are to be fitted, and the complete installation is to be tested at 600 kPa (6 Bar). The pressure is to be held for 60 minutes without further pumping and no leaks are permitted.
- All valve and tap glands are to be adjusted at 600 kPa to ensure that there is no leakage.
- A Water Pressure Test Schedule is to be prepared to cover all sections of each building / pipe section.
- A Typical Water Pressure Test Schedule is attached for completion and witnessing by the Main Contractor and the Clerk of Works respectively.
- Once the Main/Subcontractor has successfully carried out his pressure tests and completed and signed the schedules he is to notify the Clerk of Works who is required to witness and sign for acceptance of pressure tests carried out.

Once the schedules have been completed and signed for by the Clerk of Works they are to be forwarded to the Engineer for signature and for record purposes.

9.3.26 Contractor General Requirements**9.3.26.1 Contractor Information, drawings and samples**

The Wet Services Subcontractor shall within a period of two weeks of receipt of documentation verifying his appointment submit to the Engineer all drawings and samples as requested by the Engineer. The drawings shall be submitted with reasonable promptness and in an orderly sequence so as to cause no delay to the works.

The Wet Services Subcontractor shall be responsible for providing the following drawings pertaining to the Wet Services Installation for the execution of the project.

- Wet Services Sub-Contractor's Drawings
 - Builder's Work Drawings
 - Shop Drawings
 - Electrical Drawings
- Record Drawings

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By preparation and submission of this information, the Wet Services Subcontractor shall be deemed to have determined and verified all field dimensions, materials, catalogue numbers etc. In terms of the project programme, the Wet Services Subcontractor shall allow the Engineers two calendar weeks for scrutiny of drawings.

The Wet Services Subcontractor shall submit electronic copies of all drawings to the Engineer for approval before commencement of work.

No portion of the work requiring approval of shop drawings or samples shall be commenced without the necessary approval of the Engineer.

Samples Required:

- Copper pipework jointing sample.
- Example of pipe hanger and insulation installation.

9.3.26.2 *Operating and maintenance manuals*

Operating and maintenance manuals are to be prepared by the Wet Services Subcontractor for all the systems and installations for which they are responsible. This will include (but is not limited to):

- General Description of the systems
- Operating manuals for all equipment
- Maintenance requirements for all equipment and systems
 - Including lists of all spares that should be kept on hand
- Record Drawings of all system installations.
 - Including floor layouts, sections, and details of all installed equipment, plant, cables, etc. Enough detail must be provided to allow the facilities team to be able to pinpoint all the services.
 - Must include equipment numbering and all labelling

Manuals must be submitted to the Engineer at least 1 week prior to the system commissioning start date.

After approval of the manuals by the engineer, the Wet Services Subcontractor shall provide the Engineer with bound copies as well as soft copy CD ROMs/flash drives of all MS Word, Excel and AutoCAD files as well as all manufacturers information.

Manufacturer's catalogue information shall be scanned and saved to disc in "JPEG" format at a rate of compression to be clearly legible.

The CD ROM / Flash Drive copy shall read as a catalogue with drawing files separated and all files properly indexed.

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The contract will not be accepted as complete until these have been supplied, complete and to the satisfaction of the Engineer.

The Wet Services Subcontractor shall include for professional assistance in preparation of the above if necessary.

9.3.26.3 *Guarantee and maintenance*

The entire installation shall be guaranteed against defect or faulty workmanship for a period of twelve months, from date of acceptance of the Building by the Client.

The Wet Services Subcontractor shall service and maintain the installation for a period of twelve months from acceptance of the Building by the Client.

The various items of equipment shall be serviced and maintained in strict accordance with the requirements of the respective suppliers of the equipment.


Contractors shall include, in their tender prices, for travelling, labour, consumable, oils, lubricants, chemicals, tools, etc. necessary for the successful implementation of the maintenance programme.

Contractors shall allow for monthly maintenance visits over the 12-month period.

The Wet Services Subcontractor shall implement and maintain a maintenance/servicing register for the duration of the maintenance and guarantee period.

A record of each maintenance visit shall be forward to the Engineer after each visit.

At the end of the guarantee period the Wet Services Subcontractor shall hand over to the Client a full set of any special tools or instruments required for the continued maintenance of the installation.

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10 TECHNICAL SPECIFICATIONS – FOUL DRAINAGE INSTALLATION

10.1 General Requirements for Drainage Subcontractor

This specification covers the supply, install, clean, test and commission the complete above and below ground foul drainage system. All work shall be carried out to the complete satisfaction of the client and engineers.

All equipment shall meet the performance criteria as detailed in this specification, and the relevant schedules and drawings. All equipment is to be priced as per the DRAWINGS, SCHEDULES and BOQs but options on equal and approved suppliers and equipment can be provided.

The design of the foul drainage shall be to meet the requirements of SANS 10252-2 and the Building Regulations SANS 10400. The foul drainage systems shall carry effluent, waste discharges etc. by gravity from all sanitary appliances etc. for final discharge to the below ground sewer systems.

The foul drainage system shall be installed using the minimum pipework, fittings and accessories necessary to carry away all discharges from the sanitary appliances etc. quickly, quietly and with freedom from nuisance or risk to health. It is essential that air from the foul drainage system is prevented from entering the building. To this end, all waste connections to the system to be trapped.

All pipelines shall be identified in accordance with Building Regulations.

All foul drainage pipework shall be installed to convey discharges without crossflow, backfall, leakage and it is essential that the system is adequately tested, cleaned and maintained at all times and throughout the construction process.

Gradients of all foul drainage pipework shall meet the minimum requirements SANS 10252-2 table 13.

All foul drainage discharge from plantrooms and mechanical equipment shall be connected to the foul drainage system.

All foul drainage shall be designed for installation within designated services ducts or ceiling voids. Any pipework in front of house areas shall be boxed out as per Architects requirements or shall be chrome plated

Access doors shall generally be installed at the bottom of each vertical and on every floor and 1.2m above each change of direction on vertical pipes. Access doors shall be installed for horizontal pipework. Removable access panels shall be co-ordinated with the drainage access points to enable maintenance to foul drainage pipework.

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Pipework shall be installed true and supported in accordance with SANS 10252-2 and the manufacturer's recommendations. Special care should be paid when installing exposed pipework.

Main ventilating pipework shall be installed to suit the design of both the above and below ground drainage systems as necessary and shall terminate to atmosphere.

Where the design of the below ground drainage system has been undertaken by the civil engineer, all details relating to the below ground drainage shall be provided by them. It is intended that the above ground foul drainage system shall connect to the below ground drainage system by a connection / coupling / inspection chamber or manhole.

The drainage system shall be fully accessible and fully roddable for cleaning and maintenance purposes. Access junctions and points shall be installed in all pipework as required by SANS to ensure that all parts can be fully accessed by a rod or cleaning agent.

10.2 Subcontractor Responsibility and System Coordination

The Drainage system Subcontractor shall be responsible for the supply, installation, testing, commissioning and free maintenance during the guarantee period of the installation detailed in this Specification and on the accompanying drawings, schedules and BOQs.

The Drainage Subcontractor shall provide all materials, equipment, labour and services necessary for the complete, safe and efficient operation of the air drainage installations in accordance with the intent of this Specification, the Drawings, Schedules and any other formally issued documentation.


This specification and accompanying layouts, schedules and BOQs detail the requirements of the Drainage Subcontractor in terms of the drainage installation.

Coordination of the relevant elements of the installation that interface with the various other installations (HVAC, Power, Lift, etc.) is the responsibility of the Drainage Subcontractor.

Due to the nature of this Construction Project, the Drainage Subcontractor is to liaise with the Principal Contractor and Subcontractors to ensure all interfacing elements have been priced for and if not, provide the Principal Contractor with the relevant details to allow these to be priced for.

Specific areas to verify (but not limited to):

- Fixtures, Fittings and Sanitaryware: This is to be provided in the Architectural package.
- Power Supply to all Isolators required for the Drainage System Plant and Control Systems: This is to be supplied by the electrical subcontractor.

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- Concealment of pipework and equipment required: This is to be provided in the Architectural package.
- Builders work Required: This is to be provided by the civil/structural subcontractor.

Should any of these and any other requirements be lacking, the Drainage Contractor is to inform the Principal Contractor, who will inform the Client.

10.3 Exclusions and Free Issue Items

The following although associated with the Drainage installation will be provided by others. This is subject to the above requirements for coordination and pricing:

10.3.1 Builders Work Items

These items should be provided by the Principal Contractor. The Drainage Contractor is to verify this is the case. The Drainage Contractor is responsible for producing and coordinating the builders' work drawings required to inform the Principal Contractor of the requirements.

- Provision of large, preformed openings in walls, floors and roofs during initial building construction only.
- Building in of pipe sleeves and steel frames (provided by the Drainage Contractor) for the passage of pipes, and other built-in equipment. This includes the provision and fixing of any hardwood frames.
- Supply and installation of all access doors and panels to plant areas and shafts for installation and maintenance.
- Self-draining waterproof floors in plant areas.
- Sealing of holes in walls and floors around pipes.
- Where cables or pipes pass through holes in floors, walls or partitions which are fire barriers, the openings shall be sealed by the builder with vermiculite plaster or other approved non-flammable equivalent for the full thickness of the floor or wall.


10.3.2 Electrical Contractor's Item

These items should be provided by the Electrical Subcontractor. The Drainage Contractor is to verify this is the case.

- Supply of the required 1/3 phase, 230/400 Volt, 50 Hz electrical supplies to the drainage plant. The Electrical Contractor will install an isolator adjacent to the equipment required and the Drainage Contractor shall terminate and connect the required equipment supplies to the terminals of the isolator provided.

10.3.3 Fixtures and Fittings

These items should be provided by the Principal Contractor. The Drainage Contractor is to verify this is the case.

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- Supply all water dependant fixtures, fittings and sanitaryware for installation by the Drainage Subcontractor.

10.3.4 List of Free issue elements to Principal Contractor for review

In line with the above requirements, the Drainage Subcontractors is to issue a list of all the expected free issue items to the Principal Contractor to ensure these are picked up.

This list is to also form part of the Drainage Subcontractors Submission.

10.3.5 Omissions

Not all equipment for the successful completion of the project will have been described in the specification. Where this is the case, the contractor must follow accepted good practice of a high standard to the satisfaction of the Engineer.

10.3.6 Additional Documentation

This section of the specification relates to the manufacture, delivery to site and installation of the above ground foul drainage and ventilation pipes. To ensure a fully coordinated installation, this Specification is to be read in Conjunction with all of the following documents:

- Relevant Section of the Project or system BOQ

10.3.7 General Specification

The purpose of the foul drainage installation is to safely, quickly and without odour, noise or spillage remove all waste from the building. This system will discharge the waste into the new Civil Engineer designed sewerage system located around the building.

This specification covers the supply, delivery, installation, testing, commissioning and handing over of the complete Drainage system as specified below and as indicated on the drawings and schedules, which form part of this specification. All the work shall be carried out to the complete satisfaction of the Client and Consulting Engineer.

The drawings indicate the sizes of pipes and the manner in which the various systems of piping are to be run.

All pipes, fittings or any materials used shall be new, suitable for the said operating and test pressures and conform to the specification.

10.3.8 Principal items of work

Principal items of work include, but are not limited to, the supply and installation of:

- Above Ground Foul Drainage System
- Below Ground Foul Drainage System below the building, exiting the building and connecting to all main sewer lines as per the Civil Engineer.
- Installation of grease traps, oil separators, etc.
- Installation of the drainage to the AC systems.

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- All necessary supports, hangers, brackets and accessories to complete the installations as specified.
- All necessary equipment to full install and complete the system.
- Builders work required as detailed below
- Commissioning and testing of the installations.
- Provision of maintenance for 12 months after the main contract works completion and final handing over of the entire building to the client

10.3.9 Design Parameters

The foul drainage above ground system shall be based on a primary and secondary ventilated stack arrangement.

The Drainage system is to be designed and installed to meet all the requirements of the following:

- Building Regulation SANS 10400 Part P
- SANS 10252-2
- All other technical manuals and guides may be applicable.

10.3.10 General System Requirements

The above ground foul drainage systems will discharge all waste and effluent via gravity from all sanitary fittings, kitchen appliances and any mechanical plant/equipment etc, as required. The pipework will be routed to discharge flow via gravity, down through the building, turning below ground and running out the building where it will connect to the sewer lines.

The pipes will drop into the ground as indicated and the bottom bend will have a minimum radius slow bend as per SANS requirements. Unless otherwise required by SANS, a minimum radius of 300mm will be required. The 300mm radius may be made up of 2no. 45° bends that are spaced to create a 300mm radius.

All pipework will be installed in service voids, back of house areas, under counters or behind partitions and fixtures to ensure minimum visibility.

Small diameter pipework ($\leq 50\text{Ø}$) may be chased vertically into the wall but not horizontally unless agreed with the Structural Engineer.

Access shall not be compromised and where it is not possible to hide the pipes and maintain access, access for cleaning will take precedence. Where this is required, the pipework will be insulated for sound with mineral wool lagging and boxed in as required by the Architect.

All exposed traps and pipework, unless otherwise stated, will be chrome plated or as required by the Architect.

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All foul drainage and ventilation pipework and fittings shall be installed in the positions as indicated on the drawings.

The entire system will be a composite naturally ventilated pipe system. Generally, stacks will become ventilation pipes above the final waste connection. A ventilation header runs at high level in all locations and all ventilation pipes from fittings will connect to the headers. Each Header will then have a number of vent pipes that will penetrate through the roof to ventilate to above.

All pipework beneath the building will be installed on a cradle bed of 150mm of granular material compacted to 90% Mod Aashto. The pipe will then be covered by a minimum of 300mm of selected fill compacted to the same density as the base. The remainder of the trench will be general compacted fill.

Pipework below the surface bed that does not have a minimum of a 150mm cushion of sand between the top of the pipe and the surface bed concrete will be cast in concrete that will be a uniform pour with the surface bed. Where the pipework can safely exit the concrete, rocker pipe with movement connections will be installed so any building movement will not upset the pipework. A rocker pipe will have a minimum of a 1:40 fall.

10.3.10.1 B01 – Warehouse

Standard drainage will be supplied for the showers and ablutions. In general pipework will run out the back wall and drop to connect to the main drain which then runs to the manhole.

10.3.10.2 B02 – Chemical Store

Eye Wash units will be provided outside each of the main storage areas. These will drain into the ground and run to the nearest manhole. Trapped concrete gullies will be provided next to or near to the eye wash units.

10.3.10.3 B03 - Offices

The new toilet and bathroom layout will be a standard drainage installation and will connect into the existing drainage system.

10.3.10.4 B05 – Lifting Shop

New pit drainage

The two new maintenance pits will have drainage installed directly in the base of the pit or in sumps in the base of the pit. The system will allow for the drainage and cleaning of the pit. This will need to account for oil and grease spills. The main drain for each pit will run beneath the pit with several floor drains in the base of the pit connecting to the pipe.

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The drainage system will be required to be robust to ensure that minor building movement and settling will not have an impact on the drainage. Correct bedding and even concrete encasement will be used.

Existing Pits

The existing pits drainage systems are blocked and clogged and will need to be cleaned and made to work. This will entail cleaning and unblocking of the system as well as a CCTV inspection to verify the condition of the system.

Should the system be unmaintainable – new pit drainage will be installed. This will comprise the following:

Sump pumps installed in sump bases

Pipework from pump will run either:

- To high level and run out using gravity to the nearest drain connection point.
- Or to a new pipe run installed in the floor of the lifting shop. This will be a small trench in the floor that will be made with the pipe installed in the trench. This pipe will run to an appropriate location to connect to the below ground system.

Oil Separator

The existing oil separator outside the lifting shop is not being used at the moment as all the drainage is blocked. This will be fully investigated and cleaned and made to work.

The oil separator is a concrete in-ground structure that receives all the pit drainage. Once fixed, the new and existing drainage from the lifting shop floor will connect to this separator

10.3.10.5 Window Washer

The window washer will need to be connected to the oil separator. The facility will be located to the south of the lifting shop and will allow for windscreen and window water ingress testing. Drainage from the area will be by means of a main drain for the area that will need to cross beneath two sets of track to be connected to the oil separator.

10.3.10.6 Waste Area

The waste area has 3 separate waste holding spaces. Each will need drainage. General waste will have a floor drain that will connect direct to sewer. Specialist and hazardous waste will have a gulley and tap outside the area that will connect direct to sewer.

10.3.10.7 Investigations

All existing drainage will be investigated and cleaned by means of a CCTV inspection and jet washing exercise.

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- uPVC – SANS 791 class 34 for below ground applications
- uPVC – SANS 967 for above ground installations
- HDPE – used for both above and below ground applications.
- Galvanised steel – See Water Specification
- Stainless Steel – See water specifications

uPVC, manufactured in accordance with SANS and shall, where appropriate, bear the SANS mark.

Where used HDPE pipework will be black high-density polyethylene and will EN1519 compliant as well as bear the SANS quality mark.

10.3.11.2 Pipe Locations and Types used.

Generally, throughout the building, soil, waste and vent pipework shall be a combination of uPVC and HDPE.

Generally, throughout the building, soil, waste and vent pipework shall be uPVC.

Generally, beneath the building, soil pipework shall be uPVC.

HDPE will be used for pipework at soffit level over high-risk areas, high use areas and vertical stacks where a more robust solution is required.

HDPE pipework will need to be installed by an approved HDPE installer.


Where HDPE is used, all pipework from fixtures connecting into a stack will be uPVC where HDPE fitting will not provide the requisite access.

Galvanised or stainless-steel pipework may be used where hot water might harm the plastic pipes as well in specialist areas as required.

10.3.11.3 Pipe sizes

Unless otherwise specified the following pipe sizes apply to all pipe dimensions on layouts and in all correspondence.

Type of piping	Nominal Size on Layout	Pipe OD	Pipe ID
uPVC	40	40	36
	50	50	45.6
	110	110	103.6
HDPE	40	40	34

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Type of piping	Nominal Size on Layout	Pipe OD	Pipe ID
	50	56	50
	110	110	101.6
	160	160	147.6

Table 10-1 Pipe Sizes

10.3.11.4 Jointing

The method of jointing to be employed shall be the manufacturer's approved jointing system.

HDPE will generally be butt welded or electrofusion welded where end to end heat welding is not possible. Where movement is required, push fit rubber seal connection will be used.

uPVC will be solvent welded unless movement is to be allowed for as per manufacturer recommendations.

Seal ring fittings shall be used where necessary to accommodate thermal movement or where the manufacturers recommend. The rubber seals for seal ring joints shall be of section that gives more than one point of contact with the pipe.

Horizontal and vertical pipework shall include allowance for thermal expansion in accordance with the manufacturer's recommendations.

10.3.12 Access

Access will be provided on all vertical foul drainage stacks at 1200 mm above each finished floor level, to the centreline of the access door and on horizontal pipework in accordance with the requirements of the Building Regulations.

Access will be installed at every change of direction. All bends that are accessible will have inspection eyes. The whole system must be roddable and cleanable from at least one side. All pipe ends will have an access eye to ensure access down the run.

All rodding eyes will allow for 45° access for rodding. All rodding eye ends will have a rubber seal and will be screwed tight closed to ensure no air escapes. All rodding eyes will be covered by a neat steel plat that is screwed down and is finished flush with the architects FFL.

With the exception of external areas, a minimum of 10m from the building line, all covers to any access point in a drainage system will have a rubber airtight seal – this will be a double seal if required.

10.3.13 Pipe Routes

Ensure pipe routes are shortest practicable, with the minimum number of bends, unless indicated otherwise.

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It is a requirement of this specification that all branch connections that run horizontal at high level on any floor shall be made using 45° branches swept in the direction of flow, where possible.

Generally, all falls within the building 1:40 unless otherwise shown on the drawings. All main drain runs will be at a minimum of 1:60 fall unless otherwise specified. Beneath the building, falls will be at 1:60 unless otherwise shown on the drawings.

10.3.14 Fixings

Install pipes, fittings and accessories in accordance with SANS, Building Regulations and manufacturer's recommendations to ensure the complete discharge of foul drainage from the building without any leaks, ingress to the building or nuisance.

The pipes shall be fixed in straight runs and all horizontal runs are to be laid to gradients in accordance with SABS 0252-2 Table 13.

Allow for thermal and building movement when jointing and fixing drainage pipework in accordance with the manufacturer's recommendations.

Fix pipes at centres not greater than those shown in the Table below. Provide additional supports as necessary at junctions and changes in direction. Fix every length of foul drainage pipework at, or close below the socket collar.

Type of piping	Size of pipe	Spacing for horizontal (m)	Spacing for vertical (m)
Cast iron*	All sizes	2.0	3.0
uPVC	32-40	0.5	1.2
	50	0.6	1.2
	75-100	0.9	1.8
	150	1.2	1.8
HDPE	32-40	0.5	1.2
	50	0.7	1.2
	75-100	0.9	1.8
	150	1.2	1.8

Table 10-2 Pipe Fix

Where not indicated otherwise, use plated, sherardized, galvanised or non-ferrous fastenings, suitable for the purpose and background, and compatible with the material being fixed or fixed to.

Vertical fixing shall be fixed via purpose-made two-piece galvanised mild steel bolted drop rod type clips, drilled to accept M10/M12 rod.

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Where horizontal pipes are installed more than 500 mm from the soffit of the supporting slab adequate supports shall be provided to prevent lateral movement.

Install adequate restraint couplings to ensure that the system can withstand all likely accidental static water pressures. Where foul drainage pipework is required to be installed prior to the erection of supporting walls, supply and install independent adequate galvanised mild steel support framework from floor slab to soffit.

The drainage pipework shall be supported using the ductile iron bracket with acoustic dampener for pipework up to 150 mm diameter.

All expansion units shall be anchored.

All stacks that are 3 stories or taller and drop into the ground will have a thrust block installed at the base of the pipe.

10.3.15 Accessories**10.3.15.1 Wastes/Waste Connectors**

Bed in waterproof jointing compound and fix with resilient washer between appliance and backnut. Join to traps as per manufacturer's recommendations.

10.3.15.2 Floor Outlets

Several locations will have floor drains that drop through the floor slab to high level on the floor below or into the ground.

The Drainage Contractor, depending on the manufacturer's requirements will either:

- Issue the floor drains to the Structural Contractor to be cast into the floors or
- Issue the contractor the required formwork to allow for the relevant holes to be formed.

All floor outlets will have removable traps for access for rodding.


10.3.15.3 Traps and Connectors

Traps to wash hand basins and urinals in toilet areas, to be chrome plated where specified by the Architect, but installed under this specification. All traps for sinks will be reseal traps.

Traps shall be moulded from white polypropylene or be copper with brass nuts. The traps shall bear the SANS insignia.

Traps shall have seal depths and diameters in accordance with SANS 10252-2.

Traps shall be fitted with a universal compression outlet in accordance with the following unless otherwise specified:

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Specification	
WHB	32 mm conn with 75mm deep seal resealing trap or bottle trap
Sinks	40 mm conn with 75mm deep seal tubular reseal trap
Urinals	40 mm conn with 75mm deep seal tubular reseal trap or bottle trap
Bidets	32 mm conn with 75mm deep seal tubular reseal trap
Baths	40 mm conn with low profile trap with top access.
Showers	40 mm diameter shower trap with removable top grating and inner trap baffle
Dishwashers	40 mm conn with 75mm deep seal tubular trap and standpipe
Floor gullies	50 / 100 mm conn with integral 75mm full removable trap with top access.
Toilets	The connection of WCs to soil pipework shall be by a white polyethylene coupling "Multikwik" wc connector or equal and approved.

Table 10-3 Traps and Connectors

For condensate or for other situations where there is insufficient water flow to replenish a traditional water seal trap HepvO self-sealing waste valves (waterless traps) should be used.

10.3.15.4 Plastic Toilet Connectors

All WC Pans to be connected to the low-level soil pipes via the use of a "Multikwik" type pan connector or approved equivalent.

10.3.15.5 Automatic Air Inlet Valve

Automatic air inlet valves shall be as manufactured by "Marley Extrusions" or equal and approved. Automatic air inlet valves must only be fitted where indicated on the drawings and must be located above the highest appliance spill-over level.

10.3.15.6 Vent Pipe Terminations

Ventilating pipes terminating to atmosphere shall pass through the roof level with a proprietary roof vent connector and purpose made weathering slate to suit the roofing material.

Ventilating pipes terminating to atmosphere, shall terminate with a vent cowl, balloon guard or ridge tile termination, 200 mm vertically and/or 5000 mm horizontally from the nearest opening into the building or fresh air intake, in accordance with the Building Regulations.

10.3.15.7 Coatings and Coated Pipes

Install pipes, fittings and accessories in accordance with SANS 10252-2 and manufacturer's recommendations to ensure the complete discharge of foul drainage from the building without any leaks, ingress to the building or nuisance.

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Obtain all components for each type of pipework from the same manufacturer, unless otherwise indicated.

Inspect components carefully before fixing and reject and which are defective. Ensure cut ends of pipes are clean and square with burrs removed.

The pipes shall be fixed in straight runs and all horizontal runs are to be laid to gradients in accordance with Building Regulations and this specification. Horizontal runs should relate to 45/135° branches swept in the direction of flow.

Allow for thermal and building movement when jointing and fixing drainage pipework in accordance with the manufacturer's recommendations.

Form junctions using fittings intended for the purpose, ensuring that jointing material does not project into the bore of pipes and fittings.

Avoid contact between dissimilar metals and other materials, which would result in electrolytic corrosion.

In convenient locations, provide access covers and cleaning eyes as necessary and in accordance with local authority requirements, to permit adequate testing and cleaning of pipework.

10.3.15.8 Access Points

Access shall be provided by means of an integrally moulded door in an access fitting with an externally fitted rubber seal and secured with two galvanised bolts and nuts, or alternatively by a two-piece clamp type door fitted into the pipe run.

10.3.16 Thermal Insulation


Provide and install pipe insulation to pipework where required which would be prone to the formation of condensation or to prevent freezing. All insulated foul drainage pipes are to be labelled to aid identification. Labels shall be provided at a maximum of 3 m centres.

Insulation shall comprise 25 mm foil faced mineral wool and shall be securely located on the pipe by the use self-adhesive aluminium tape.

or,

Insulation shall be 25 mm thick plain finish rigid fibre glass sections 915 mm long of 80-110 kg/m³ density, split for fixing, neatly cut with mitres at all bends and fittings and fastened with 0.9 mm galvanised wire, unless specified otherwise.

Metal Cladding

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All insulation on Drainage Piping installed externally, in service risers and in Plant Rooms shall be protected with 0.4 mm thick galvanised steel sheet metal cladding, which shall be applied directly over the insulation.

The cladding shall be secured by means of removable and re-usable stainless-steel bands every 330 mm. Self-tapping screws will not be accepted. No dents or damage to the sheet metal cladding will be accepted.

10.3.17 Connections between Pipes of Different Materials

Connect pipework of different materials using the manufacturer's purpose made, proprietary approved adapters.

Generally, the coupling that will be used will be by the supplier of the pipework" downhill" of the connection required.

10.3.18 Builders work

The Drainage Subcontractor shall be responsible for providing all openings in brick walls and partition walls for pipework etc. and for providing the necessary flashing, support brackets for pipework ductwork etc.

The Drainage Subcontractor shall be responsible for providing all Builder's Work Drawings for the work to be carried out by the Principal / Structural Contractor. Full details of all large openings for pipework in the roofs, slabs and brick walls, details of concrete bases, etc are to be included on these drawings which are to be submitted to the Engineer for approval in good time to comply with building program.

The Drainage Subcontractor shall also check the positions and sizes of all these openings, bases, etc provided by the Principal / Structural Contractor. The Principal / Structural Contractor shall provide all waterproofing and making good.

10.3.19 Fire Safety

All plastic pipes that pass-through floors or fire compartment walls they shall be fitted with an intumescent fire sleeve below the floor structure or within the riser, as required by the Building Regulations. The intumescent fire sleeves shall clamp onto the pipe and be fitted to the structure using non-combustible fixings.

Provide and install protection of openings and fire stopping in accordance with the Building Regulations.

10.3.19.1 Intumescent painting

All services penetrations shall be fire sealed.

The Drainage Subcontractor shall identify, on drawings, where his services penetrate floor slabs and fire barriers and furnish these to the Main Contractor.

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The Builder will caulk in all services.

Once services have been caulked in a specialist contractor other than the Drainage Subcontractor shall apply intumescent paint to cables, ducts, piping etc. where such passes through floor slab and fire barriers.

Before requesting the Engineer to carry out an inspection the Drainage Subcontractor shall satisfy himself that all penetrations relating to his installation have been caulked and fire sealed with intumescent paint.

10.3.20 Earth Bonding

All new metal drainage systems pipework shall be continuity bonded and tested to ensure earth continuity.

Carry out equi-potential bonding and tests of the foul drainage system (above ground) to prove the effectiveness of the earthing system. All tests shall be fully recorded and included within the operating and maintenance manuals.

10.3.21 Workmanship

Prevent entry of foreign matter into any part of system by sealing openings during construction. Fit all access covers and cleaning eyes as work proceeds. Failure to undertake this will result in the requirement for CCTV inspections to be carried out to the entire system, to prove that the system is free from debris.

Handle, store and securely fix all products and accessories in accordance with manufacturer's recommendations.

All pipework and fittings shall be properly cleaned, where necessary following completion of the installation.

All pipework runs shall be installed straight and direct between bends. Falls will be accurately measured and adhered to.

Where other contractor jeopardises the functionality of the drainage system, these contractors are to be reported to the principal contractor and the consultant so a solution can be found.

10.3.22 Labelling and Marking

All items of equipment and plant shall be labelled. All labels shall be in English. Labels shall be of engraved aluminium be securely fixed by screws or rivets. Lettering shall be blocking capitals in a minimum size of 8mm.

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All Pipework will be labelled as per the table below.

Drainage:

All pipework to have a band of colour 100mm wide on the pipework every 6 metres and 500mm from where the pipe enters or exits the space with an arrow showing direction of flow

Foul Drain and Waste Pipes and Stacks - 100mm wide black band

Condensate Pipes - 100mm wide black band with 50mm blue band in the middle

Table 10-4 Drainage Pipework and Labelling

10.3.23 Testing and Commissioning

The entire installation shall be commissioned in accordance with the relevant CIBSE commissioning codes and guides.

Carry out all tests and inspections to prove that the installation meets the requirements of the Building Regulations.

Carry out all tests required by the building control officer giving adequate notice. Should the installation fail to hold against any test, identify the location of the failure or leak, rectify and re-test at no additional cost to this contract.

Tests shall include all new pipework and fittings from the point of connection to the underground drainage, to the point of connection and termination at roof level as a vent pipe.

The installation shall be tested section by section as the work proceeds and subsequently on completion, to ensure that the installation is free from superfluous matter and obstruction and that all work which is to be concealed, is free from defects before it is finally enclosed. Systems shall be submitted to two separate tests, air test and hydraulic performance test in accordance with SANS 10252-2.

10.3.24 Requirements and Methodology

The foul drainage pipework systems shall be air tested at a pressure equal to 38 mm water gauge which shall remain constant for a period of 30 minutes. Pipes shall be tested in the presence of the supervising RE, or consultant and all pipework shall be visible at the time of the test. All test bungs are to be removed in the presence of the engineer.

Before testing, all foul drainage pipes shall be cleaned and prepared thoroughly as follows:

- Traps for all appliances and floor gullies shall be plugged and flushed thoroughly with clean water.
- Main stacks and branches shall have duct covers and ceiling tiles removed where necessary.

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- Access covers, cleaning and rodding eyes shall be removed, and the stacks rodded by means of drain rods or similar flexible springs and plungers, of a suitable diameter.
- Obstructions in pipes shall be removed using suitable cleaning tools.
- Care should be taken when carrying out the above operations to ensure deposits and other extraneous matters are not flushed into the drainage system.
- In order to be assured of the cleanliness of the system, these cleaning operations shall be carried out in the presence of the engineer.
- A water test may be called for, but this shall only apply to the horizontal sections of plumbing and drainage and the section of pipework below the lowest sanitary appliance. This shall be carried out by inserting a plug in the lowest end of the pipe where it enters the inspection chambers and filling the system up to a head 6 m or the flood level of the lowest connected appliance, whichever is the lower.
- Before commencing air tests all water seals of all sanitary appliances and floor gullies etc must be fully charged with water and all open ends of pipework i.e. vents and/or outfalls, must be plugged off.
- All traps must retain not less than 25 mm of seal when subjected to the appropriate discharge tests. The number of appliances to be tested shall be as detailed in Building Regulations.
- Upon completion of satisfactory testing to all stack pipes, branch pipes and appliances, all duct covers should be re-fixed and ceiling tiles replaced where necessary.
- Allow for intermediate testing where work is to be concealed by other services. Should final tests reveal defects on concealed pipework, rectify the defects at no additional cost.
- All tests shall be carried out in the presence of the Engineer.
- Keep a record of all tests carried out, including the following:
 - a. Date of test
 - b. Location and Identification of the pipeline
 - c. Drawing reference
 - d. Method of test
 - e. Result of test
 - f. Signature of operative undertaking test
 - g. Signature of supervising officer
 - h. Marked up schematic

10.3.25 Contractor General Requirements**10.3.25.1 Contractor Information, drawings and samples**

The Drainage Subcontractor shall within a period of two weeks of receipt of documentation verifying his appointment submit to the Engineer all shop drawings and samples as requested by the Engineer Architect or Client. The drawings shall be submitted with reasonable promptness and in an orderly sequence so as to cause no delay to the works.

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By preparation and submission of the shop drawings, the Drainage Subcontractor shall be deemed to have determined and verified all field dimensions, materials, catalogue numbers etc. In terms of the project programme, the Drainage Subcontractor shall allow the Engineers two calendar weeks for scrutiny of drawings.

The Drainage Subcontractor shall submit electronic copies of all shop drawings to the Engineer for approval before commencement of work.

No portion of the work requiring approval of shop drawings or samples shall be commenced without the necessary approval of the Engineer.

10.3.25.2 Operating and maintenance manuals

Operating and maintenance manuals are to be prepared by the Drainage Subcontractor for all the systems and installations for which they are responsible.

After approval of the manuals by the Engineer, the Drainage Subcontractor shall provide the Engineer with five bound sets and soft copy CD ROM of MS Word, Excel and AutoCAD files.

Manufacturer's catalogue information shall be scanned and saved to disc in "JPEG" format at a rate of compression to be clearly legible.

The CD ROM / Flash Drive copy shall read as a catalogue with drawing files separated and all files properly indexed not, as a random assortment of files.

The contract will not be accepted as complete until these have been supplied, complete and to the satisfaction of the Engineer.

The Drainage Subcontractor shall include for professional assistance in preparation of the above if necessary.

10.3.25.3 Guarantee and maintenance

The entire installation shall be guaranteed against defect, or faulty workmanship for a period of twelve months, from date of acceptance of the installation by the Engineer.

The Drainage Subcontractor shall service and maintain the installation for a period of twelve months from acceptance of the Building by the Client.

The various items of equipment shall be serviced and maintained in strict accordance with the requirements of the respective suppliers of the equipment.

Contractors shall include, in their tender prices, for travelling, labour, consumable, oils, lubricants, chemicals, tools, etc. necessary for the successful implementation of the maintenance programme.

Contractors shall allow for monthly maintenance visits over the 12-month period.


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The Drainage Subcontractor shall implement and maintain a maintenance/servicing register for the duration of the maintenance and guarantee period.

A record of each maintenance visit shall be forward to the Engineer after each visit.

At the end of the guarantee period the Drainage Subcontractor shall hand over to the Client a full set of any special tools or instruments required for the continued maintenance of the installation.

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11 TECHNICAL SPECIFICATIONS – HVAC INSTALLATION

This specification covers the supply, install, clean, test and commission the complete HVAC system. All work shall be carried out to the complete satisfaction of the client and engineers.

All equipment shall meet the performance criteria as detailed in this specification, and the relevant schedules, drawings and BOQs. All equipment is to be priced as per the schedules and BOQs but options on equal and approved suppliers and equipment can be provided.

The design of the HVAC system shall be to meet the requirements the Building Regulations SANS 10400. The HVAC system will provide fresh conditioned air to the occupants of the building as well as extract any and all odorous air from the building.

The system shall be installed using the minimum Ductwork, fittings and accessories necessary to ensure a complete and working air distribution system.

All ducts shall be identified in accordance with Building Regulations. All ducts shall be designed for installation within designated ceiling voids. Any ductwork in front of house areas shall be boxed out as per Architects requirements.

11.1 Subcontractor Responsibility and System Coordination


The HVAC system Subcontractor shall be responsible for the supply, installation, testing, commissioning and free maintenance during the guarantee period of the installation detailed in this Specification and on the accompanying drawings, schedules and BOQs.

The HVAC Subcontractor shall provide all materials, equipment, labour and services necessary for the complete, safe and efficient operation of the air conditioning and ventilation installations in accordance with the intent of this Specification and Drawings.

This specification and accompanying layouts, schedules and BOQs detail the requirements of the HVAC Subcontractor in terms of the HVAC installation. Coordination of the relevant elements of the installation that interface with the various other installations (Drainage, Power, Lift, etc.) is the responsibility of the HVAC Subcontractor. The HVAC Subcontractor is to liaise with the Principal Contractor to ensure all interfacing elements have been priced for and if not, provide the Principal Contractor with the relevant details to allow these to be priced for.

Specific areas to verify (but not limited to):

- Power Supply to all mechanical Control Panels and Control Systems:
 - a. This is to be supplied by the electrical subcontractor and the Principal Contractor is to verify that all power requirements for this installation have

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been priced for. Should this not be the case, the Principal Contractor is to price for the outstanding items in line with this Tender.

- Builders work Required
 - a. This is to be provided by the civil/structural subcontractor and the Principal Contractor is to verify that all requirements for this installation have been priced for. Should this not be the case, the Principal Contractor is to price for the outstanding items in line with this Tender.
- Concealment Required
 - a. This is to be provided in the Architectural package and the Principal Contractor is to verify that all requirements for this installation have been priced for. Should this not be the case, the Principal Contractor is to price for the outstanding items in line with this Tender.


11.2 Exclusions and Free Issue Items

The following although associated with the HVAC installation will be provided free of charge by others. This is subject to the above requirements for coordination and pricing:

11.2.1 Builders Work Items

These items should be provided by the Principal Contractor. The HVAC Contractor is to verify this is the case.

- Provision of walls, with plastered finish forming supply, return, fresh air intake and exhaust air duct paths and forming air plenums.
- The casting of concrete inertia blocks required for dampening the vibration caused by rotating machinery.
- Provision of openings in walls, floors and roofs during initial building construction only.
- Building in of pipe sleeves and steel frames (provided by the HVAC Contractor) for the passage of pipes, and other built-in equipment. This includes the provision and fixing of any hardwood frames.
- Supply and installation of all access doors and panels to plant areas and shafts for mechanical plant installation and maintenance.
- Self-draining waterproof floors in plant areas.
- Sealing of holes in walls and floors around ducts, pipes and fire dampers.
- Where cables, pipes or ducts pass through holes in floors, walls or partitions which are fire barriers, the openings shall be sealed by the builder with vermiculite plaster or other approved non-flammable equivalent for the full thickness of the floor or wall.
- Painting of walls and ceilings in the plantrooms.

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11.2.2 Plumbers Items

These items should be provided by the Wet Services Subcontractor. The HVAC Contractor is to verify this is the case.

- Supply and installation of at least one 100 mm diameter trapped gulley (connected into the soil water drainage system) in each plant area.
- Provision of a mains cold water tap, fitted with garden hose connection in each plant area.

11.2.3 Electrical Contractor's Item

Supply of the required 3/1 phase, 380/220 Volt, 50 Hz electrical supplies to the mechanical control panels. The HVAC Contractor shall terminate and connect those supplies to the terminals of the main isolator of the respective boards.

11.2.4 List of Free issue elements to Principal Contractor for review

In line with the above requirements, the HVAC Contractor is to issue a list of all the expected free issue items to the Principal Contractor to ensure these are picked up. This list is to also form part of the HVAC Contractors Submission.

11.2.5 Omissions

Not all equipment for the successful completion of the project will have been described in the specification. Where this is the case, the contractor must follow accepted good practice of a high standard to the satisfaction of the Engineer.

11.2.6 Additional Documentation

This section of the specification relates to the manufacture, delivery to site and installation of the HVAC system. To ensure a fully coordinated installation, this Specification is to be read in Conjunction with all of the following documents:

- Relevant Section of the Project or system BOQ
- Architects Layouts

11.2.7 Schedule of Technical Particulars

The applicable equipment schedules details the base requirements for several of the items that will be purchased. The Schedules may also contain Blank Areas that indicate the additional information required to be provided by the HVAC Subcontractor. This additional information as well as the duty point information must be provided as a detailed specification sheet from the manufacturer.

11.2.8 General Specification

The purpose of the HVAC installation is to safely, quickly and without excessive noise remove all stale air from the buildings as well as provide fresh, tempered air to all occupied spaces.

The HVAC system that will be installed will provide the following:

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- Extract systems for rooms where smells and odours might build up and create an uninhabitable space.
- Extract systems for rooms where hazardous chemicals might build up and cause a danger to the site or human health.
- Fresh air supply systems to ensure that fresh air is provided as required by the occupancy of the space.
- Air Conditioning installations to ensure that rooms that are habitable are of a sufficiently warm or cool nature so the inhabitants will feel comfortable.


The system will be installed to ensure that the minimum requirements of the relevant regulations are met. The system will be efficient in terms of installation of ductwork as well as energy use.

This specification covers the supply, delivery, installation, testing, commissioning and handing over of the complete HVAC system as specified below and as indicated on the drawings and schedules, which form part of this specification. All the work shall be carried out to the complete satisfaction of the Client and Consulting Engineer.

11.2.9 Principal items of work

Principal items of work include, but are not limited to, the supply and installation of:

- Supply Fans to Offices including, louvres, ductwork, filters, grilles, etc
- Attenuation to Office supply on the fresh air supply fans to reduce noise generated by the fans
- Extract Fans to kitchens including ductwork and wall louvres
- Extract Fans to bathrooms including ductwork, air valves, louvres, attenuators, etc
- VRF systems associated with the office building, including the indoor units, external units, cabling, piping, controls and other requirements.
- Mechanical Plant Control panels
- Electronic temperature control systems
- Extract Systems, including fans, attenuators, controls, etc.
- Louvre system to the warehouses, including actuators, cabling, links to control panels, etc
- Control Panel and Links to machines and fire systems
- Site wiring between control panels and air conditioning / ventilation equipment
- Galvanised sheet metal ducting including fittings, dampers and other accessories as detailed and required
- Insulated Copper VRF piping including fittings and valves as detailed and required
- Drains from equipment to nearest condensate pickup point.

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- All necessary supports, hangers, brackets and accessories to complete the installations as specified
- All necessary conduit, tray and basket required to support cables and pipework as well as fittings and fixings required.
- The powder coating of all conduit and containment to the colours as per the system requirements.
- Commissioning and testing of the installations
- Provision of maintenance for 12 months from date of entire works after Taking-Over.
- Generating of O&M Manuals

11.3 Design Parameters


The following general parameters have been used for the design of the systems.

Ventilation		
Areas	Rates	Noise Levels [NR]
WC spaces	20 Air Changes per hour	45
Kitchens	20 Air Changes per hour	50
Cleaners Spaces	1 Air Changes per hour	N/A
Cafeteria / Mess Halls etc	2 Air Changes per hour	45
Offices and Occupied spaces	2 Air Changes per hour	40
Occupied spaces with excessive use	10 to 20 Air Changes per hour Or 7.5l/s per person – whichever is greater	40
Specialist Storerooms and Hazard Areas	As required to ensure H&S requirements are met	N/A
Warehouse spaces	2 Air Changes per hour	50

Table 11-1 Ventilation Design Parameters

Air Conditioning (Comfort Cooling)	
External Conditions	
Temperature [°C dB]	28°C
Humidity [%]	75%
Internal Conditions	
Temperature [°C dB]	22.5°C
Humidity [%]	50% (design condition only – not controlled)

Table 11-2 Air-conditioning Design Parameters

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Space Heating	
External Conditions	
Temperature [°C dB]	10°C
Humidity [%]	50%
Internal Conditions	
Temperature [°C dB]	22.5°C
Humidity [%]	50% (design condition only – not controlled)

Table 11-3 Space Heating Parameters

The HVAC system is to be designed and installed to meet all the requirements of the following:

Document Numbers	Documents Description
SANS 10400- Part O	Lighting and Ventilation
SANS 10400- Part T	Fire Protection
SANS 10400- Part XA	Energy
SANS 204:2011	Energy efficiency in buildings
SANS 1238	Air conditioning ductwork
OHS ACT	Occupational Health and Safety Act No 85 of 1993 (as amended), including Regulations
ACT 45	Atmospheric Pollution Prevention Act.

Table 11-4 HVAC Design Document Reference Numbers

11.4 General System Requirements

The Ventilation systems for the building comprise of several systems that are standalone. Each will be discussed below:

11.4.1 Extract Systems:

11.4.1.1 WC's

All WC extract systems will extract air at the minimum rate as required in the design parameters. Generally, these systems will be installed such that the extract fan is mounted in the ceiling void and discharges air outside the building through louvres located in suitable area.

Each WC cubicles and urinal areas to have extract valve as per the layouts. All valves and grilles will have VCDs (Volume control Dampers) as scheduled and will be installed as required. All accessories will be installed as required in the sections below.

11.4.1.2 Stale Air

Stale air from the building will be extracted using fans located in the ceiling voids/ducts/high level areas/walls, etc. These extract fans will be controlled in such a way that they only turn on when the fresh air supply fans are turned on.

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All rooms that have a ceiling will contain a return air ceiling grille, whereby air will be extracted to the ceiling void. The air in the ceiling void will travel through the wall openings provided at high level to reach the extract fan. Fire dampers will be installed in all wall openings above the ceiling level that are on the fire lines. The fans will be mounted on the soffit and will extract at the required design parameter.

The fans will be in-line fans and will have inverters to control the speed of the fans. Where speed variation is not required the inverter will be set to control a single speed.

11.4.1.3 Kitchenettes

The kitchens have ceiling extract fans that connect to duct work in the ceiling void to discharge air outside of the building.

11.4.1.4 Power and Controls

Power to the fans and all control elements will be supplied from an electrical panel / isolator situated adjacent to the fans.

The system will be installed with PIR sensors to control the systems when the various rooms are occupied or as required.

11.4.2 Fresh Air Supply Systems

Fresh air will be required to several occupied spaces and will be supplied using ceiling void mounted fans that connect to the back of the AC systems or supply direct into the spaces.

The supply fans will be inline fans. They will have inverters to ensure that the fans run only at the required duty point.

Dual filter banks will be installed on all supply air systems to ensure that the air entering the space is of a good quality. The filter banks comprise of one bag filter and one Pleated Filter. Filters to be washable and removable.


A minimum 37% free area weather louvre with insect mesh will be installed on the intake duct.

The supply air will be supplied into the space using a single or multiple supply grilles. These grilles will be installed in the ceiling and will have VCDs as required.

11.4.2.1 Power and Controls

Power to the fans and all control elements will be supplied from an electrical panel / isolator situated adjacent to the fans.

The supply air system will be on when the building is operation only. This will be achieved using and programmable time switch located in the main supply panel / isolator or that will be supplied with the fan as part of the standards control package. Each fan will also be supplied

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with a proprietary inverter controller that will control the fan speed as well as the on/off operation.

The system must also be linked to the air conditioning system. Should the ventilation not be on and the air conditioning system is turned on, the ventilation system will turn on.

11.4.3 Air Conditioning systems

The Air conditioning system will be a VRF system that is capable of heating and cooling at the same time. The VRF system will be a heat recovery system. The system will comprise (but is not limited to):

- external condenser unit/s
- internal evaporator units
 - a. ceiling mounted cassette units
 - b. in ceiling units
- Central controller that controls the whole system and provides individual control to each unit.
- Fixed controllers to all wall mount and cassette units
- Drainage – all indoor units will have pumped condensate drainage
- Refrigerant pipework (including insulation)
- All ancillary systems and supports

The systems will be installed in the following locations

- All offices
- Meeting rooms
- Ticket sales
- Server Room – this will be a separate redundant system

The external units will be installed in the locations as indicated on the drawings. All the units will be installed on vibration damping mounts on the plinths.

11.4.3.1 Power and Controls

All power to the system will be supplied from an electrical panel / isolator Control Panel installed adjacent to each unit.

A Central controller will be installed that can control each unit individually. This controller must have links back to the ventilations system to allow the AC system to turn the fresh fans on and off. This controller will also be linked to the fire alarm panel to ensure that

Each room that houses an indoor AC unit will be supplied with a control panel for that unit. The panel will allow temperature control and will indicate a full set of details including (but not

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limited to): room temp, set point temp, fan, cool, heat, speed. Each control panel will be wall mounted and hard wired to the unit.

Should two or more units be found in a single room, all the control panels will be in the same place (or controlled from one panel) and will be clearly labelled.

The VRF system must be linked to the fresh air supply system to ensure that the fresh air supply system is activated when the air conditioning is activated.

The system must be linked to the fire alarm to ensure shut down in the case of a fire.

11.4.3.2 B01 – Warehouse

The warehouse will be both naturally and mechanically ventilated. Natural ventilation will be by means of louvres at high level and low level to allow stack ventilation. Fans will be installed in the roof lights to enhance the ventilation.

Smoke ventilation will also be installed in the roof light areas that will open in the case of a fire allowing smoke to escape.

The ablutions will be mechanically extracted using fans, ductwork and air valves. The small offices will be naturally ventilated using windows in the external walls. DX units will be installed in the office and kitchenette to keep them comfortable.

11.4.3.3 B02 – Chemical Store

The chemical store will have mechanical extract or fume removal. Intake louvres will be installed for makeup air that will also provide background ventilation.

11.4.3.4 B03 - Offices

The ablutions will be mechanically extracted using fans, ductwork and air valves. The kitchenette will have a small extract fan.

The main office space will have a VRF air conditioning system. Cassette units and in-ceiling units will provide the cooling and heating. Supply fans will provide the fresh air with natural ventilation louvres for makeup air.


11.4.3.5 B05 – Lifting Shop

The lifting shop is generally naturally ventilated with what appear to be the smoke vent fans along the length of the building. The existing fans will be replaced with new, with additional new fans being installed in the extension. The new fans will be used as smoke extract fans.

Window Washer

The window washer is open to air and will therefore be naturally ventilated.

Waste Area

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The waste area is open to air and will therefore be naturally ventilated.

11.5 General Equipment Requirements

11.5.1 Ventilation Fans

Details of fan selections and fan curves shall be submitted to the Engineer for approval before purchasing of fans. Fan curves shall show absorbed power, static pressure and static efficiency plotted against air volume. All fans shall be capable of delivering the specified air volumes indicated in the schedules.

Fans shall be mounted on anti-vibration mountings/spring hangers, which shall eliminate all vibration transmissions. Anti-vibration mountings shall be selected from the Mason Industries range.

Fan motors shall be of the totally enclosed fan cooled type and the enclosure shall meet the requirements of IP55 (Standard Protection specifications).

Fan motors shall have a minimum of 10% excess power over peak shaft power drawn under site operating conditions.

All accessories such as mounting feet, mating flanges, inlet and outlet cones, etc shall be proprietary made items and be supplied with the fans.

Fan shaft and bearings where accessible shall be protected from rust by means of protective “tecto” coatings.

All fans shall be statically and dynamically balanced and be quiet in operation

Each fan shall fit into the space provided and shall be installed without damage to the building, building equipment or the fan.


Fans shall not be operated for any purpose such as temporary ventilation, testing, etc until the connected ducts have been cleaned and the filters, if any, have been put in regular operating condition.

All finished parts of fans, such as shafts and bearings, where accessible, shall be protected from rust prior to operation by means of wrappings and protecting grease coatings.

11.5.1.1 Axial Flow Fans

Axial flow fans shall be of the long casing type with terminal boxes.

Impellers shall comprise pressure die cast aluminium hubs and faceplates with either aluminium or injection moulded chemically coupled glass reinforced nylon blades. Impellers shall be fully adjustable. Impellers shall be assembled with high tensile setscrews and self-locking nuts.

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Blades shall be cast with an integral aerofoil section.

Impellers shall be tested in accordance with BS848 Parts 1 and 2 for aerodynamic and acoustic performance.

11.5.1.2 Propeller Fans

Propellers shall incorporate heavy gauge pressed steel blades, contoured for smooth air flow and balanced to ISO 1940-G6.3 standard.

- Motors are to be totally enclosed; fan cooled and comply with IP55 requirements.
- Motors shall have self-lubricated bearings that will have durability and long life.
- Propeller fans are to be fitted with neoprene vibration isolating fixings on the mounting arms.
- Sizes, quantities, types and performances shall be as indicated in the applicable equipment schedule.

11.5.1.3 Sound Attenuators

All fans and air handling units are to be fitted with suction and discharge attenuators. Circular pod attenuators will be used in circular ductwork. Rectangular Splitter type attenuators will be used in rectangular ductwork

Sound attenuators shall be the product of a firm regularly engaged in the manufacture of sound attenuators and similar products and who publish catalogued selection data. All Attenuators will be one manufacturer's standard size larger than the nominal duct sizes on either side of the fan.

Sound levels in the occupied spaces shall be achieved as stated in the design parameters.

The sound attenuators shall be fitted with sheet metal covers at the ends for protection during transport, handling and storage.

Noise levels generated by the plant shall not exceed 40 dBA when measured 15 metres from the building.

The Contractor shall ensure that the equipment and sound absorbers comply with this requirement.

11.5.1.4 Fire Dampers

Fire dampers shall be installed where ductwork passes through fire rated partitions/walls/areas.

Fire dampers shall be UL approved and labelled as conforming to the requirements of NFPA Pamphlet NO.90A.

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Damper shall be fabricated from galvanised steel, with galvanised steel sleeves, fusible links, spring latches, and non-corrosive bearings. In addition, fire dampers shall be approved by and shall meet the requirements of the Local Fire Department.

Fusible links shall be UL listed for a minimum 72 °C release.

Dampers located in rectangular, circular or oval ductwork shall be shutter type with shutter held out of air stream and having a minimum of 95% free area.

For dampers up to 1 000 mm in width and 600 mm in height, provide 1.6 mm thick galvanised steel sleeves; for larger dampers provide 2 mm thick galvanised steel sleeves around dampers.

Sleeves shall have perimeter iron mounting angles on both sides of wall opening, secured to the wall, and shall extend at least 150 mm beyond mounting angles. Ducts shall be joined to the sleeve such that the sleeve becomes a section of the duct.

Fire dampers shall not be built into the structure.

Dampers mounted in floors or in horizontal positions shall be similar to the type specified for installation in rectangular ductwork except that they shall be provided with stainless steel closure springs.

Access will be provided in all ductworks adjacent to fire dampers to allow resetting of the links after testing.

11.5.1.5 Volume Control Dampers (VCD) / Balancing Damper

Balancing Dampers shall be installed in all branch ducts and in branch-main ducts and main ducts as indicated on the drawings and as required to completely balance the system with regard to noise generation.

Dampers shall be multi-louvre type, opposed acting, with inter-locking blades, having maximum width of 180 mm. Dampers shall be factory fabricated balanced type, with flat or formed galvanised steel or aluminium blades, with factory assembled linkages, mounted in galvanised steel or aluminium frames. Blades shall have interlocking edges, which seal over the entire length of the blades. Damper blades shall have steel trunnions mounted in bronze sleeve bearings, nylon or ball bearings. Damper blades shall not be more than 1 200 mm between bearings.

Dampers shall have bar or channel frames and rectangular dampers larger than 0.4 square meters in area shall have corner bracing.

All parts of steel dampers shall be factory finished with two coats of rust inhibitive paint.

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Each damper shall be fitted with a locking type adjusting device, vent-lock 641 or equal. Where duct pressure exceeds 50 Pa SP use vent-lock 640 Hivel locking device and 609 Hivel end bearings.

Where dampers are concealed above plaster ceilings the HVAC sub-contractor shall request the installation of access hatches.

11.5.1.6 Air Terminals

Subcontractors shall verify that the sizes shown on the drawings are correct for the intended air volume, throw and noise level.

Sizes and quantities shall be as indicated on the layout drawings and schedules.

Supply and Extract diffusers

Square diffusers shall have a standard over the flange size of 596 x 596 mm or 1196 x 596 to facilitate installation into a standard 600 x 600 or 1200 x 600 ceiling grid. Air terminals are to be epoxy powder coated to a colour of the Architects choice. Where no ceiling is present, white shall be used.

The diffusers are to be connected to the galvanised sheet metal duct runs by means of insulated flexible aluminium ducting.

Supply Air grilles

Grilles shall be of the double deflection type. Unless otherwise stated grilles will be supplied with opposed bladed dampers. Dampers shall be painted matt black.

Return Air Grilles

Return air grilles shall be of the egg crate type. The grille frames and cores shall be of aluminium, epoxy powder coated to a colour of the Architects choice.

All egg crate grilles are to be fitted with non-vision baffle plates painted matt black.

Extract Air Grilles


Extract air grilles shall be of the single deflection, fixed blade type and unless otherwise stated complete with oppose bladed dampers. Epoxy powder coated to a colour of the Architects choice.

Extract Valves

Extract valves shall be as scheduled and complete with integral, butterfly type fire damper

11.5.2 Ductwork

Ductwork Design velocities:

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These design velocities are provided to ensure a balance between fan size, fan power and noise is reached.

Ductwork	Velocity Max	Velocity Min
	[m/s]	[m/s]
Kitchen extract ductwork		
Entire Length of ductwork	9	7
Toilet Extract Ductwork		
Primary Ductwork (Duct piece connecting to grille)	2	1.5
Secondary ductwork (from primary ductwork back to backbone)	3.5	2
Backbone ductwork (all remaining ductwork back to fan)	5	3.5
Exhaust ductwork (from fan to outside building)	5	4
Supply Air Ductwork		
Primary Ductwork (Duct piece connecting to grille)	1.5	1.0
Secondary ductwork (from primary ductwork back to backbone)	2.5	1.5
Backbone ductwork (all remaining ductwork back to fan)	4	2.5
Exhaust ductwork (from fan to outside building)	4	3

Table 11-5 HVAC Ductwork Velocity

These ductwork velocities are based on ductwork inside of the building, once outside the building in a plant room where noise levels are not sensitive, ductwork velocities can be increased. Design pressure loss in Pa/m should not exceed 300 in order to maintain a reasonably sized fan and fan power.

DO NOT EXCEED 300Pa/m PRESSURE DROP IN THE DUCTWORK – 200 to 250 IS IDEAL.

Rather use bigger ductwork to reduce pressure loss thereby requiring a smaller fan which requires less fan power and is cheaper overall.

11.5.2.1 General Ventilation Ductwork

Ductwork will be galvanised steel and will be a combination of square and round ductwork. Generally, height will be restrictive, and square duct will be used to minimise void heights required.

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Circular duct will be used where possible to connect to final circular spigotted units/grilles/valves etc.

Flexible circular ductwork will be used for the final 1m only (to the valve/grille) of the installation and this distance should be reduced where possible.

All ductworks shall be fabricated from galvanised sheet metal unless otherwise specified. All ductworks shall be fabricated and installed in strict accordance with SABS Specification 1238 of 1979.

Where ducting passes through un-air-conditioned spaces, particular care shall be taken to seal all joints.

All exposed ducting shall be painted. All concealed ducting shall be left unpainted. All ducting shall be colour coded in accordance with the relevant SABS specification.

All cross-sectional joints on duct work shall be of the "MEZ Flange" type. All joints shall be taped over with "Hardcast".

Air flow indication arrows and service labels shall be fixed to the ductwork at all branches and wherever ductwork passes through holes in the structure.

Provide 50 mm drain connections with plugged gate valve at the bottom of the duct risers to drain condensate and residue from the ducts at regular servicing intervals.

11.5.2.2 *Insulated Flexible Ductwork*

Flexible ducts may be PPG Glass-Flex Thermaflex II type M-KF, or Wiremold type 4K, pre-insulated flexible duct, or other approved.

Insulated flexible air ducts for air connection between air terminals, ductwork, air mixing boxes, regulators, etc shall be factory pre-insulated flexible metal type or spiral reinforced fabric type. The flexible metal type shall be of interlocked spiral construction or zinc-coated steel. The spiral reinforced fabric type shall consist of a steel wire helix, or a corrosion resistant flat steel spiral supporting and permanently connected to a coated fabric having a mineral base. The spiral reinforcement shall be zinc-coated unless completely enclosed by plastic or sealed by the fabric.

Flexible ducting shall be supported at regular intervals and shall not be supported by resting on the false ceilings. Supporting brackets and hangers shall not damage the insulation or insulation covering and shall not distort the ducting

11.5.2.3 *Hot Dip Galvanising*

All metal work exposed to the weather, inclusive of supports, brackets, hangers' platforms, etc shall be hot dip galvanised AFTER manufacture.

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All exposed, ungalvanised, indoor metal work, inclusive of supports, brackets, hangers, platforms, etc. shall be thoroughly cleaned, de-scaled and painted with one coat of zinc chromate primer followed by one undercoat and two finishing coats of gloss enamel.

All exposed, galvanised, indoor metal work shall be thoroughly cleaned with a galvanised iron cleaner and painted with one coat of calcium plumbate primer followed by 1 coat of universal undercoat and two coats of gloss enamel. The pipe paint finishes, and colour coding shall be in accordance with SANS 10140 Part III. Flow direction arrows shall be painted onto pipe finishes at all tees, branches, plant connections and where piping passes through holes in the structure.

11.5.3 Duct Accessories**11.5.3.1 General Accessories****Vibration Mountings:**

All HVAC machinery that vibrates will be mounted on anti-vibration mountings/spring hangers, which shall eliminate all vibration transmissions. Anti-vibration mountings shall be selected from the Mason Industries range.

Flexible Connections

All fans to ductwork connections will be completed using flexible ductwork connections. These will be no longer than 150mm.

Filters:

All filters (supply and extract as required) must be installed in accessible ductwork sections with access door to allow easy maintenance and replacement of filters. The filter frame shall be of U-channel form and constructed of 0.5 mm galvanised mild steel. The U-channel edges will be double returned by at least 4 mm in order to give added strength to the frame section and to prevent injury to personnel handling the frame.

11.5.4 Thermal and Acoustic Insulation**11.5.4.1 Ductwork**

Except where internal insulation is indicated on the drawings, all air conditioning supply and return air ducting is to be externally insulated with 25 mm thick aluminium foil reinforced mineral wool.

The insulation shall be glued to the ducting and sealed along all longitudinal and transverse overlapping joints with approved adhesive to provide a vapour seal. The overlapping joints shall be approximately 75 mm wide. The edges of overlaps are to be taped down with self-adhesive aluminium tape no less than 50 mm wide.

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The use of spikes spot welded to the ductwork is not acceptable.

The insulation shall be strapped with nylon straps at intervals of more than one metre apart. Where necessary, especially at bends, transformation pieces, branches, etc. insulation is to be glued, taped and strapped to ensure that the joints are vapour sealed.

Ducting and equipment exposed to the elements shall be insulated with 50 mm thick 24 kg/m³ density mineral wool insulation, which shall be glued and strapped to the ducting. Insulation shall then be clad with 0.6 mm galvanised sheet metal. All longitudinal and cross-sectional joints on the insulation cladding shall be sealed against rain and moisture penetration.

Brackets and hangers for ducting shall be on the outside of vapour seals and shall not crush insulation.

Under no circumstances will damage and/or patched insulation be accepted.

Any damaged insulation shall be removed and replaced with a completely new section around the entire perimeter of the duct.

11.5.4.2 Flexible Ductwork

Flexible duct insulation shall be 25 mm nominal thickness fibreglass of 24 kg/m³ density. The insulation shall encase the flexible duct and shall be sheathed with a moisture barrier having a permeability of not over 0.02 perm. The duct and insulation components shall have a flame spread of not over 10 with a smoke development of not over 25.

Pressure requirements of external sheathing and vapour barrier will not apply where flexible duct inside of insulation meets all pressure and velocity requirements.

All insulated ducts, exclusive of vapour barrier material, shall have a flame spread of not over 10 with a smoke development of not over 25.

Where insulated flexible ducts join ductwork, air mixing boxes and air terminals, the flexible duct liner shall be secured with a pressure-sensitive vapour seal adhesive tape and secured with a stainless-steel clamp applied over the vapour tight joint.

All ends of duct sections to be joined in the field shall be coated, before assembly, with a cementing material that will prevent erosion. Finished flexible ductwork insulation shall not impart loose fibres or odours to the air stream in any manner when the system is operating.

11.5.4.3 Refrigeration Piping and Drain lines

All refrigerant piping shall be insulated with flame retardant pre-formed pipe sections. This shall be foil faced glass wool, Foil Faced Mineral wool or closed cell insulation type that meets the requirements of the table below.

ALL insulation will have an ODP of 0 in accordance with green star building guidelines.

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The insulation thickness shall be as follows:

Thermal Conductivity	Pipe Diameter	Insulation Thickness
(W/mK)	(mm)	(mm)
<0.034	up to 40	25
<0.034	50 to 100	32

Table 11-6 HVAC Insulation Thickness

Joints shall be sealed by means of tape, glue or a proprietary jointing system, in accordance with the manufacturer's recommendations.

All joints, bends, valves and other fittings shall be insulated. The thickness of the insulation shall not be less than the associated pipes. Adhesive shall be used where necessary, in accordance with the manufacturer's recommendations.

For smaller size pipes with slow bends the insulation can be drawn around the bend. For larger pipes (40 mm & above) with short radius bends, standard or segmented bends shall be used, in accordance with the manufacturer's recommendations.

DO NOT COMPRESS THE INSULATION WHEN FIXING TO PIPEWORK

DO NOT USE CABLE TIES TO FIX INSULATION

Use good quality tools—in particular, fresh adhesive, good adhesive brushes, and sharp knives.

Apply insulation only when the pipes are clean, dry, and unheated or uncooled. The surface to be insulated must be free of rust.

Never stretch insulation when sealing the joints. It is better to compress it slightly. Use pieces of insulation that are at least as long as the section of pipe to be insulated.

Always use the insulation that is properly sized for the pipe it is to cover. Do not stretch it over the pipe.

Do not crowd insulation-covered pipes. Space pipes far enough apart to allow for the free circulation of air. Air movement is an extra safeguard against surface condensation of cold pipes, especially under hot, humid conditions.

All piping insulation must be properly sealed to minimize heat loss and control condensation. On cold lines, open pipe insulation joints may allow the formation of condensation, increasing

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the potential for or contributing to possible pipe or tubing corrosion. Seal insulation joints as shown in this guide.

When using refrigeration piping insulation outdoors, always paint with a recommended finish. Follow the manufacturer's instructions regarding the type of finish, the number of coats required, etc. Allow proper drying times between coats.

In double-layer work, apply insulation with the side and end joints staggered.

Do not compress piping insulation at joists, studs, columns, ducts, hangers, etc. This is important because the insulation will lose thermal efficiency where it is compressed. On cold systems, surface condensation may occur where insulation is compressed.

Metal Cladding

All insulation installed externally and in Plant Rooms shall be protected with 0.4 mm thick galvanised steel sheet metal cladding, which shall be applied directly over the insulation.

The cladding shall be secured by means of removable and re-usable stainless-steel bands every 330 mm. Self-tapping screws will not be accepted. No dents or damage to the sheet metal cladding will be accepted.

11.5.5 Pipelines

11.5.5.1 Copper

Copper pipes and fittings shall be manufactured in accordance with SANS. The tubes shall be straight, smooth, of true cylindrical bore and free from all flaws.

The pipes and fittings shall be jointed as required by the system.

Pipes crossing building expansion joints shall be provided with a flexible coupling either side of the joint.

Access shall be provided by the use of purpose made bolted access doors on all vertical pipes at the specified height above each finished floor level, to centre line of that access door. Access shall be provided horizontally as shown on the drawings and in accordance with the Building Regulations.

11.5.5.2 Builderswork

The HVAC Subcontractor shall be responsible for providing all small openings in brick walls for pipework, ductwork etc. and for providing the necessary flashing, support brackets for pipework and ductwork etc.

The HVAC Subcontractor shall be responsible for providing all Builder's Work Drawings for the work to be carried out by the Principal / Structural Contractor. Full details of all large openings for ducting, in the roofs, slabs and brick walls, details of concrete bases, etc are to

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be included on these drawings which are to be submitted to the Engineer for approval in good time to comply with building program.

The HVAC Subcontractor shall also check the positions and sizes of all these openings, bases, etc provided by the Principal / Structural Contractor.

The Principal / Structural Contractor shall provide all waterproofing and making good.

11.5.5.3 Controls

Generally, throughout, controls will be by standard control systems that comes with the equipment.

- Fresh air supply fans will be controlled by timers.
- Stale Air extract fans will be controlled by the fresh air supply fans
- Kitchen extract fans will be controlled by the fresh air supply fans.
- AC systems will be controlled using proprietary wall mounted, hard wired controllers.

The wiring and commissioning of the controls shall be carried out by the suppliers of the various systems.

11.5.5.4 Site Wiring

The HVAC Subcontractor shall be responsible for all field wiring between the HVAC control panels and remote items of HVAC plant.

Generally, field wiring shall be carried out in PVC SWA LSF cable neatly and securely strapped to adequately size cable trays with ½ rated insulated earth wires.

Where field wiring is located within an air plenum wiring shall be installed in screwed, galvanised conduit.

All cable trays, cable trunking, accessories and supports shall be galvanised.


No fixing to air conditioning plant and piping will be allowed without the approval of the Engineer.

All equipment, such as air-cooled condensing units and ventilation fans, located remotely from their respective control panels shall be fitted with its own lockable, local isolator.

The air conditioning contractor shall install ceiling void mounted electrical power supply circuits and 15-amp switch socket outlets of sufficient number and capacity to operate all remotes control equipment.

NOTE:

Only one diffuser or damper is to be powered from a socket outlet.

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The variable volume diffusers and pressure control dampers shall each be complete with its own flexible cable and 15 amp plug top.

11.5.6 Fire Safety

Fire dampers will be required where any ductwork passes through a rated partition/wall. These will be installed as required by the Fire Consultants layouts.

All Ventilation and AC equipment must also be connected to the Fire Alarm and Detection systems to ensure that they will shut down all the Vent and AC equipment should the fire alarm be triggered (see Fire Smoke Extract System above as this system is an exception)

All services penetrations shall be fire sealed.

Before requesting the Engineer to carry out an inspection the HVAC Subcontractor shall satisfy himself that all penetrations relating to his installation have been caulked and fire sealed with intumescent paint.

11.5.7 Earth Bonding

All new metal pipework systems shall be continuity bonded and tested to ensure earth continuity. These shall all be tied into the buildings main earthing system, whether it is rebar or other system being employed.

Carry out equi-potential bonding and tests of the HVAC system to prove the effectiveness of the earthing system. All tests shall be fully recorded and included within the operating and maintenance manuals.

11.5.8 Workmanship

Prevent entry of foreign matter into any part of system by sealing openings during construction. Fit all access covers as work proceeds. Failure to undertake this will result in the requirement for CCTV inspections to be carried out to the entire system, to prove that the system is free from debris.

Handle, store and securely fix all products and accessories in accordance with manufacturer's recommendations.

All ductwork, plant, pipework, fixtures and fittings shall be properly cleaned, where necessary following completion of the installation.

11.5.9 Testing and Commissioning

The entire installation shall be commissioned in accordance with the relevant CIBSE commissioning codes and guides.

Carry out all tests and inspections to prove that the installation meets the requirements of the Building Regulations.

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Carry out all tests required by the building control officer giving adequate notice. Should the installation fail to hold against any test, identify the location of the failure rectify and re-test at no additional cost to this contract.

The installation shall be tested section by section as the work proceeds and subsequently on completion, to ensure that the installation is free from superfluous matter and obstruction and that all work which is to be concealed, is free from defects before it is finally enclosed.

The ductwork system will be air tested.

Before testing, all ductworks shall be cleaned and prepared thoroughly.

11.6 Contractor General Requirements

11.6.1 Shop drawings and samples.

The HVAC Subcontractor shall within a period of two weeks of receipt of documentation verifying his appointment submit to the Engineer all shop drawings and samples as requested by the Engineer. The drawings shall be submitted with reasonable promptness and in an orderly sequence so as to cause no delay to the works.

By preparation and submission of the shop drawings, the HVAC Subcontractor shall be deemed to have determined and verified all field dimensions, materials, catalogue numbers etc. In terms of the project programme, the HVAC Subcontractor shall allow the Engineers two calendar weeks for scrutiny of drawings.

11.6.2 Operating and maintenance manuals

Operating and maintenance manuals are to be prepared by the HVAC Subcontractor for all the systems and installations for which they are responsible. This will include (but is not limited to):

- General Description of the systems
- Operating manuals for all equipment
- Maintenance requirements for all equipment and systems
 - Including lists of all spares that should be kept on hand
- Record Drawings of all system installations.
 - Including floor layouts, sections, and details of all installed equipment, plant, cables, etc. Enough detail must be provided to allow the facilities team to be able to pinpoint all the services.
- Must include equipment numbering and all labelling

After approval of the manuals by the Engineer, the HVAC Subcontractor shall provide the Engineer with five bound sets and soft copy CD ROM of MS Word, Excel and AutoCAD files.

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Manufacturer's catalogue information shall be scanned and saved to disc in "JPEG" format at a rate of compression to be clearly legible.

The CD ROM copy shall read as a catalogue with drawing files separated and all files properly indexed not, as a random assortment of files.

The contract will not be accepted as complete until these have been supplied, complete and to the satisfaction of the Engineer.

The HVAC Subcontractor shall include for professional assistance in preparation of the above if necessary.

11.6.3 Guarantee and maintenance.

The entire installation shall be guaranteed against defect or faulty workmanship for a period of twelve months, from date of acceptance of the installation by the Engineer.

The HVAC Subcontractor shall service and maintain the installation for a period of twelve months from acceptance of the installation by the Engineer.

The various items of equipment shall be serviced and maintained in strict accordance with the requirements of the respective suppliers of the equipment.

Contractors shall include, in their tender prices, for travelling, labour, consumable, oils, lubricants, refrigerants, chemicals, tools, filters, etc. necessary for the successful implementation of the maintenance programme.

Contractors shall allow for monthly maintenance visits over the 12-month period.

The HVAC Subcontractor shall implement and maintain a maintenance/servicing register for the duration of the maintenance and guarantee period.

A record of each maintenance visit shall be forward to the Engineer after each visit.

At the end of the guarantee period the HVAC Subcontractor shall hand over to the Client a full set of any special tools or instruments required for the continued maintenance of the installation.


The HVAC Subcontractor shall submit electronic copies of all shop drawings to the Engineer for approval before commencement of work.

No portion of the work requiring approval of shop drawings or samples shall be commenced without the necessary approval of the Engineer.

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All items of equipment and plant shall be labelled. All labels shall be in English. Labels shall be of engraved aluminium be securely fixed by screws or rivets. Lettering shall be block capitals in a minimum size of 8mm.

All ductworks will be labelled with the required arrows showing direction of air flow as well as labels stating the type of air in the duct. Arrows and labels will be stuck to the ductwork at ever change of direction, tee-off and otherwise every three meters

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12 TECHNICAL SPECIFICATIONS – FIRE PROTECTION INSTALLATION

This specification covers supply, install, clean, test and commission of the complete Fire protection and reticulation system. All work shall be carried out to the complete satisfaction of the client and engineers.

All equipment shall meet the performance criteria as detailed in this specification, and the relevant schedules, drawings and BOQs. All equipment is to be priced as per the schedules and BOQs but options on equal and approved suppliers and equipment can be provided.

The design of the Fire protection shall meet the Building Regulation SANS 10400-part T & W well as comply with the requirements of the client. The Fire Fighting equipment, installations and fire protection system shall be installed properly as to be ready for their purpose at all times.

The fire water system shall be installed using the minimum pipework, will be free of contamination and will be free flowing as required. To ensure fittings and accessories necessary to be able to carry and supply water quickly, quietly and with freedom from nuisance or risk to health.

All pipelines shall be identified in accordance with Building Regulations.

Removable access panels shall be co-ordinated with the valve locations to enable maintenance.


Pipework shall be installed true and supported in accordance with SANS 10252-1 and the manufacturer's recommendations.

All parts and equipment used with portable and non-portable fire extinguishers shall be in accordance with Codes SANS 810-1985, SANS 889-1973, SANS 1151-1977 and SANS 0105-1971.

Markings and signage shall comply with the requirements of SANS 10114-2 with regard to the maximum viewing distance of the sign in proportion to the vertical dimension of the sign.

All visible fittings and fixtures, such as mounting brackets, fire extinguisher cabinets (where specified), labels etc. shall be approved by the Architect and the Engineer.

The Contractor shall submit identified duplicate samples of all manufactured items. One sample of each item will be signed by the Architect and handed to the builder, who will keep it on site available for inspection.

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12.1 Subcontractor Responsibility and System Coordination

The Fire Protection services Subcontractor shall be responsible for the supply, installation, testing, commissioning and free maintenance during the guarantee period of the installation detailed in this Specification and on the accompanying drawings, schedules and BOQs.

The Fire protection services Subcontractor shall provide all materials, equipment, labour and services necessary for the complete, safe and efficient operation of the installations in accordance with the intent of this Specification and Drawings.

This specification and accompanying layouts, schedules and BOQs detail the requirements of the Fire protection Services Subcontractor in terms of the Fire protection Services installation. Coordination of the relevant elements of the installation that interface with the various other installations (HVAC, Power, Lift, Wet services etc.) is the responsibility of the Fire protection Services Subcontractor.

Due to the nature of this Construction Project, the Fire Protection Subcontractor is to liaise with the Principal Contractor to ensure all interfacing elements have been priced for and if not, provide the Principal Contractor with the relevant details to allow these to be priced for.

Specific areas (but not limited to) to verify:

- Fixtures and Fittings.: This is to be provided in the Architectural package.
- Builders work Required: This is to be provided by the civil/structural subcontractor.
- Concealment of pipework and equipment Required: This is to be provided in the Architectural package.

Should any of these and any other requirements be lacking, the Fire protection Services Subcontractor is to inform the Principal Contractor, who will inform the Client.


12.2 Exclusions and Free Issue Items

The following although associated with the Fire Protection services installation will be provided free of charge by others. This is subject to the above requirements for coordination and pricing:

12.2.1 Builders Work Items

These items should be provided by the Principal Contractor. The Fire Protection services Contractor is to verify if this is the case. The Fire Protection services Subcontractor is responsible for producing and coordinating the builders work drawings required to inform the Principal Contractor of the requirements.

- Provision of openings in walls, floors and roofs during initial building construction only.

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- Building in of pipe sleeves and steel frames (provided by Fire Protection services Contractor) for the passage of pipes, and other built-in equipment. This includes the provision and fixing of any hardwood frames.
- Supply and installation of all access doors and panels to plant areas and shafts for installation and maintenance.
- Sealing of holes in walls and floors around pipes.
- Where cables or pipes pass through holes in floors, walls or partitions which are fire barriers, the openings shall be sealed by the builder with vermiculite plaster or other approved non-flammable equivalent for the full thickness of the floor or wall.
- Painting of walls and ceilings in the plantrooms.

12.2.2 List of Free issue elements to Principal Contractor for review

In line with the above requirements, the Fire Protection services Subcontractor is to issue a list of all the expected free issue items to the Principal Contractor to ensure these are picked up.

This list is to also form part of the Fire Protection services Subcontractor Submission.

12.2.3 Omissions

Not all equipment for the successful completion of the project will have been described in the specification. Where this is the case, the contractor must follow accepted good practice of a high standard to the satisfaction of the Engineer.

12.2.4 Additional Documentation

This section of the specification relates to the manufacture, delivery to site and installation of the HVAC system. To ensure a fully coordinated installation, this Specification is to be read in Conjunction with all of the following documents:


- Relevant Section of the Project or system BOQ

12.3 General Specification

12.3.1 General Description

The purpose of the fire protection system is to provide the building with measures that extinguish a fire or allow persons to extinguish a fire that is small and manageable. The system is also to allow for the escape of all persons from the building safely and quickly.

This specification covers the supply, delivery, installation, testing, commissioning and handing over of the complete Fire protection System specified below and as indicated on the drawings, which form part of this specification. All the work shall be carried out to the complete satisfaction of the Client and Consulting Engineer.

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The drawings indicate the sizes of pipes and the manner in which the various systems of piping are to be run.

All pipes, fittings or any materials used shall be new, suitable for the said operating and test pressures and conform to the specification.

12.3.2 Principal items of work

Principal items of work include, but are not limited to, the supply and installation of:

- Fire extinguisher, Hose reels, signage and Booster connection.
- Fire Pipework Installation.
- Fire Tank installation
- Fire pumps installation
- All control panels and monitoring equipment necessary for the complete working of the system.
- All necessary supports, hangers, brackets and accessories to complete the installations.
- Commissioning and testing of the installations.
- Provision of maintenance for 12 months after the main contract works completion and final handing over of the entire building to the client.

12.4 Design Parameters

Fire Protection services installation will comply with all the requirements of the following:

- SANS 10252-1:2012
- SANS 10400 XA
- SANS 10400 T
- SANS 10400 W
- All other relevant guides and building regulations


12.5 General System Requirements

12.5.1 Fire Protection System

The Consulting Civil Engineers shall provide a water connection to each building facility (site) separating into domestic water and firefighting systems.

The main reticulation shall be external to the building, including external fire hydrants and a fire booster connection at the site entrance, and shall enter and terminate within the relevant buildings with a minimum of a flanged 100 mm diameter galvanized steel pipe.

The twin booster set, and suction line will be installed after the municipal meter and from this point the rest of the fire water reticulation will move into the building. A Non return Valve will

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be installed between the suction line and the booster to ensure the municipal line is not pressurised should a booster truck need to connect.

In the event of galvanized steel piping being used underground, all such underground steel piping and fittings shall treat with Rapid bond in accordance with the manufacturer's specification / recommendations, and to the Consulting Civil Engineer's approval, in order that the piping and fittings are fully protected against external corrosion.

SANS part T states that a building of 250m² or greater per floor area shall be provided with a fire hose reel for each 500m² that is able to reach the furthest corner of the building, therefore for fire-fighting purposes hose reels shall be installed in the building as per SANS requirements.

SANS part T states that a building of 1000m² or greater floor area shall be provided with a fire hydrant for each 1000m² that is able to reach the furthest corner of the building, therefore for fire-fighting purposes hydrants shall be installed in the buildings as per SANS requirements.

Fire extinguishers, mounted on treated wooden backboards will be installed as required by SANS throughout the site and buildings.

The fire protection system might be connected to the sprinkler system or may have its own tank and booster should the municipal pressure prove unreliable. This will be included for in the BOQ

Generally, pipework should run within service and back of house zones and push through to the required areas where possible.


12.5.2 Fire Suppression systems

The server room will have a fire suppression system that will ensure that the electrical equipment is not damaged by the fire or the suppressant.

The system will be a complete clean agent total flooding fire suppression system using agent manufactured by a reputable manufacturer.

The cylinders will be located in the room with the alarm panel being located just outside the door.

The system will be linked to the Fire detection system to provide a warning on the detection system panel of the issue in the server room.

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12.5.3 General Equipment Requirements

12.5.3.1 Fire Water Storage

The fire water storage will be by means of a galvanised sectional steel tank. The tank will be divided in 2 providing 2 compartments for the stored water ensuring half the capacity is available should one side need cleaning.

Each of the tank half sections will be installed with the following:

- Overflow pipe
- ASIB Approved manual level indication system.
- Drain valve to drain the tank
- Test Tap – standard bib tap connected at low level to tap off water for testing
- Temperature indicator at high level
- Temperature indicator at low level
- Inlet float valve and isolation valve
- Outlet with anti-vortex end piece

The tank will be installed on concrete beams that will lift the tank to allow for connection below. The tank ensuring maximum water capacity can be used.

The tank will be covered and sealed (if external) to prevent rain and other debris entering the tank. The tank will have an access hatch in the cover for access for cleaning and other maintenance. A step ladder will be installed outside the tank to facilitate access to the hatch.

12.5.3.2 Fire Water Boosting

Fire Water Boosting will be by means of a dual pump system with one duty pump and one standby pump. The duty pump will be an electric pump, and the standby pump will be a diesel engine powered pump.


Each pump will be able to handle the full design duty.

The pumps will be installed on a skid base that will be attached to a plinth. The controls for the pumps will be installed either mounted to the skid system or on the nearest adjacent wall.

12.5.3.3 Fire Hydrants

Fire hydrants shall be supplied in accordance with SANS 10400 “Part T” of the National Building Regulations, with a Building Occupancy of D2 Medium Risk Industrial (Process Area), J2 Medium Risk Storage (Storage Area) and G1 (Offices)

- fire hydrants shall be provided within the buildings, at the rate of one (1) per 1000 m² or part thereof, together with the requisite number of hoses, couplings and 16 mm diameter nozzles. Pipework feeding fire hydrants shall not be less than 75 mm diameter.

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- all pipework shall be hydraulically sized in accordance with the relevant South African National Standards documentation.

12.5.4 Fire Hose Reel

Fire hydrants shall be supplied in accordance with SANS 10400 “Part T” of the National Building Regulations, with a Building Occupancy of D2 Medium Risk Industrial (Process Area) and / or J2 Medium Risk Storage (Storage Area), i.e.:

- Fire hose reels shall be provided within the buildings, at the rate of one (1) per 500 m² or part thereof, mounted at 1500 mm (to centre of the appliance) above finished floor level, 30 m x 20 mm internal diameter rubber hose and nozzle, pressure gauge, brass water way and gland, stopcock, pipework etc. all in accordance with the relevant South African National Standards documentation.
- Any piping feeding any single fire hose reel is to be a minimum of 25 mm diameter galvanized pipe in accordance with the relevant South African National Standards documentation.
- All pipework shall be hydraulically sized in accordance with the relevant South African National Standards documentation.

Hose reel installed in building shall comply with the requirements in SANS 543, shall be installed in accordance with SANS 10105-1 and SANS 10400-W, and shall be maintained in accordance with the requirements in SANS 1475-2.

Hose reels shall be red enamelled type of all steel construction, and provided with wall mounting bases, spindles and glands and shall be securely fixed to the wall with suitable “rawl” bolts and plate washers.

Hose reels shall be fitted complete with supply pipe, nozzle cock and hose guide in conformity with SANS 543 and bear the SANS mark. Fire hose shall be reinforced rubber 25mm nominal bore, having 28mm outside diameter and shall be in 30m lengths.

Any hose reel installed shall be positioned to ensure that the end of the hose will reach any point in the area to be protected.

12.5.5 Fire Extinguishers

Portable fire extinguishers installed in a building shall comply with the requirements in

SANS 1910, and shall be installed, maintained and serviced by competent persons in accordance with SANS 1475-1 and SANS 10105-1.

Such portable fire extinguishers shall bear a certification mark from an accredited Certification body.

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All portable fire extinguishers shall be supplied complete with quick release brackets and fixings for wall mounting. The brackets are to be fixed to the structure with rawl bolts.

All fire extinguishers shall be supplied in the charged condition

All fire extinguishers shall be fitted with means to provide visual indication that the unit has been partially or wholly discharged. Each extinguisher shall be marked with operating instructions, and markings shall conform to SANS requirements. Each extinguisher shall be stamped with the design pressure, test pressure and test date.

All fire extinguishers shall be painted red with their labels colour coded or the cylinder itself is colour coded to indicate its contents. The colour coding shall be:

- Dry Chemical Powder : Blue
- Halon 1211 (BCF) : Green
- Water : Red
- Foam : White
- Carbon Dioxide : Black

12.5.6 Fire suppression system.

The agent shall be manufactured at an ISO 9001 and ISO 14001 registered facility.

The system shall be a Clean Agent Fluid system and shall have an Ozone Depletion Potential (ODP) of zero. The Clean Agent Fluid shall also have a Global Warming Potential (GWP) of < 1.


The Clean Agent Fluid shall not be one of these greenhouse gases or ozone depleters; Perfluorocarbons (PFCs), Hydrofluorocarbons (HFCs), and Hydrochlorofluorocarbons (HCFCs).

The Clean Agent must have a minimum safety factor of 60% between the design concentration percentage and the No Observed Adverse Effect Level (NOAEL) for Class A and C hazards.

The minimum extinguishing concentration determined by test as witnessed per recognized testing laboratory standards (i.e. UL 2166, FM 5600) shall be no greater than 3.3%.

System cylinders shall be labelled indicating the system manufacturer and agent brand. System service and refill shall be by an authorized manufacturer's representative and shall be the agent of the original installation brand.

The system shall be certified by the fire suppression system manufacturer to have a noise level during agent discharge not to exceed 110 dB, from 0.5 to 5.0 kHz, for longer than 20 seconds, at a distance of three feet from the gas discharge nozzle.

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12.5.7 Valves

Valves will be required as per the installation requirement as well as the following not indicated:

- Valves shall be suitable for the pressure duty required, and shall be of a suitable pressure Class, depending on the mounting location.
- Valves shall be sealed or locked in the correct position by means of an approved lock and chain.
- Hose reel valves shall be 25mm bronze shut off valves, globe type with threaded ends.
- Valves shall be suitable for PN16 with non-shock water and shall be clearly marked with an arrow and the words open in red.
- Valves shall be suitable for the installation of an approved sealing device.

12.6 Pipelines

Generally, the following pipework materials will apply, unless detailed or specified otherwise.

12.6.1 Galvanised Steel

The fire appliance ring main within the factory / building shall be galvanized steel to relevant South African Standards and shall include red bands every 6 m lengths. The dropper pipes to relevant fire hydrants / fire hose reels shall be cleaned, primed and painted with red oxide and signal red enamel paint on completion of installation.

All piping shall be hydraulically pressure tested in sections, in accordance with the Principal Contractor's construction programme. The testing thereof shall be witnessed by the Consulting Mechanical Engineers and the relevant pressure test certificates prepared accordingly.

All pipe-work is to include galvanized / stainless steel hangers / fittings and must be adequately and neatly supported in both the horizontal and vertical direction.

Welded sections of piping shall have flange / coupling joints at suitable intervals to facilitate removal.

All fittings shall be groove type systems in accordance with SANS 1109 / BS21 and ASIB.

Galvanised Steel pipes and fittings shall be manufactured in accordance with SANS. The tubes shall be straight, smooth, of true cylindrical bore and free from all flaws.

The pipes and fittings shall be joined by screw fit or flanged connection with PN of 16 Bar to suit the pipework material and/or the fitting being connected to. Generally, connections will be flanged for all pipes 50mm in diameter or greater with screwed connections for smaller pipes.

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Galvanised will only be used where specifically stated. This is generally confined to all major supply pipework above ground. All pipework 50ND or less will be screwed

All pipework greater than 50ND will be either welded or shoulder ended to allow for specialist coupling of the pipework (Klambon / Klamflex) or similar. Pressure ratings of joints must comply with the maximum working pressure of the system

12.6.2 HDPE

HDPE pipes and fittings shall be manufactured in accordance with SANS. The tubes shall be straight, smooth, of true cylindrical bore and free from all flaws.

The pipes and fittings shall be suitable for a PN of 16 Bar.

HDPE will be used for all major water runs below ground.

12.6.3 Pipe Routes

Ensure pipe routes are shortest practicable, with the minimum number of bends, unless indicated otherwise. Pipe routes are indicated on the drawings and the contractor is to follow these routes as far as is practicable

12.6.4 Fixing and Jointing

Pipes supplying the hose reels will be supported as follows (or as per manufacturer's minimum recommendation – whichever is more robust):

Size of pipe	Spacing for Horizontal (m)	Spacing for Vertical (m)
15-28	1.8	2.4
28-40	2.7	3.0
40-50	3.0	3.6
65-150	4.0	4.5

Table 12-1 Fire Protection Pipe Size

Install pipes, fittings and accessories in accordance with Building Regulations and manufacturer's recommendations.

Where horizontal pipes are installed in excess of 300 mm from the soffit of the supporting slab adequate supports shall be provided to prevent lateral movement.

Install adequate restraint couplings to ensure that the system can withstand all likely accidental static water pressures.

12.7 Marking and signposting

Escape routes shall be clearly marked and signposted to indicate the direction to be travelled in the case of any emergency. Such signage may be of the internally or externally illuminated,

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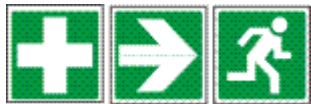
or photo luminescent type and shall comply with the relevant requirements of SANS 1186-1, SANS 1186-3, SANS 1186-5 and SANS 1464-22.

Marks or signs which are not of the illuminated type shall be illuminated to an intensity of not less than 50 lx. Internally illuminated signs shall comply with the luminance requirements of SANS 1186-3. Photo luminescent signs shall comply with the luminance requirements of SANS 1186-5.

The system, which is based on international standards, is briefly described as follows:



Informative, Fire Fighting: square in shape with a white background and red border. The symbol must be in red and placed in the centre of the sign. Typical examples of such signs are the location arrow, fire extinguisher, fire hose, etc.



Informative, General: square in shape with a green background and white symbol centrally placed. Typical examples of such signs are those for first aid equipment, general direction arrows. direction to escape route, etc.



Mandatory Sign: round in shape with a blue background, with the symbol placed centrally and in white. Typical examples of such signs are those advising that certain pieces of protective clothing must be worn (e.g. goggles, respiratory protection, hand protection, etc.).



Prohibition Sign: round in shape with a white background and circular band and diagonal bar in red. The symbol must be black and placed in the centre of the sign without obliterating the crossbar. Typical examples of such signs are those prohibiting smoking, fire and open flames, the use of cell phones, etc.



Warning Sign: triangular in shape with a yellow background and black triangular band. The symbol or words must be black and placed in the centre of the sign. Typical examples of such signs are those warning of the danger of explosion, electric shocks, slippery walking surface, etc.

12.8 Builders work

The Fire Protection services Subcontractor shall be responsible for providing all small openings in brick walls for pipework etc. and for providing the necessary flashing, support brackets for pipework ductwork etc.

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The Fire Protection services Subcontractor shall be responsible for providing all Builders' Work Drawings for the work to be carried out by the Principal / Structural Contractor. Full details of all large openings for pipework in the roofs, slabs and brick walls, details of concrete bases, etc are to be included on these drawings which are to be submitted to the Engineer for approval in good time to comply with building program.

The Fire Protection services Subcontractor shall also check the positions and sizes of all these openings, bases, etc provided by the Principal / Structural Contractor.

The Principal / Structural Contractor shall provide all waterproofing and making good.

12.9 Fire Safety

Provide and install protection of openings and fire stopping in accordance with the Building Regulations.

Provide and install on all plastic pipework passing through fire compartment floors or walls and exceeding 40mm internal diameter an intumescent fire sleeve in accordance with Building Regulations. The fire sleeve shall have a fire rating compatible with the floor, wall or cavity barrier to which it is fitted.

12.10 Earthing and Bonding


All new metal pipework systems shall be continuity bonded and tested to ensure earth continuity. These shall all be tied into the buildings main earthing system, whether it is rebar or other system being employed.

Carry out equi-potential bonding and tests of the foul drainage system (above ground) to prove the effectiveness of the earthing system. All tests shall be fully recorded and included within the operating and maintenance manuals.

12.11 Workmanship

Prevent entry of foreign matter into any part of system by sealing openings during construction. Fit all access covers and cleaning eyes as work proceeds. Failure to undertake this will result in the requirement for CCTV inspections to be carried out to the entire system, to prove that the system is free from debris. Handle, store and securely fix all products and accessories in accordance with manufacturer's recommendations.

All pipework and fittings shall be properly cleaned, where necessary following completion of the installation.

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12.12 Testing and Commissioning

TESTING AND COMMISSIONING SHALL BE UNDERTAKEN IN LINE WITH THE CIBSE COMMISSIONING CODES AS WELL AS BELOW. THIS IS IN LINE WITH THE GREEN STAR RATING SPECIFICATION

The Fire Protection services Subcontractor shall be responsible for testing and commissioning of the complete plant and allow for inspections by the Engineer as required.

After the Fire Protection services Subcontractor has completed his testing and commissioning and is satisfied that the plant is ready for the Taking-Over Inspection he shall notify the Engineer so that the Taking-Over Inspection can be arranged.

12.12.1 Commissioning Schedule

The subcontractor shall submit to the engineer a complete commissioning schedule at least 1 month before commissioning commences. The commissioning schedule shall contain all commissioning activities, all equipment to be tested and all variables of all equipment to be checked. The following tests and measurements are to be included and recorded:

Mechanical Tests and Measurements


- Capacity of the systems.
- Operation of control, safety and alarm devices.
- Noise levels.
- Any other tests that may be required for the particular system.

12.12.2 Commissioning is to be conducted as follows:

The Fire Protection services Subcontractor will be responsible for the supply of all test equipment necessary to carry out all tests. Performance tests shall be carried out in the presence of the Principal Contractor, the Consultant as agreed and, if required, the local Fire Department.

The method of checking and testing the operation of the system shall generally be as follows (or as more specifically detailed elsewhere in this specification):

- The pressure and flow test through the fire hose reel control valve test arrangement, assuring that the minimum requirements set by SANS are met.
- The operation of the hydraulic alarm bells.
- The opening of a test valve arrangement at the extremity of the system to ensure there is free flow of fire water through the distribution system, and to check on the operation of the control valve and its accessories.
 - a. The control valves must be checked and tested for correct operation.
- Fire Brigade Signalling

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a. The activation of the alarm at the Station must be checked for correct operation with the energisation of the water flow switch.

- Every fire hose reel shall be checked for operation, prior to the Municipalities seal being fixed.
- The automatic start operation of the pumps, pump flow tests and tests on the battery charger unit, batteries and switchboards (if pumps installed) shall be checked in detail as specified elsewhere in this document.

Once the schedules have been completed and signed for by the Clerk of Works they are to be forwarded to the Engineer for signature and for record purposes.

12.13 Contractor General Requirements

12.13.1 Contractor Information, drawings, and samples

The Fire Protection Services Subcontractor shall within a period of two weeks of receipt of documentation verifying his appointment submit to the Engineer all drawings and samples as requested by the Engineer. The drawings shall be submitted with reasonable promptness and in an orderly sequence so as to cause no delay to the works.

The Fire Protection Services Subcontractor shall be responsible for providing the following drawings pertaining to the Fire Protection Installation for the execution of the project.

- Fire Protection Services Sub-Contractor's Drawings
- Builder's Work Drawings
- Shop Drawings
- As Installed Record Drawings


By preparation and submission of this information, the Fire Protection Services Subcontractor shall be deemed to have determined and verified all field dimensions, materials, catalogue numbers etc. In terms of the project programme, the Fire Protection Services Subcontractor shall allow the Engineers two calendar weeks for scrutiny of drawings.

The Fire Protection Services Subcontractor shall submit electronic copies of all drawings to the Engineer for approval before commencement of work.

No portion of the work requiring approval of shop drawings or samples shall be commenced without the necessary approval of the Engineer.

Samples Required:

- Galvanised pipework jointing sample.
- Example of pipe hanger.

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12.13.2 Operating and maintenance manuals

- Operating and maintenance manuals are to be prepared by the Fire Protection Services Subcontractor for all the systems and installations for which they are responsible. This will include (but is not limited to):
 - General Description of the systems
 - Operating manuals for all equipment
 - Maintenance requirements for all equipment and systems
 - Including lists of all spares that should be kept on hand
 - Record Drawings of all system installations.
 - Including floor layouts, sections, and details of all installed equipment, plant, cables, etc. Enough detail must be provided to allow the facilities team to be able to pinpoint all the services.
 - Must include equipment numbering and all labelling

Manuals must be submitted to the Engineer at least 1 week prior to the system commissioning start date.

After approval of the manuals by the engineer, the Fire Protection Services Subcontractor shall provide the Engineer with bound copies as well as soft copy CD ROMs/flash drives of all MS Word, Excel and AutoCAD files as well as all manufacturers information.

Manufacturer's catalogue information shall be scanned and saved to disc in "JPEG" format at a rate of compression to be clearly legible.

The CD ROM copy shall read as a catalogue with drawing files separated and all files properly indexed.

The contract will not be accepted as complete until these have been supplied, complete and to the satisfaction of the Engineer.

The Fire Protection Services Subcontractor shall include for professional assistance in preparation of the above if necessary.

12.13.3 Guarantee and maintenance

The entire installation shall be guaranteed against defect or faulty workmanship for a period of twelve months, from date of acceptance of the Building by the Client.

The Fire Protection Services Subcontractor shall service and maintain the installation for a period of twelve months from acceptance of the Building by the Client.

The various items of equipment shall be serviced and maintained in strict accordance with the requirements of the respective suppliers of the equipment.

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Contractors shall include, in their tender prices, for travelling, labour, consumable, oils, lubricants, chemicals, tools, etc. necessary for the successful implementation of the maintenance programme.

Contractors shall allow for monthly maintenance visits over the 12-month period.

The Fire Protection Services Subcontractor shall implement and maintain maintenance/servicing register for the duration of the maintenance and guarantee period.

A record of each maintenance visit shall be forward to the Engineer after each visit.

At the end of the guarantee period the Fire Protection Services Subcontractor shall hand over to the Client a full set of any special tools or instruments required for the continued maintenance of the installation.

12.13.4 Labelling and Painting

All labels shall be in English

12.13.4.1 Equipment

All items of equipment and plant shall be labelled. Labels shall be of engraved aluminium be securely fixed by screws or rivets. Lettering shall be block capitals in a minimum size of 8mm. The labels are to be rigidly fixed to the wall or to a framework fitted to the piping with chrome-plated screws or escutcheon pins. The use of adhesive tape will not be permitted.

12.13.4.2 Pipework

All surface to be thoroughly cleaned with a detergent chemical solution in accordance with SABS 064 Code of Practice for the Preparation of Steel Surfaces for Coating.

One coat of self-etching primer to SABS 723 (Wash Primer)/ (Metal Etch Primer).

- One coat of zinc chromate paint to SABS 679 (Zinc Chromate Primers for Steel) Type II, Grade I.

One coat Signal Red oleo-resinous, micaceous iron oxide paint.

- Two coats pure acrylic emulsion exterior paint to SABS 634.

All paints used shall be by the same and approved manufacturer and the Contractor shall ensure that the various paints are compatible one with the other.

Surfaces exposed on galvanised material through cutting, drilling and/or pipe grips shall be painted with Galvalloy or similar.

12.13.4.3 Valve Identification

In instances where the sprinkler control valve room contains banks of valves which serve different protected zones, each such zone shall be clearly identified by a label. The label is to be fixed in the vicinity of the valve. The label shall be of white traffolyte or equivalent material, with engraved letters. The letters shall not be less than 20 mm in height.

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Each alarm valve of a multiple valve installation shall also have a number indicated thereon. The corresponding alarm bell must bear the same number in bold figures.

12.13.4.4 Location Plate

A location plate must be fixed on the outside of an external wall as near to the main stop valve as possible. It shall read:

SPRINKLER

STOP VALVE

INSIDE

12.13.5 Intumescent painting


All services penetrations shall be fire sealed.

The Fire Protection Services Subcontractor shall identify, on drawings, where his services penetrate floor slabs and fire barriers and furnish these to the Main Contractor.

The Builder will caulk in all services.

Once services have been caulked in a specialist contractor other than the Fire Protection Services Subcontractor shall apply intumescent paint to ducts, piping etc. where such passes through floor slab and fire barriers.

Before requesting the Engineer to carry out an inspection the Fire Protection Services Subcontractor shall satisfy himself that all penetrations relating to his installation have been caulked and fire sealed with intumescent paint.

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13 TECHNICAL SPECIFICATIONS – FIRE SPRINKLER INSTALLATION

This specification covers supply, install, clean, test and commission of the complete Fire Sprinkler system and reticulation system. All work shall be carried out to the complete satisfaction of the client and engineers.

All equipment shall meet the performance criteria as detailed in this specification, and the relevant schedules, drawings and BOQs. All equipment is to be priced as per the schedules and BOQs but options on equal and approved suppliers and equipment can be provided.

The design of the Fire Sprinkler protection system will meet the requirements of the ASIB rule book twelfth edition as well as comply with the requirements of the client. The Fire sprinkler equipment, installations and fire protection system shall be installed properly as to be ready for their purpose at all times.

The fire sprinkler water system shall be installed using the minimum pipework, will be free of contamination and will be free flowing as required. To ensure fittings and accessories necessary to be able to carry and supply water quickly, quietly and with freedom from nuisance or risk to health.

All pipelines shall be identified in accordance with ASIB Rule book as well as Building Regulations.

Removable access panels shall be co-ordinated with the valve locations to enable maintenance.

Pipework shall be installed true and supported in accordance with the ASIB Rule book or SANS 10252-1 and the manufacturer's recommendations.

Markings and signage shall comply with the requirements of SANS 10114-2 regarding the maximum viewing distance of the sign in proportion to the vertical dimension of the sign.

All visible fittings and fixtures, such as mounting brackets, fire extinguisher cabinets (where specified), labels etc. shall be approved by the Architect and the Engineer.

The Contractor shall submit identified duplicate samples of all manufactured items. One sample of each item will be signed by the Architect and handed to the builder, who will keep it on site available for inspection.

13.1 Subcontractor Responsibility and System Coordination

The Fire Sprinkler System Subcontractor shall be responsible for the supply, installation, testing, commissioning and free maintenance during the guarantee period of the installation detailed in this Specification and on the accompanying drawings, schedules and BOQs.

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The Fire Sprinkler System Subcontractor shall provide all materials, equipment, labour and services necessary for the complete, safe and efficient operation of the installations in accordance with the intent of this Specification and Drawings.

This specification and accompanying layouts, schedules and BOQs detail the requirements of the Fire Sprinkler System Subcontractor in terms of the Fire protection Services installation. Coordination of the relevant elements of the installation that interface with the various other installations (HVAC, Power, Lift, Wet services etc.) is the responsibility of the Fire protection Services Subcontractor.

Due to the nature of this Construction Project, the Fire Protection Subcontractor is to liaise with the Principal Contractor to ensure all interfacing elements have been priced for and if not, provide the Principal Contractor with the relevant details to allow these to be priced for.

Specific areas (but not limited to) to verify:

- Fixtures and Fittings: This is to be provided in the Architectural package.
- Builders work Required: This is to be provided by the civil/structural subcontractor.
- Concealment of pipework and equipment Required: This is to be provided in the Architectural package.

Should any of these and any other requirements be lacking, the Fire Sprinkler System Subcontractor is to inform the Principal Contractor, who will inform the Client.


13.2 Exclusions and Free Issue Items

The following although associated with the Fire Protection services installation will be provided free of charge by others. This is subject to the above requirements for coordination and pricing:

13.2.1 Builders Work Items

These items should be provided by the Principal Contractor. The Fire Protection services Contractor is to verify if this is the case. The Fire Sprinkler System Subcontractor is responsible for producing and coordinating the builders' work drawings required to inform the Principal Contractor of the requirements.

- Provision of openings in walls, floors and roofs during initial building construction only.
- Building in of pipe sleeves and steel frames (provided by Fire Protection services Contractor) for the passage of pipes, and other built-in equipment. This includes the provision and fixing of any hardwood frames.
- Supply and installation of all access doors and panels to plant areas and shafts for installation and maintenance.
- Sealing of holes in walls and floors around pipes.

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- Where cables or pipes pass through holes in floors, walls or partitions which are fire barriers, the openings shall be sealed by the builder with vermiculite plaster or other approved non-flammable equivalent for the full thickness of the floor or wall.
- Painting of walls and ceilings in the plantrooms.

13.3 List of Free issue elements to Principal Contractor for review

In line with the above requirements, the Fire Sprinkler System Subcontractor is to issue a list of all the expected free issue items to the Principal Contractor to ensure these are picked up.

This list is to also form part of the Fire Sprinkler System Subcontractor Submission.

13.4 Omissions

Not all equipment for the successful completion of the project will have been described in the specification. Where this is the case, the contractor must follow accepted good practice of a high standard to the satisfaction of the Engineer.

13.5 Additional Documentation

This section of the specification relates to the manufacture, delivery to site and installation of the HVAC system. To ensure a fully coordinated installation, this Specification is to be read in Conjunction with all the following documents:

- Relevant Section of the Project or system BOQ

13.6 General Specification

13.6.1 General Description

The purpose of the fire sprinkler system is to provide the building with measures that extinguish a fire. The system is also to allow for the escape of all persons from the building safely and quickly.

This specification covers the supply, delivery, installation, testing, commissioning and handing over of the complete Fire sprinkler system specified below and as indicated on the drawings, which form part of this specification. All the work shall be carried out to the complete satisfaction of the Client and Consulting Engineer.

The drawings indicate the sizes of pipes and the way the various systems of piping are to be run.

All pipes, fittings or any materials used shall be new, suitable for the said operating and test pressures and conform to the specification.

13.6.2 Principal items of work

Principal items of work include, but are not limited to, the supply and installation of:

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- Fire Sprinkler systems
- Fire Sprinkler Pipework Installation
- Sprinkler ICV installation
- Fire Sprinkler Tank
- Fire Sprinkler Pumps – both electrical and diesel
- All control panels and monitoring equipment necessary for the complete working of the system.
- All necessary supports, hangers, brackets and accessories to complete the installations.
- Commissioning and testing of the installations.
- Provision of maintenance for 12 months after the main contract works completion and final handing over of the entire building to the client.
- Attendance and associated costs to get ASIB out to inspect the system and approve.

13.7 Design Parameters

Fire Protection services installation will comply with all the requirements of the following:

- ASIB Twelfth Edition 2019 release
- All other relevant guides and building regulations

13.8 General System Requirements**13.8.1 Fire Sprinkler Supply**

The water supply for sprinkler protection will be provided by an ASIB-approved pumped firefighting system, comprising two pumps and one split (in half) dedicated storage tanks as follows:

- Booster pumps capacity = 5300 l/min @ 4.5 bar
- Sprinkler water storage effective capacity = 500 m³ (split into two sections of 250 m³)

The pumps will supply to the ICV chambers located locally or adjacent the building being protected. From the ICV, the supply will enter the building and run up to high level where the sprinkler system will then form and spread throughout.

In the event of galvanized steel piping being used underground, all such underground steel piping and fittings shall be wrapped with rapid bond in accordance with the manufacturer's specification / recommendations, and to the Consulting Civil Engineer's approval, in order that the piping and fittings are fully protected against external corrosion.

13.8.2 Sprinkler Installation

The sprinkler system shall be designed, installed and commissioned in accordance with the Automatic Sprinkler Inspection Bureau (ASIB) 12th Edition Rules, and parts thereof.

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The sprinkler heads are to be the latest design-technology using the “Glass Bulb” fusible element and shall be approved by ASIB. Furthermore, the sprinkler heads shall be of the response type and have an operating temperature rating as detailed below.

13.8.2.1 Lifting Shop and canopies

The above system is to be based on a grid-type, High Hazard Class II system. The grid system will cover the full length of the lifting shop and a number of gridded or tree type systems being used to protect canopies.

13.8.2.2 Warehouse

The above system is to be based on a grid-type, High Hazard Class II system. The grid system will cover the full length of the warehouse and a number of gridded or tree type systems being used to protect canopies.

13.8.2.3 Valve Chamber

The valve chamber for the lifting shop will be located adjacent to the pump room. The valve chamber for the warehouse will be located adjacent to the warehouse.

The lifting shop valve chamber shall comprise of a sprinkler control valve assembly to the lifting shop and a spare set of connections for any additional system required in future. The warehouse valve chamber shall comprise of a single sprinkler control valve assembly to the warehouse.

Both ICV assemblies will be complete with alarm gongs, gauges, test and drain, chamber protection, by-pass loop, etc. all in compliance with the relevant ASIB Rules.

13.9 General Equipment Requirements**13.9.1 Fire Water Storage**

The fire water storage will be by means of a galvanised sectional steel tank. The tank will be divided in two providing two compartments for the stored water ensuring half the capacity is available should one side need cleaning.

Each of the tank half sections will be installed with the following:

- Overflow pipe
- ASIB Approved manual level indication system.
- Drain valve to drain the tank.
- Test Tap – standard bib tap connected at low level to tap off water for testing.
- Temperature indicator at high level
- Temperature indicator at low level
- Inlet float valve and isolation valve
- Outlet with anti-vortex end piece

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The tank will be installed on structural platform above the main pump room and some parking. The pipework feed to the pumps will be down from the tank into the pump room where they will connect to the pumps.

The tank will be covered and sealed (if external) to prevent rain and other debris entering the tank. The tank will have an access hatch in the cover for access for cleaning and other maintenance. A step ladder will be installed outside the tank to facilitate access to the hatch.

13.9.2 Fire Sprinkler Pumps

The Fire Sprinkler Pumps will be by means of a dual pump system with one duty pump and one standby pump. The duty pump will be an electric pump, and the standby pump will be a diesel engine powered pump.

Each pump will be able to handle the full design duty.

The pumps will be installed on a skid base that will be attached to a plinth. The controls for the pumps will be installed either mounted to the skid system or on the nearest adjacent wall.

13.9.3 Sprinkler Heads**13.9.3.1 Lifting Shop, Warehouse and canopies**

Sprinkler heads shall be standard spray, brass upright type, with glass bulb, as suited to the installation position, and shall be rated at 93 °C (K factor = 11.5), with an operating pressure of 350 kPa.

For external units, the heads will be treated with an approved corrosive resistant material.

13.9.4 ICV

The control valves within the valve chamber shall be of the wet type, as per ASIB Twelfth (12th) Edition.

Each control valve is to be equipped with all ancillary items, as required for ASIB approval, and shall comprise, but not limited to, the following items:

- Gear operated wafer-type monitored stop valves, with pointer to indicate whether open or shut
- Approved patent automatic alarm valve with special seating designed to retain water in the pipework, and to pass water to the alarm motor under flow conditions
- Bourdon type pressure gauges, to indicate water supply and installation pressure respectively. All pressure gauges shall be of the glycerine filled type and shall have a range of 0-1600 kPa. Each gauge shall be mounted remotely from the main pipe by means of a 100 mm long extension pipe, complete with an isolating ball valve mounted in its line

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- Hydraulically driven alarm motor and gong assembly, connected to the alarm valves (The alarm valve shall not be connected directly to the isolating stop valve)
- One off fiberglass / galvanized cabinet, containing spare sprinkler heads and spanner
- One off block plan (non-fade material), giving all details as per the ASIB requirements
- Test pipe
- Drainpipe
- A bypass test loop of same diameter as the feed main with a flow proving test arrangement
- One pressure operated micro switch will be provided within the valve chamber, mounted in the alarm gong line
- Flow switch to be interfaced with the fire detection system

13.9.5 Pipelines

Generally, the following pipework materials will apply, unless detailed or specified otherwise.

13.9.5.1 Galvanised Steel

All sprinkler pipework (including mains) installed within the facility shall be black mild steel to relevant South African Standards. All sprinkler pipework (including mains) installed externally i.e. canopies, etc. shall be galvanized steel to relevant South African Standards.

All pipework shall be rated to the maximum capacity of the system – 1000kPa.


All pipework and fittings fabricated shall be de-greased with a suitable de-greasing agent. After de-greasing the pipework and fittings, they shall immediately be painted with red oxide (PA10) self-etching primer. All void pipework to be painted with red oxide and exposed pipework to be painted with red oxide and signal red enamel.

All piping shall be hydraulically pressure tested in sections, in accordance with the Principal Contractor's construction programme. The testing thereof shall be witnessed by the Consulting Mechanical Engineers and the relevant pressure test certificates prepared accordingly.

Terminal points shall be installed at the extremities of the distribution pipe at each level to prove that the water is accessing all points of the system. These points must be accessible for demonstration at commissioning of the installation.

All pipe-work is to include galvanized / stainless steel hangers / fittings and must be adequately and neatly supported in both the horizontal and vertical direction. All hangers and supports must be highly corrosion resistant.

Welded sections of piping shall have flange / coupling joints at suitable intervals to facilitate removal.

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All fittings shall be groove type systems in accordance with SANS 1109 / BS21 and ASIB.

All pipework 50ND or less will be screwed

All pipework greater than 50ND will be either welded or shoulder ended to allow for specialist coupling of the pipework (Klambon / Klamflex) or similar. Pressure ratings of joints must comply with the maximum working pressure of the system

13.9.5.2 Pipe Routes

Ensure pipe routes are shortest practicable, with the minimum number of bends, unless indicated otherwise. Pipe routes are indicated on the drawings and the contractor is to follow these routes as far as is practicable

13.9.5.3 Fixing and Jointing

All pipework will be fixed, jointed and installed as per the ASIB Rulebook.

Where not required to meet the ASIB requirements, Pipes supplying the hose reels will be supported as follows (or as per manufacturer's minimum recommendation – whichever is more robust):

Size of pipe	Spacing for Horizontal (m)	Spacing for Vertical (m)
15-28	1.8	2.4
28-40	2.7	3.0
40-50	3.0	3.6
65-150	4.0	4.5

Table 13-1 Fire Sprinkler Pipe Size


Install pipes, fittings and accessories in accordance with Building Regulations and manufacturer's recommendations.

Where horizontal pipes are installed more than 300 mm from the soffit of the supporting slab adequate supports shall be provided to prevent lateral movement. Install adequate restraint couplings to ensure that the system can withstand all likely accidental static water pressures.

13.10 Builders work

The Fire Sprinkler System Subcontractor shall be responsible for providing all small openings in brick walls for pipework etc. and for providing the necessary flashing, support brackets for pipework ductwork etc.

The Fire Sprinkler System Subcontractor shall be responsible for providing all Builders' Work Drawings for the work to be carried out by the Principal / Structural Contractor. Full details of all large openings for pipework in the roofs, slabs and brick walls, details of concrete bases,

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etc are to be included on these drawings which are to be submitted to the Engineer for approval in good time to comply with building program.

The Fire Sprinkler System Subcontractor shall also check the positions and sizes of all these openings, bases, etc provided by the Principal / Structural Contractor.

The Principal / Structural Contractor shall provide all waterproofing and making good.

13.11 Fire Safety

Provide and install protection of openings and fire stopping in accordance with the Building Regulations.

Provide and install on all plastic pipework passing through fire compartment floors or walls and exceeding 40mm internal diameter an intumescent fire sleeve in accordance with Building Regulations. The fire sleeve shall have a fire rating compatible with the floor, wall or cavity barrier to which it is fitted.

13.12 Earthing and Bonding

All new metal pipework systems shall be continuity bonded and tested to ensure earth continuity. These shall all be tied into the buildings main earthing system, whether it is rebar or other system being employed.

Carry out equi-potential bonding and tests of the foul drainage system (above ground) to prove the effectiveness of the earthing system. All tests shall be fully recorded and included within the operating and maintenance manuals.

13.13 Workmanship


Prevent entry of foreign matter into any part of system by sealing openings during construction. Fit all access covers and cleaning eyes as work proceeds. Failure to undertake this will result in the requirement for CCTV inspections to be carried out to the entire system, to prove that the system is free from debris.

Handle, store and securely fix all products and accessories in accordance with manufacturer's recommendations.

All pipework and fittings shall be properly cleaned, where necessary following completion of the installation.

13.14 Testing and Commissioning

TESTING AND COMMISSIONING SHALL BE UNDERTAKEN IN LINE WITH THE CIBSE COMMISSIONING CODES AS WELL AS BELOW. THIS IS IN LINE WITH THE GREEN STAR RATING SPECIFICATION

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The Fire Sprinkler System Subcontractor shall be responsible for testing and commissioning of the complete plant and allow for inspections by the Engineer as required.

After the Fire Sprinkler System Subcontractor has completed his testing and commissioning and is satisfied that the plant is ready for the Taking-Over Inspection he shall notify the Engineer so that the Taking-Over Inspection can be arranged.

13.14.1 Commissioning Schedule

The subcontractor shall submit to the engineer a complete commissioning schedule at least 1 month before commissioning commences. The commissioning schedule shall contain all commissioning activities, all equipment to be tested and all variables of all equipment to be checked. The following tests and measurements are to be included and recorded:

13.14.1.1 Mechanical Tests and Measurements


- Capacity of the systems.
- Operation of control, safety and alarm devices.
- Noise levels.
- Any other tests that may be required for the system.

13.14.2 Commissioning is to be carried out as follows:

The Fire Sprinkler System Subcontractor will be responsible for the supply of all test equipment necessary to carry out all tests. Performance tests shall be carried out in the presence of the Principal Contractor, the Consultant as agreed and, if required, the local Fire Department.

The method of checking and testing the operation of the system shall generally be as follows (or as more specifically detailed elsewhere in this specification):

- The pressure and flow test through the fire hose reel control valve test arrangement, assuring that the minimum requirements set by SANS are met.
- The operation of the hydraulic alarm bells.
- The opening of a test valve arrangement at the extremity of the system to ensure there is free flow of fire water through the distribution system, and to check on the operation of the control valve and its accessories.
 - a. The control valves must be checked and tested for correct operation.
- Fire Brigade Signalling
 - a. The activation of the alarm at the Station must be checked for correct operation with the energisation of the water flow switch.
- Every fire hose reel shall be checked for operation, prior to the Municipalities seal being fixed.

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- The automatic start operation of the pumps, pump flow tests and tests on the battery charger unit, batteries and switchboards (if pumps installed) shall be checked in detail as specified elsewhere in this document.

Once the schedules have been completed and signed for by the Clerk of Works they are to be forwarded to the Engineer for signature and for record purposes.

13.15 Contractor General Requirements

13.15.1 Contractor Information, drawings, and samples

The Fire Sprinkler System Subcontractor shall within a period of two weeks of receipt of documentation verifying his appointment submit to the Engineer all drawings and samples as requested by the Engineer. The drawings shall be submitted with reasonable promptness and in an orderly sequence to cause no delay to the works.

The Fire Sprinkler System Subcontractor shall be responsible for providing the following drawings pertaining to the Fire Protection Installation for the execution of the project.

- Fire Protection Services Sub-Contractor's Drawings
- Builder's Work Drawings
- Shop Drawings
- As Installed Record Drawings

By preparation and submission of this information, the Fire Sprinkler System Subcontractor shall be deemed to have determined and verified all field dimensions, materials, catalogue numbers etc. In terms of the project programme, the Fire Sprinkler System Subcontractor shall allow the Engineers two calendar weeks for scrutiny of drawings.

The Fire Sprinkler System Subcontractor shall submit electronic copies of all drawings to the Engineer for approval before commencement of work.

No portion of the work requiring approval of shop drawings or samples shall be commenced without the necessary approval of the Engineer.

Samples Required:


- Galvanised pipework jointing sample
- Example of pipe hanger

13.15.2 Labelling and Painting

All labels shall be in English

13.15.2.1 Equipment

All items of equipment and plant shall be labelled. Labels shall be of engraved aluminium be securely fixed by screws or rivets. Lettering shall be block capitals in a minimum size of 8mm.

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The labels are to be rigidly fixed to the wall or to a framework fitted to the piping with chrome-plated screws or escutcheon pins. The use of adhesive tape will not be permitted.

13.15.2.2 Pipework

All surface to be thoroughly cleaned with a detergent chemical solution in accordance with SABS 064 Code of Practice for the Preparation of Steel Surfaces for Coating.

- One coat of self-etching primer to SABS 723 (Wash Primer)/ (Metal Etch Primer).
- One coat of zinc chromate paint to SABS 679 (Zinc Chromate Primers for Steel) Type II, Grade I.
- One coat Signal Red oleo-resinous, micaceous iron oxide paint.
- Two coats pure acrylic emulsion exterior paint to SABS 634.

All paints used shall be by the same and approved manufacturer and the Contractor shall ensure that the various paints are compatible one with the other.

Surfaces exposed on galvanised material through cutting, drilling and/or pipe grips shall be painted with Galvalloy or similar.

13.15.2.3 Valve Identification

In instances where the sprinkler control valve room contains banks of valves which serve different protected zones, each such zone shall be clearly identified by a label. The label is to be fixed in the vicinity of the valve. The label shall be of white traffolyte or equivalent material, with engraved letters. The letters shall not be less than 20 mm in height.

Each alarm valve of a multiple valve installation shall also have a number indicated thereon. The corresponding alarm bell must bear the same number in bold figures.

13.15.2.4 Location Plate

A location plate must be fixed on the outside of an external wall as near to the main stop valve as possible. It shall read:

SPRINKLER

STOP VALVE

INSIDE

13.15.3 Intumescent painting

All services penetrations shall be fire sealed.

The Fire Protection Services Subcontractor shall identify, on drawings, where his services penetrate floor slabs and fire barriers and furnish these to the Main Contractor.


The Builder will caulk in all services.

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Once services have been caulked in a specialist contractor other than the Fire Sprinkler System Subcontractor shall apply intumescent paint to ducts, piping etc. where such passes through floor slab and fire barriers.

Before requesting the Engineer to carry out an inspection the Fire Protection Services Subcontractor shall satisfy himself that all penetrations relating to his installation have been caulked and fire sealed with intumescent paint.

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14 TECHNICAL SPECIFICATIONS – LIFT INSTALLATION

14.1 General Requirements for Lift Subcontractor

This specification covers supply, install, clean, test and commission of the complete Lift system for the Durban Depot Upgrade. All work shall be carried out to the complete satisfaction of the client and engineers.

All equipment shall meet the performance criteria as detailed in this specification, and the relevant schedules, drawings and BOQs. All equipment is to be priced as per the schedules and BOQs but options on equal and approved suppliers and equipment can be provided.

THE LIFT CONTRACTOR IS RESPONSIBLE FOR PROVIDING THE STRUCTURAL AND PRINCIPAL CONTRACTORS WITH THE REQUIRED OPENING AND OTHER BUILDERSWORK REQUIREMENTS FOR THE LIFT. THIS INCLUDES THE VENTILATION REQUIREMENTS.

14.2 Subcontractor Responsibility and System Coordination


The Lift system Subcontractor shall be responsible for the detailed design, supply, installation, testing, commissioning and free maintenance during the guarantee period of the installation detailed in this Specification and on the accompanying drawings, schedules and BOQs.

The Lift Subcontractor shall provide all materials, equipment, labour and services necessary for the complete, safe and efficient operation of the air conditioning and ventilation installations in accordance with the intent of this Specification and Drawings.

This specification and accompanying layouts, schedules and BOQs detail the requirements of the Lift Subcontractor in terms of the Lift installation. Coordination of the relevant elements of the installation that interface with the various other installations (Drainage, LIFT, Power, etc.) is the responsibility of the Lift Subcontractor. The Lift Subcontractor is to liaise with the Principal Contractor to ensure all interfacing elements have been priced for and if not, provide the Principal Contractor with the relevant details to allow these to be priced for.

Specific areas to verify (but not limited to):

- Power Supply to Lift system:
 - a. This is to be supplied by the electrical subcontractor and the Principal Contractor is to verify that all power requirements for this installation have been priced for. Should this not be the case, the Principal Contractor is to price for the outstanding items in line with this Tender.
- Builderswork Required

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- a. This is to be provided by the civil/structural subcontractor and the Principal Contractor is to verify that all requirements for this installation have been priced for. Should this not be the case, the Principal Contractor is to price for the outstanding items in line with this Tender.

14.3 Exclusions

The following although associated with the LIFT installation will be provided free of charge by others. This is subject to the above requirements for coordination and pricing:

14.4 Builders Work Items

These items should be provided by the Principal Contractor. The Lift Subcontractor is to verify if this is the case. The Lift Subcontractor is responsible for producing and coordinating the builders' work drawings required to inform the Principal Contractor of the requirements.


- Provision of the lift shaft
- Provision of all in shaft requirements that will be installed by the principal contractor
- Provision of openings in walls, floors and roofs during initial building construction only.
- Building in of pipe sleeves and steel frames for the passage of pipes, and other built-in equipment.
- Supply and installation of all access doors and panels to plant areas and shafts for installation and maintenance.
- Sealing of holes in walls and floors around pipes.
- Where cables or pipes pass through holes in floors, walls or partitions which are fire barriers, the openings shall be sealed by the builder with vermiculite plaster or other approved non-flammable equivalent for the full thickness of the floor or wall.
- Painting of walls and ceilings in the plantrooms.

14.5 Electrical Contractor's Item

Supply of the required 3 phase, 380/220 Volt, 50 Hz electrical supplies to the Lift. The Lift Contractor shall terminate and connect those supplies to the terminals of the main isolator of the respective boards.

14.6 List of Free issue elements to Principal Contractor for review

In line with the above requirements, the Lift Contractor is to issue a list of all the expected free issue items to the Principal Contractor to ensure these are picked up. This list is to also form part of the Lift Contractors Submission.

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14.7 Omissions

Not all equipment for the successful completion of the project will have been described in the specification. Where this is the case, the contractor must follow accepted good practice of a high standard to the satisfaction of the Engineer.

14.8 Additional Documentation

This section of the specification relates to the manufacture, delivery to site and installation of the HVAC system. To ensure a fully coordinated installation, this Specification is to be read in Conjunction with drawings.

14.9 General Specification

The purpose of the lift installation is to provide the disabled users of the building with access to both floors of the building. The lift is to do this in an efficient manner using the robust motor room less technology.


The lift will be a standalone supplier constructed platform lift including shaft and lift box. The shaft will be steel and glass and will mount to the structure as required. The lift will be installed in the shaft.

14.10 Contractor Coordination

This specification details the requirements of the main Contractor in terms of the lift installation. Coordination of the purchasing of the relevant elements of the installation from different sources (Ventilation, Power, etc.) is the responsibility of the Contractor. The Contractor is to ensure that all requirements, whether by the lift installer, the electrical installer or any other party are purchased under this specification and installed as required by the relevant parties.

Specific areas of concern (but not limited to):

- Power to all lift plant:
 - a. This need to be supplied by the electrical sub/contractor and the Principal Contractor is to verify that all power requirements for this installation have been priced for. Should this not be the case, the Principal Contractor is to price for the outstanding items in this Tender.
- Power to shaft lighting and shaft lighting:
 - a. This need to be supplied by the electrical sub/contractor and the Principal Contractor is to verify that all power requirements for this installation have been priced for. Should this not be the case, the Principal Contractor is to price for the outstanding items in this Tender.

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14.11 Design Parameters

The system is to be designed and installed to meet all the requirements of the following:

- SANS 10400 Part T – Fire protection
- SANS 10400 Part S – Facilities for disabled persons
- SANS 1545 – Lifts with person with disabilities
- SANS 50081 – Electric installation of lifts
- Other applicable SANS regulations
- All other technical manuals and guides that may be applicable.
- The car must be installed to allow disabled access as per the SANS requirements above
- The car must also be able to carry a wheelchair from the ground to the first floor as required.

14.12 General Requirements

The Lift installation is to provide access from the ground floor the mezzanine floor for all disabled users. The lift installation will serve the following floors:

	Travel (The exact floor to floor is to be confirmed by the Contractor)
Ground Floor	+0
Mezz floor level	+4m

Table 14-1Lift Installation Requirements

The lifts will be installed in the locations shown on the Architects Layouts.


14.12.1 Lift Shaft

The lift shaft will be an integral part of the lift provided. The manufacturer will provide all the lift shaft requirements for the lift.

The shaft must be a combination of steel and glass to allow visibility of the lift and person as they move up and down. The walls of the shaft will be glass as far as is practicable. Glazing must be continuous and visible from ground up to first floor.

Shaft dimensions	
Width[mm]	1380
Depth[mm]	1300
Pit depth[mm]	200
Headroom[mm]	4145

Table 14-2 Lift Shaft Dimensions

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The Contractor is to ensure that they are fully aware of the structural requirements for the lift and are to ensure that all structural requirements are checked by the structural engineer. This coordination is to happen as soon as possible to ensure the lift requirements are cast into the lift shaft as required.


14.12.2 Platform Design

The landing doors will open outwards from the shaft and are swing door type doors and will be a minimum of 800 wide.

The “Car” is in essence a platform that rises in the lift shaft and houses all the control for the lift.

Lighting in the car will be provided by LED downlights behind a vandal resistant roof panel.

Lift 1		
Type:		2-person, platform lift
Drive		TBC
No of Lifts:		1
Load:	[kg]	450 kg
Travel:	[m]	4m (approximately)
Stops/entrances:		2 opposing
Platform		
Access sides		2
Width	[mm]	800
Depth	[mm]	1217
Wall finish		Stainless Steel, with handrail and control panel
Floor finish		Rubber, vinyl
Handrail		Stainless steel back and sides
Shaft		
Type		Proprietary shaft installed as package with platform. Shaft to be a combination of metal and glass allowing visibility from inside and outside.

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Light fitting/s		Recessed LED downlight in shaft ceiling - (with emergency backup)
Ventilation		Statutory
Safety device/s		Infra-red sensors all around entry/exit
Landing Doors		
Landing Doors		Automatic Swing doors
Construction		Glass Panel at least 50% of door full height.
Clear height	[mm]	2070
Clear width	[mm]	800
Safety		
Kick plate		
Control System		
Type		Standard
Location		On platform
Internal Ventilation		Fan
Landings		Call buttons, with call accept lights Pre arrival announcement tone Direction indicator


Table 14-3 Lift Design

14.12.3 Lift Controls

On each Landing there will be a panel that provides the user the ability to call the lift by use of a button. On a floor where either option for up or down is possible, “up” and “down” buttons will be on the panel. On the top and bottom floors, only the relevant “up” or “down” button will be supplied.

The internal control panel will be a very simple and robust control panel. Buttons will be provided that allow for floor selection and LED lights will be provided that indicate this action.

The panel will also contain all necessary emergency information as well as a system by which a person trapped within the lift can call outside to maintenance or management or even emergency services. This can be in the form of a phone, an emergency button and speaker/receiver system, etc.

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The signage for the lift controls is to be agreed with the client before the signage is bought. Initially the samples are to have the following wording:

14.12.3.1 Power and Lighting

Power to the lift and lift shaft is to be provided as required by the Lift installer. The Lift Installer / supplier is to provide the required isolator for the electrical installation. Cabling will be supplied by the Electrical Subcontractor.

Shaft Lighting will use 10W LED spotlights or tubes located at each floor to provide lighting for maintenance purposes. These will be switched as required by the lift manufacturer. These will be powered from a distribution board installed by the lift contractor at the top of the lift shaft. This board will be fed from the nearest sub board and all light fittings and wiring will be provided and installed by the lift contractor

14.13 Fire Safety

As required by the Rational Fire design. Lift will return to ground floor on alarm activation. First floor door will lock, and ground floor door will remain unlocked.

Signage on the outside and inside of the lift will state that “lift is not to be used in the event of a fire”

14.14 Workmanship

A very high level of workmanship will be required in this instance to ensure that the installation is vandal resistant.

All joints must be full closed to ensure that no sharp objects can be pushed inside.


14.15 Testing and Commissioning

The lift is to be fully tested and commissioned at least 1 month prior to Taking-Over of the full works to ensure that any defects will be fixed before the building is handed over.

The Contractor shall test the lift installation prior to commissioning in accordance with the requirements of the applicable SANS and EN standard and the equipment manufacturer’s / supplier’s recommendations.

The Contractor shall notify the Engineer timeously, prior to testing and commissioning, in order that the Engineer may witness such tests as he chooses. The Engineer requires, in any event, to witness the following tests and commissioning:

- Operational Tests
- Load Tests
- Safety Tests

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14.16 Submittals

The Contractor is to provide the Design Team with a full set of coordinated information regarding the installation of the lift. This will include (but is not limited to):

- Full set of installation drawings
- Installation Programme
- Commissioning and Testing Programme
- Full set of lift details as seen on 4.4.2

14.17 Contractor General Requirements

14.17.1 Shop drawings and samples

The LIFT Subcontractor shall within a period of two weeks of receipt of documentation verifying his appointment submit to the Engineer all shop drawings and samples as requested by the Engineer. The drawings shall be submitted with reasonable promptness and in an orderly sequence to cause no delay to the works.

By preparation and submission of the shop drawings, the LIFT Subcontractor shall be deemed to have determined and verified all field dimensions, materials, catalogue numbers etc. In terms of the project programme, the LIFT Subcontractor shall allow the Engineers two calendar weeks for scrutiny of drawings.

The LIFT Subcontractor shall submit electronic copies of all shop drawings to the Engineer for approval before commencement of work.

No portion of the work requiring approval of shop drawings or samples shall be commenced without the necessary approval of the Engineer.

14.17.2 Operating and maintenance manuals


Operating and maintenance manuals are to be prepared by the LIFT Subcontractor for all the systems and installations for which they are responsible.

After approval of the manuals by the Engineer, the LIFT Subcontractor shall provide the Engineer with five bound sets and soft copy CD ROM of MS Word, Excel and AutoCAD files.

Manufacturer's catalogue information shall be scanned and saved to disc in "JPEG" format at a rate of compression to be clearly legible.

The CD ROM copy shall read as a catalogue with drawing files separated and all files properly indexed not, as a random assortment of files.

The contract will not be accepted as complete until these have been supplied, complete and to the satisfaction of the Engineer.

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The LIFT Subcontractor shall include for professional assistance in preparation of the above if necessary.

14.17.3 Guarantee and maintenance

The entire installation shall be guaranteed against defect or faulty workmanship for a period of twelve months, from date of acceptance of the installation by the Engineer.

The LIFT Subcontractor shall service and maintain the installation for a period of twelve months from acceptance of the installation by the Engineer.

The various items of equipment shall be serviced and maintained in strict accordance with the requirements of the respective suppliers of the equipment.

Contractors shall include, in their tender prices, for travelling, labour, consumable, oils, lubricants, refrigerants, chemicals, tools, filters, etc. necessary for the successful implementation of the maintenance programme.

Contractors shall allow for monthly maintenance visits over the 12-month period.

The LIFT Subcontractor shall implement and maintain maintenance/servicing register for the duration of the maintenance and guarantee period.

A record of each maintenance visit shall be forward to the Engineer after each visit.

At the end of the guarantee period the LIFT Subcontractor shall hand over to the Client a full set of any special tools or instruments required for the continued maintenance of the installation.

14.17.4 Labelling

All items of equipment and plant shall be labelled.

All labels shall be in English.

Labels shall be of engraved aluminium be securely fixed by screws or rivets.

Lettering shall be block capitals in a minimum size of 8mm.

14.17.5 Intumescent painting

All services penetrations shall be fire sealed.


The LIFT Subcontractor shall identify, on drawings, where his services penetrate floor slabs and fire barriers and furnish these to the Main Contractor.

The Builder will caulk in all services.

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Once services have been caulked in a specialist contractor other than the LIFT Contractor shall apply intumescent paint to cables, ducts, piping etc. where such passes through floor slab and fire barriers.

Before requesting the Engineer to carry out an inspection the LIFT Subcontractor shall satisfy himself that all penetrations relating to his installation have been caulked and fire sealed with intumescent paint.

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15 TECHNICAL SPECIFICATIONS – ELECTRICAL INSTALLATION

15.1 General Requirements for Subcontractor

The Contractor for the principal contract shall submit additional information regarding the installer of the Electrical Installation together with the returnable enclosed with the tender enquiry documents.

The Contractor, on acceptance of his tender for the principal contract shall submit within the period stated, the information indicated on the forms following immediately after the Summary of the bills of quantities for this installation.

After completion of the works and before Taking-Over is taken, a full test shall be carried out on the installation for a period of sufficient duration to determine the satisfactory working thereof. During this period the installations will be inspected, and the Contractor shall make good, to the satisfaction of the client's Representative/Agent, any defects which may arise.

The Contractor shall provide all instruments and equipment required for testing and any water, power and fuel required for the commissioning and testing of the installations at completion.

15.2 Maintenance of Installations


With effect from the date of the Taking-Over Certificate the Contractor shall at his own expense undertake the regular servicing of the installation during the maintenance period and shall make all adjustments necessary for the correct operation thereof.

If during the said period the installations is not in working order for any reason for which the Contractor is responsible, or if the installations develop defects, he shall immediately upon being notified thereof take steps to remedy the defects and make any necessary adjustments.

Should such stoppages however be so frequent as to become troublesome, or should the installations otherwise prove unsatisfactory during the said period the Contractor shall, if called upon by the client Representative/Agent or the Client, at his own expense replace the whole of the installations or such parts thereof as the client Representative/Agent or the Client may deem necessary with apparatus specified by the client Representative/Agent or the Client.

15.3 General Description

After completion of the works and before Taking-Over, a full test shall be carried out on the installation for a period of sufficient duration to determine the satisfactory working thereof. During this period the installations will be inspected, and the Contractor shall make good, to the satisfaction of the client's Representative/Agent, any defects which may arise.

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15.4 Maintenance of Installations

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Should such stoppages however be so frequent as to become troublesome, or should the installations otherwise prove unsatisfactory during the said period the Contractor shall, if called upon by the client Representative/Agent or the Client, at his own expense replace the whole of the installations or such parts thereof as the client Representative/Agent or the Client may deem necessary with apparatus specified by the client Representative/Agent or the Client.

15.5 Regulations

The installation shall be erected and tested in accordance with the following Acts and regulations:

- The latest issue of SANS 10142; “Code of Practice for the Wiring of Premises”,
- SANS 10114-1: Code of practice for interior lighting
- SANS 10114-2: Code of practice for emergency lighting
- SANS 204: Energy Efficiency in Buildings
- SANS 10313: The protection of structures against lightning
- SANS 62305 – Series 1 to 4: Protection against lightning
- SANS 10199: The design and installation of earth rods
- SANS 1063: Earth rods, couplers and connectors
- SANS 10139: Fire detection and alarm systems for buildings – System design, installation and servicing
- SANS 10400 – Part T
- SANS 10389: Part 1 Exterior lighting – Artificial lighting of exterior areas for work and safety
- SANS 10389: Part 3 Exterior lighting – Guide on limitation of the effects of obtrusive light from outdoor lighting installations.
- SANS 10400: The Application of The National Building Regulations

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- SANS 556-1: Low Voltage Switchgear Part 1 – Circuit Breakers
- The Occupational Health and Safety Act, 1993 (Act 85 of 1993) as amended,
- The Local Government Act 1998 (Act 10 of 1998 (Gauteng)) as amended and the municipal by- laws and any special requirements of the local supply authority.
- The Fire Brigade services Act 1993 Act 2000 (Act 14 of 2000) as amended,
- The National Building Regulations and Building Standards Act 1996 (Act 29 of 1996) as amended,
- The Post Office Act 1998 (Act 124 of 1998) as amended,
- The Electricity Act 1996 (Act 88 of 1996) as amended and
- The Regulations of the Local Gas Board where applicable.

15.6 Notices and Fees

The Contractor shall give all notices required by and pay all necessary fees, including any inspection fees, which may be due to the local Supply Authority.

On production of the official account, only the net amount of the fee charged by the Supply Authority for connection of the installation to the supply mains, will be refunded to the Contractor by the Client.

15.7 Schedule of Fittings

In all instances where schedule of light, socket outlet and power points are attached to or included on the drawings, these schedules are to be regarded as forming part of the specification.

15.8 Quality of Materials

Only materials of first-class quality shall be used, and all materials shall be subject to the approval of the client Representative/ Agent or the Client. The specifications for various materials to be used on this Contract are attached to and form part of this specification.

Wherever applicable the material is to comply with the relevant South African National Standards, specifications, or to British Standard Specifications, where no SANS Specifications exist.

Materials wherever possible, must be of South African manufacture.

15.9 Conduit and Accessories

The type of conduit and accessories required for the service, i.e. whether the conduit and accessories shall be of the screwed type, plain-end type or of the non-metallic type and whether metallic conduit shall be black enamelled or galvanized, is specified in Part 3 of this specification.

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Unless other methods of installation are specified for certain circuits, the installation shall be in conduit throughout. No open wiring in roof spaces or elsewhere will be permitted.

The conduit and conduit accessories shall comply fully with the applicable SANS specifications as set out below and the conduit shall bear the mark of approval of the South African National Standards.

- Screwed metallic conduit and accessories: SABS 1065, parts 1 and 2.
- Plain-end metallic conduit and accessories: SABS 1065, Parts 1 and 2
- Non-metallic conduit and accessories: SABS 950

All conduit fittings except couplings, shall be of the inspection type. Where cast metal conduit accessories are used, these shall be of malleable iron. Zinc base fittings will not be allowed.

Bushes used for metallic conduit shall be brass and shall be provided in addition to locknuts at all points where the conduit terminates at switchboards, switchboxes, draw-boxes, etc.

Draw-boxes are to be provided in accordance with the "Wiring Code" and wherever necessary to facilitate easy wiring.

For light and socket outlet circuits, the conduit used shall have an external diameter of 20mm. In all other instances the sizes of conduit shall be in accordance with the "Wiring Code" for the specified number and size of conductors, unless otherwise directed in part 3 of this specification or indicated on the drawings.

Only one manufactured type of conduit and conduit accessories will be permitted throughout the installation.

Running joints in screwed conduit are to be avoided as far as possible and all conduit systems shall be set or bent to the required angles. The use of normal bends must be kept to a minimum with exception of larger diameter conduits where the use of such bends is essential.

All metallic conduits shall be manufactured of mild steel with a minimum thickness of 1,2mm for plain- end conduit and 1,6mm in respect of screwed conduit.

Under no circumstances will conduit having a wall thickness of less than 1,6mm be allowed in screeding laid on top of concrete slabs.

Bending and setting of conduits must be done with special bending apparatus manufactured for the purpose and which are obtainable from the manufacturers of the conduit systems. Damage to conduit resulting from the use of incorrect bending apparatus or methods applied must on indication by the client's representative or agent, be completely removed and rectified and any wiring already drawn into such damaged conduits must be completely renewed at the Contractor's expense.

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Conduit and conduit accessories used for flame-proof or explosion proof installations and for the suspension of luminaires as well as all load bearing conduit shall in all instances be of the metallic screwed type.

All conduit and accessories used in areas within 50 km of the coast shall be galvanized to SABS 763.

Contractors must ensure that general approval of the proposed conduit system to be used is obtained from the local electricity supply authority prior to the submission of their tender. Under no circumstances will consideration be given by the client to any claim submitted by the Contractor, which may result from a lack of knowledge regarding the supply authority's requirements.

15.9.1 Conduit In Roof Spaces

Conduit in roof spaces shall be installed parallel or at right angles to the roof members and shall be secured at intervals not exceeding 1,5m by means of saddles screwed to the roof timbers.

Nail or crampets will not be allowed.

Where non-metallic conduit has been specified for a particular service, the conduit shall be supported and fixed with saddles with a maximum spacing of 450 mm. The Contractor shall supply and install all additional supporting timbers in the roof space as required.

Under flat roofs, in false ceilings or where there is less than 0,9m of clearance, or should the ceilings be insulated with glass wool or other insulating material, the conduit shall be installed in such a manner as to allow for all wiring to be executed from below the ceilings.

Conduit runs from distribution boards shall, where possible terminate in fabricated sheet steel draw- boxes installed directly above or near the boards.

15.9.2 Surface Mounted Conduit

Wherever possible, the conduit installation is to be concealed in the building work; however, where unavoidable or otherwise specified under Part 3 of the specification, conduit installed on the surface must be plumbed or levelled and only straight lengths shall be used.

The use of inspection bends is to be avoided and instead the conduit shall be set uniformly and inspection coupling used where necessary.

No threads will be permitted to show when the conduit installation is complete, except where running couplings have been employed.

Running couplings are only to be used where unavoidable and shall be fitted with sliced couplings as a lock nut.

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Conduit is to be run on approved spaced saddles rigidly secured to the walls.

Alternatively, fittings, tees, boxes, couplings etc., are to be cut into the surface to allow the conduit to fit flush against the surface. Conduit is to be bedded into any wall irregularities to avoid gaps between the surface and the conduit.

Crossing of conduits is to be avoided, however, should it be necessary purpose-made metal boxes are to be provided at the junction. The finish of the boxes and positioning shall be in keeping with the general layout.

Where several conduits are installed side by side, they shall be evenly spaced and grouped under one purpose-made saddle.

Distribution boards, draw-boxes, industrial switches and socket outlets etc., shall be neatly recessed into the surface to avoid double sets.

In situations where there are no ceilings the conduits are to be run along the wall plates and the beams. Painting of surface conduit shall match the colour of the adjacent wall finishes.

Only approved plugging materials such as aluminium inserts, fibre plugs, plastic plugs, etc., and round-head screws shall be used for fixing saddles, switches, socket outlets, etc., to walls, wood plugs and the plugging in joints in brick walls are not acceptable.

15.9.3 Conduit In Concrete Slabs


In order not to delay building operations the Contractor must ensure that all conduits and other electrical equipment which are to be cast in the concrete columns and slabs are installed in good time.

The Contractor shall always have a representative in attendance when the casting of concrete takes place.

Draw-boxes, expansion joint boxes and round conduit boxes are to be provided where necessary. Sharp bends of any nature will not be allowed in concrete slabs. Draw and/or inspection boxes shall be grouped under one common cover plate and must preferably be installed in passages or male toilets.

All boxes, etc., are to be securely fixed to the shuttering to prevent displacement when concrete is cast. The conduit shall be supported and secured at regular intervals and installed as close as possible to the neutral axis of concrete slabs and/or beams.

Before any concrete slabs are cast, all conduit droppers to switchboards shall be neatly spaced and rigidly fixed.

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15.10 Flexible Connections for Connecting Up of Stoves, Machines, Etc.

Flexible tubing connections shall be of galvanised steel construction, and in damp situations of the plastic sheathed galvanised steel type. Other types may only be used subject to the prior approval of the client's site electrical representative.

Connectors for coupling onto the flexible tubing shall be of the gland or screw-in types, manufactured of either brass or cadmium or zinc plated mild steel, and the connectors after having been fixed onto the tubing, shall be durable and mechanically sound. Aluminium and zinc alloy connectors will not be acceptable.

15.11 Wiring:

Except where otherwise specified in Part 3 of this specification, wiring shall be carried out in conduit throughout. Only one circuit per conduit will be permitted.

No wiring shall be drawn into conduit until the conduit installation has been completed and all conduit ends provided with bushes. All conduits to be clear of moisture and debris before any wiring is commenced.

Unless otherwise specified in Part 3 of this specification or indicated on the service drawings, the wiring of the installation shall be carried out in accordance with the "Wiring Code". Further to the requirements concerning the installation of earth conductors to certain light points as set out in the "Wiring Code", it is a specific requirement of this document that where plain-end metallic conduit or non-metallic conduit has been used, earth conductors must be provided and drawn into the conduit with the main conductors to all points, including all luminaires and switches throughout the installation.

Wiring for lighting circuits is to be carried out with 1,5mm² conductors and a 1,5mm²-earth conductor. For socket outlet circuits the wiring shall comprise 2.5mm² conductors and a 2,5mm²-earth conductor. In certain instances, as will be directed in Part 3 of this specification, the sizes of the conductors may be increased for specified circuits. Sizes of conductors to be drawn into conduit in all other instances, such as feeders to distribution boards, power points etc., shall be as specified elsewhere in this specification or indicated on the drawings. Sizes of conductors not specified must be determined in accordance with the "Wiring Code".

The loop-in system shall be followed throughout, and no joints of any description will be permitted.

The wiring shall be done in PVC insulated 600/1000 V grade cable to SABS 150.

Where cable ends connect onto switches, luminaires etc., the end strands must be neatly and tightly twisted together and firmly secured. Cutting away of wire strands of any cable will not be allowed.

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All switches and switch-socket outlet combination units shall conform to the Project Technical Specifications, which form part of this specification.

No other than 16A 3 pin sockets are to be used, unless other special purpose types are distinctly specified or shown on the drawings.

All light switches shall be installed at 1,4m above finished floor level and all socket outlets as directed in the Schedule of Fittings which forms part of this specification or alternatively the height of socket outlets may be indicated on the drawings.

15.11.2 Switchgear

Switchgear, which includes circuit breakers, iron-clad switches, interlocked switch-socket outlet units, contactors, time switches, etc., is to be in accordance with the Project Technical Specifications which form part of this specification and shall be equal and similar in quality to such brands as may be specified.

For uniform appearance of switchboards, only one approved make of each of the different classes of switchgear mentioned in the Project Technical Specifications shall be used throughout the installations.

15.11.3 Switchboards

All boards shall be in accordance with the types as specified, be constructed according to the detail or type drawings and must be approved by the client Representative/ Agent before installation.

In all instances where provision is to be made on boards for the supply authority's main switch and/or metering equipment the contractor must ensure that all requirements of the authorities concerned in this respect are met.

Any construction or standard type aboard proposed, as an alternative to that specified must have the prior approval of the client Representative/ Agent.

All busbars, wiring, terminals, etc., are to be adequately insulated and all wiring is to enter the switchgear from the back of the board. The switchgear shall be mounted within the boards to give a flush front panel. Cable and boxes and other ancillary equipment must be provided where required.

Clearly engraved labels are to be mounted on or below every switch. The working of the labels in English is to be according to the lay-out drawings or as directed by the client's Representative/ Agent and must be confirmed on site. Flush mounted boards to be installed with the top of the board 2,0m above the finished floor level.

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Except in the case of electrical installations supplied by a single-phase electricity supply at the point of supply, an accredited person shall exercise general control over all electrical installation work being carried out.

The workmanship shall be of the highest grade and to the satisfaction of the client Representative/ Agent and the Client.

All inferior work shall, on indication by the client's inspecting officers, immediately be removed and

rectified by and at the expense of the Contractor.

15.13 Certificate Of Compliance

On completion of the service, a certificate of compliance must be issued to the client's

Representative/Agent in terms of the Occupational Health and Safety Act, 1993 (Act 85 of 1993).

15.14 Earthing Of Installation**15.14.1 Main earthing**

The type of main earthing must be as required by the supply authority, and in any event as directed by the Client's representative, who may require additional earthing to meet test standards.

Where required an earth mat shall be provided, the minimum size, unless otherwise specified, being 1,0m x 1,0m and consisting of 4mm diameter hard-drawn bare copper wires at 250mm centres, brazed at all intersections. Alternatively, or additionally earth rods or trench earths may be required as specified or directed by the Client's authorised representative.

Installations shall be effectively earthed in accordance with the "Wiring Code" and to the requirements of the supply authority. All earth conductors shall be stranded copper with or without green PVC insulation.

Connection from the main earth bar on the main board must be made to the cold water main, the incoming service earth conductor, if any and the earth mat or other local electrode by means of 12mm x 1,60 mm solid copper strapping or 16 mm² stranded (not solid) bare copper wire or such conductor as the Client's representative may direct. Main earth copper strapping was installed below 3m from ground level, must be run in 20 mm diameter conduit securely fixed to the walls.

All other hot and cold-water pipes shall relate to 12mm x 0,8mm perforated for solid copper strapping (not conductors) to the nearest switchboard. The strapping shall be fixed to the

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pipework with brass nuts and bolts and against walls with brass screws at 150-mm centres. In all cases where metal water pipes, down pipes, flues, etc., are positioned within 1,6m of switchboards an earth connection consisting of copper strapping shall be installed between the pipework and the board. In vertical building ducts accommodating both metal water pipes and electrical cables, all the pipes shall be earthed at each distribution board.

15.14.2 Roofs, gutters, and down pipes

Where service connections consist of overhead conductors, all metal parts of roofs, gutters and down pipes shall be earthed. One bare 10mm² copper conductor shall be installed over the full length of the ceiling void, fixed to the top purlin and connected to the main earth conductor and each switchboard. The roof and gutters shall be connected at 15m intervals to this conductor by means of 12mm X 0,8mm copper strapping (not conductors) and galvanised bolts and nuts. Self-tapping screws are not acceptable. Where service connections consist of underground supplies, the above requirements are not applicable.

15.14.3 Sub-distribution boards

A separate earth connection shall be supplied between the earth busbar in each sub-distribution board and the earth busbar in the Main Switchboard. These connections shall consist of a bare or insulated stranded copper conductor installed along the same routes as the supply cables or in the same conduit as the supply conductors. Alternatively armoured cables with earth continuity conductors included in the armouring may be utilised where specified or approved.

15.14.4 Sub-circuits

The earth conductors of all sub-circuits shall be connected to the earth busbar in the supply board in accordance with SANS 10142-1 as amended.


15.14.5 Ring Mains

Common earth conductors may be used where various circuits are installed in the same wire way in accordance with SANS 10142-1. In such instances the sizes of earth conductors shall be equivalent to that of the largest current carrying conductor installed in the wire way, alternatively the size of the conductor shall be as directed by the Engineer. Earth conductors for individual circuits branching from the ring main shall be connected to the common earth conductor with T-ferrules or soldered. The common earth shall not be broken.

15.14.6 Non-metallic Conduit

Where non-metallic conduit is specified or allowed, the installation shall comply with the Project Technical Specification for "conduit and conduit accessories".

Standard copper earth conductors shall be installed in the conduits and fixed securely to all metal appliances and equipment, including metal switch boxes, socket-outlet boxes, draw-

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boxes, switchboards, luminaires, etc. The securing of earth conductors by means of self-threading screws will not be permitted.

15.14.7 Flexible Conduit

An earth conductor shall be installed in all non-metal's flexible conduits. This earth conductor shall not be installed externally to the flexible conduit but within the conduit with the other conductors. The earth conductor shall be connected to the earth terminals at both ends of the circuit.

15.14.8 Connection

Under no circumstances shall any connection points, bolts, screws, etc., used for earthing be utilised for any other purpose. It will be the responsibility of the Contractor to supply and fit earth terminals or clamps on equipment and materials that must be earthed where these are not provided.

Unless earth conductors are connected to proper terminals, the end shall be tinned and lugged.

15.15 Mounting and Positioning of Luminaires

The Contractor is to note that in the case of board and acoustic tile ceilings, i.e. as opposed to concrete slabs, close co-operation with the building contractor is necessary to ensure that as far as possible the luminaires are symmetrically positioned about the ceiling pattern.

The layout of the luminaires as indicated on the drawings must be adhered to as far as possible and must be confirmed with the Client's representative.

Fluorescent luminaires installed against concrete ceilings shall be screwed to the outlet boxes and in addition 2 x 6mm expansion or other approved type fixing bolts are to be provided. The bolts are to be $\frac{3}{4}$ of the length of the luminaires apart.


Fluorescent luminaires to be mounted on board ceilings shall be secured by means of two 40mm x No. 10 round head screws and washers. The luminaires shall also be bonded to the circuit conduit by means of locknuts and brass bushes. The fixing screws are to be placed $\frac{3}{4}$ of the length of the fitting apart.

Earth conductors must be drawn in with the circuit wiring and connected to the earthing terminal of all fluorescent luminaires as well as other luminaires exposed to the weather in accordance with the "Wiring Code".

15.16 Installation Details

15.16.1 Cable Sleeve Pipes

Where cables cross under roadways, other services and where cables enter buildings, the cables shall be installed in sleeves, earthenware or high-density polyethylene pipes.

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The ends of all sleeves shall be sealed with a non-hardening watertight compound after the installation of cables. All sleeves intended for future use shall likewise be sealed.

15.16.2 Notices

The Contractor shall issue all notices and make the necessary arrangements with Supply Authorities and other authorities as may be required with respect to the installation.

15.16.3 Electrical Equipment

All equipment and fittings supplied must be in accordance with the attached Project Technical Specification (Part 4 of this document), suitable for the relevant supply voltage, and frequency and must be approved by the Client's representative.

15.16.4 Drawings

The drawings generally show the scope and extent of the proposed work and shall not be held as showing every minute detail of the work to be executed.

The position of power points, switches and light points that may be influenced by built-in furniture must be established on site, prior to these items being built in.

15.16.5 Balancing Of Load

The Contractor is required to balance the load as equally as possible over the multiphase supply.

15.16.6 Service Conditions

All plant shall be designed for the climatic conditions appertaining to the service.

15.16.7 Switches and Socket outlets

The installation of switches and socket outlets must conform to clause 13 of Part 2 of this specification.

15.16.8 Light Fittings and Lamps

The installation and mounting of luminaires must conform to clause 19 of Part 2 of this specification.

All fittings to be supplied by the Contractor shall comply with the Client's Specification.
Incandescent

lamps shall bear the approved mark of the S.A.B.S. and shall have the British light centre length. The light fittings must be of the type specified in the Schedule of Light Fittings.

15.16.9 Earthing and Bonding

The Contractor will be responsible for all earthing and bonding of the building and installation. The earthing and bonding are to be carried out strictly as described in clause 18 of Part 2 of this specification and to the satisfaction of the Client's representative.

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All interruptions of the electrical supply that may be necessary for the execution of the work will be subject to prior arrangement between the Contractor and the user of the site or building and the Client's representative.

15.16.11 Extent of Work

The scope of the Electrical Sub-contract Works includes the low voltage reticulation and distribution, lighting, small power, lightning protection system, lightning protection system, relocation of some of the existing services, associated services (conduits, wireways, trays, trunking, ducts, manholes, etc.) and all other materials, equipment, labour and services necessary for the complete, safe and efficient operation of the sub-contract Works in full accordance with the specifications as detailed herein, the free maintenance and warranty during the stipulated defects liability period and the preparation and submission of record drawings, operating and maintenance manuals and certificates of compliance.

The electrical contractor shall provide the master electrician to carry out the work in the Chemical Store.

15.16.12 Electrical or Mains Supply

There is an existing electrical supply to site, Durban Yard Lifting Shed. The electrical supply to this project will be taken from the existing electrical supply.

Low Voltage supply to the Durban Lifting Shed facility is currently provided by two 750 kVA transformers installed in "Staging Yard Substation". This substation is situated to the north of the lifting shop at the end of the service road passing the facility.


The substation is supplied at 11 kV via an underground cable network. The first supply originates from

"Train lighting Substation" and the second from "R.T.S Argyle Road Substation".

The Lifting shop is supplied via a low voltage circuit breaker rated at 1 200A (designated "Coach and Wagon Building") connected to the "Staging Yard Substation" low voltage switchboard. The Lifting shop's main LV distribution board is connected to the "Staging Yard" low voltage switchboard via an underground cable installed in a duct.

It is our understanding that the "Staging Yard Substation" and its electrical assets are owned and operated by Transnet Freight Rail. Any changes that may be required, will have to be approved by them prior to implementation.

A new LV main board will be installed at the Lifting Shop Extension part of the building. New XLPE single core cables will be terminated onto the existing 1200A low voltage circuit breaker, currently supplying the Lifting Shed LV main board. This breaker will now supply the

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new LV main board. The new LV main board will then supply the existing LV main board. The single core cables will be installed in sleeves or ducts.

When electrical reticulation switch-over is done, power interruption will be kept to a minimum. Prior work which includes installation of single cores cables between the substation and the new LV main board, making off terminations, and installation of the new LV main board, will be completed first.

15.16.13 Low Voltage (LV) Reticulation

Low voltage reticulation and distribution board designs covered by the scope of work include, but are not limited, to the following.

- Supply and installation of a new LV main board in the Lifting Shop Extension.
- Supply and install new cable ladders, trays, trunking and welded wire mesh basket as shown on layout drawings.
- Install DBs in various buildings as per layout drawings.
- Install LV reticulation cables from the new LV main board to Office Ground Floor DB, and from Office Ground Floor DB to all other DBs forming part of this project.
- Install LV reticulation cables from the standby power main DB to LV main DB.
- Install LV reticulation cables from LV main board to Office Ground Floor DB, and from the Office Ground Floor DB to all other DBs forming part of this project.
- Supply and install sleeves and manholes for electrical systems reticulation, telecommunications systems and security systems.
- Installation of LV reticulation cables from various DBs to mechanical plant, HVAC, shore supply, lifting jacks, water pumps, etc.
- All low voltage reticulation cables shall be manufactured to SANS 1507 – 1990 and shall have stranded copper conductors with PVC insulation, PVC bedding, steel wire armouring, earth continuity conductor and PVC sheathing.
- All electrical distribution boards shall be manufactured by a reputable company, with relevant experience in the manufacturing of electrical distribution boards, control panels, etc. The colour coding of the distribution boards shall be as follows.
- Frame (Outer and Inner) – Electric Orange: RAL 2003 (Electric Orange)
- Normal section (DB face plate) – Electric Orange: RAL 2003 (Electric Orange)
- Essential section (DB face plate) – Red: RAL 3020 (Traffic red)
- UPS Section (DB face plate) - Blue: RAL 5005 (Signal blue)

15.16.14 Standby Power Supply

There is an existing standby generator on site. Standby power will be supplied to the essential load. Distribution boards will have two compartments, mains and standby power.

The essential load includes the following.

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- All security systems, CCTV camera and access control systems
- Fire alarm system, ICT and public address systems
- Lighting

In the event of power failure or load shedding, only the essential load will remain operational.

15.16.15 Uninterruptible Power Supply

No UPS will be supplied separately on this project. UPS power for the servers and electronic systems will be supplied with respective systems, installed in racks.

15.16.16 Lighting Installation

The lighting scope of work covers interior lighting, both normal and emergency lighting, and exterior lighting. Interior lighting control is by both conventional light switches and occupancy or motion sensors, depending on the area. Exterior lighting will be provided by light fittings mounted on walls. Lighting control for exterior lighting is by day/ night switches or photocells. Lighting layout shows how different types of light fittings have been used to light up various areas as well as different lighting control mechanisms. Lighting installation shall include but not limited to, the following.

- Installation of new containment or wireways for new lighting installation as indicated on the drawings
- Installation of conductors/ lighting circuits as indicated on the drawings
- Installation of new light fittings as indicated on the drawings
- Light fittings detailed specifications are shown on the schedule of light fittings.
- Lighting will be provided at the Waste area.

15.16.17 Small Power Installation

A provision for small power installation has been made within all the buildings by means of switched socket outlets and isolators. Power installation shall include but not limited the following.

- Installation of new containment or wire ways for new power installation as indicated on the drawings
- Installation of conductors/ power circuits as indicated on the drawings
- Installation of new power socket outlets and isolators as indicated on drawings
- Installation of two compartment PVC power skirting as per small power layout drawings.

15.16.18 Temporary Power Supply

The contractor shall provide a temporary power supply for construction purposes. Furthermore, the contractor shall provide temporary power supply to the end user while construction is underway as may be required.

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A meter shall be installed on the LV Main Board to meter the total power consumption by the Lifting Shop including all the other buildings forming part of this project. A smart meter shall be installed. The smart meter installed shall enable the client to read or see power consumption in real time. The client shall also be able to download information from the smart meter to analyse power quality.

15.16.20 Lightning Protection System

The appointed electrical subcontractor shall appoint the lightning protection specialist to design, supply and install lightning protection system. The design and installation of the lightning protection system shall comply with SANS 10313 and SANS 62303-1 to SANS 62305-3, both standards as amended. Soil resistivity tests will be done and results recorded.

A provisional sum has been allowed for in the bill of material for this system. The appointed electrical contractor shall provide three quotations to the engineer for evaluation and recommendation.

15.16.21 Relocation of Some of the Existing Services


The existing electrical services or installation mounted on the western side wall of the Lifting Shop will need to be relocated. The western side wall will be removed as part of the extension of the Lifting Shop. Relocation of existing services will be done in close liaison with the main contractor. It should be noted that this Lifting Shop is currently in use. Provision of temporary electrical supply will be required during project implementation. This will be done as and when directed so by the engineer. Relocation of existing services or installation will include but not limited to, the following:

- Switch off power supply to the DBs mounted on the western wall of the Lifting Shop.
- Uninstall the services mounted on the western wall.
- The services to be relocated include DBs, cables and cable ladders/ trays, conduits, switches, outlets, etc.
- Install the services at place to be directed so by the engineer.
- Should non-compliance with regulations exist on the current installation mounted on the western wall, compliance with regulations will be ensured as the services are relocated. This may include installing new equipment.

15.16.22 Refurbishment of the Existing Lifting Shop

The existing electrical installation in the Lifting Shop will be refurbished to extend the life of the installation as well as addressing any non-compliances that may exist. Refurbishment of the installation will include but not limited to, the following:

- Replace obsolete and/ or damaged light switches, socket outlets and isolators.
- Replace old technology type light fittings with new LED technology light fittings

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- Inspect and test earthing and bonding and repair where necessary.
- Replace obsolete switchgear on DBs
- Repair or replace DB face plates as may be required.

15.17 Supply And Connection

The supply will be at 400/230 Volt 50Hz.

15.18 Conduit And Wiring

Conduit and conduit accessories shall be galvanized plain end conduit in accordance with SABS 162, 763 and 1007 respectively.

PVC square ducting will be acceptable where exposed – prior approval to be obtained.

All conduits, regardless of the system employed, shall be installed strictly as described in the applicable paragraphs of clauses 4 to 8 of Part 2 of the specification. Wiring of the installation shall be carried out as directed in clause 9 part 2 of this specification.

Where plain end conduit is offered all switches, and light fittings must be supplied with a permanent earth terminal for the connection of the earth wire.

Lugs held by switch fixing screws or self-tapping screws will not be acceptable.

15.18.1 Power Trunking

The Contractor shall be responsible for the supply and installation of all power trunking complete with corner pieces, end pieces, junction pieces, supply conduits, cover plates and power outlets as specified and indicated on the drawings.

The power trunking must comply with SABS 1197. The Contractor must ensure that the power trunking is installed to the satisfaction of the client's representative before commencing with the wiring of the power trunking. The installation of the trunking shall be done as per the manufacturer's requirements.

The power trunking sizes shall be as indicated on the drawings and bill of material.

15.18.2 Power Points


Allow for the installation of power points and equipment as indicated on the layout drawings.

The socket outlets shall comply with SANS 164-1 and SANS 164-2.

15.18.3 Cables

Where necessary, the Contractor shall supply and completely install all distribution cables as indicated in the drawings and listed in the schedule of quantities.

The storage, transportation, handling and laying of the cables shall be according to first class practice, and the contractor shall have adequate and suitable equipment and labour to ensure that no damage is done to cables during such operations.

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On completed installation of cable, the insulation resistance shall be tested to approval with an approved “Megger” type instrument of not less than 500 V for low tension cables.

Earth continuity conductors are to be run with all underground cables constituting part of a low-tension distribution system. Such continuity conductors are to be stranded bare copper of a cross-sectional area equal to at least half that of one live conductor of the cable but shall not be less than 4mm² or more than 70mm². A single earth wire may be used as earth continuity conductor for two or more cables run together, branch earth wires being brazed on where required.

15.19 Distribution Boards

In addition to clause 14 and clause 15 of Part 2 of this specification the following shall also be applicable to switchboards required for this service.

The Contractor shall supply and install new distribution boards as indicated on the drawings and distribution boards’ single line diagram. All distribution boards shall comply with the project technical specification in Part 4 of this specification and be approved by the client’s representative.

15.20 Schedule Of Light Fittings

The light fittings and accessories are to be according to the project technical specifications in Part 4 and shall be approved by the client’s representative. All the suspended light fittings shall be supplied complete with materials necessary for the light fitting’s suspension and the associated electrical wiring. All these shall be included in the light fittings supply and install rates.

Type B: Surface mounted 16W LED bulkhead light fitting. The body of the light fitting shall be powder coated aluminium housing with polymethyl methacrylate (PMMA) diffuser and black trim. The light fitting shall have a minimum colour rendering index of 80+ and colour temperature of 4000K. The light fitting shall be rated IP65. All light fitting components shall carry the SANS or IEC mark. The light fitting shall be Rubicon Lighting Fitting Type Saturn or similar and equivalent, approved.

Type BE: Surface mounted 16W LED bulkhead light fitting supplied complete with battery backup pack. The battery pack shall provide backup power for at least 1 hour at a minimum of 20% of light fitting output. The body of the light fitting shall be powder coated aluminium housing, polymethyl methacrylate (PMMA) diffuser and black trim. The light fitting shall have a minimum colour rendering index of 80+ and colour

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temperature of 4000K. The light fitting shall be rated IP65. All light fitting components shall carry the SANS or IEC mark. The light fitting shall be Rubicon Lighting Fitting Type Saturn or similar and equivalent, approved.

Type D: 10W Recessed downlight LED light fitting. The body shall be powdering coated aluminium with die-cast housing as heatsink. The light fitting shall have external driver and a high transmission polycarbonate (PC) cover. The light fitting shall be white in colour. The light fitting shall have a minimum colour rendering index of 80+ and colour temperature of 4000K. All light fitting components shall carry the SANS or IEC mark and shall comply with SANS 1464-22. The light fitting shall be Rubicon Light Fitting Type AegeonRD100/80/4000/W/10W or similar and equivalent, approved.

Type D1: 20W Recessed downlight LED light fitting. The light fitting shall be dimmable and have a light sensing system for efficient use of energy. The body shall be powder coated aluminium with die-cast housing as heatsink. The light fitting shall have external driver and a high transmission polycarbonate (PC) cover. The light fitting shall be white in colour. The light fitting shall have a minimum colour rendering index of 80+ and colour temperature of 4000K. All light fitting components shall carry the SANS or IEC mark and shall comply with SANS 1464-22. The light fitting shall be Rubicon Light Fitting Type AegeonRD170/80/4000/W/20W or similar and equivalent, approved.

Type H: 47W Surface mounted Zone 2 application, explosion-proof LED light fitting with GRP fiberglass body and injection moulded lens with internal prism. The light fitting shall be suitable for use in hazardous areas, Zones 2, 21 and 22. The light fitting shall have a minimum colour rendering index of 80+ and colour temperature of 4000K. The light fitting shall have an IP rating of IP66 and IK rating of IK08. All light fitting components shall carry the SANS or IEC mark. The light fitting shall be Rubicon Light Fitting Type CHADD or similar and equivalent, approved.

Type HE: 47W Surface mounted Zone 2 application, explosion-proof LED light fitting with GRP fiberglass body and injection moulded lens with

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internal prism. The light fitting shall be supplied complete with a battery backup pack suitable to provide backup power for at least 1 hour at a minimum of 20% of light fitting output. The light fitting shall be suitable for use in hazardous areas, Zones 2, 21 and 22. The light fitting shall have a minimum colour rendering index of 80+ and colour temperature of 4000K. The light fitting shall have an IP rating of IP66 and IK rating of IK08. All light fitting components shall carry the SABS or IEC mark. The light fitting shall be Rubicon Light Fitting Type CHADD or similar and equivalent, approved

Type J: 30W Recessed 600X600mm LED backlit panel light fitting. The light fitting shall be dimmable and have a light sensing system for efficient use of energy. The light fitting body shall be powder coated aluminium with polycarbonate diffuser. The light fitting shall be supplied with a 3m cable + 5amp plug top. The light fitting shall have a flicker-free driver and be white in colour. The light fitting shall have a minimum colour rendering index of 80+ and colour temperature of 4000K. The light fitting shall have an efficacy of 120lm/W and a minimum lumen maintenance of 50 000h (L80B10). All light fitting components shall carry the SANS or IEC mark. The light fitting shall be Rubicon Light Fitting Type Theia or similar and equivalent, approved.

Type JE: 30W Recessed 600X600mm LED backlit panel light fitting. The light fitting shall be supplied complete with a battery backup pack suitable to provide backup power for at least 1 hour at a minimum of 20% of light fitting output. The light fitting shall be dimmable and have a light sensing system for efficient use of energy. The light fitting body shall be powder coated aluminium with polycarbonate diffuser. The light fitting shall be supplied with a 3m cable + 5amp plug top. The light fitting shall have a flicker-free driver and be white in colour. The light fitting shall have a minimum colour rendering index of 80+ and colour temperature of 4000K. The light fitting shall have an efficacy of 120lm/W and a minimum lumen maintenance of 50 000h (L80B10). All light fitting components shall carry the SANS or IEC mark. The light fitting shall be Rubicon Light Fitting Type Theia or similar and equivalent, approved.

Type K: 36W Surface mounted linear LED light fitting. The light fitting shall be dimmable and have a light sensing system for efficient use of energy. The light fitting body shall be a powder coated extruded aluminium

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complete with polymethyl methacrylate (PMMA) opal diffuser and have a minimum lumen maintenance of 54 000h (L90B10). The light fitting shall have a minimum colour rendering index of 80+ and colour temperature of 4000K. All light fitting components shall carry the SANS or IEC mark. The light fitting shall be Rubicon Light Fitting Type Light Frame 55X80/80/4000/880/SUR/W/36W or similar and equivalent, approved.

Type KE: 36W Surface mounted linear LED light fitting. The light fitting shall be dimmable and have a light sensing system for efficient use of energy. The light fitting shall be supplied complete with a battery backup pack suitable to provide backup power for at least 1 hour at a minimum of 20% of light fitting output. The light fitting body shall be a powder coated extruded aluminium complete with polymethyl methacrylate (PMMA) opal diffuser and have a minimum lumen maintenance of 54 000h (L90B10). The light fitting shall have a minimum colour rendering index of 80+ and colour temperature of 4000K. All light fitting components shall carry the SANS or IEC mark. The light fitting shall be Rubicon Light Fitting Type Light Frame 55X80/80/4000/880/SUR/W/36W or similar and equivalent, approved.

Type L: Surface mounted 36W linear vapour-proof LED light fitting with aluminium body and shock and pressure proof polycarbonate diffuser. The light fitting shall have a minimum colour rendering index of 80+ and colour temperature of 4000K. The light fitting shall have an IP rating of IP65 and IK rating of IK10. The light fitting shall have an efficacy of 120lm/W and a minimum lumen maintenance of 50 000h (L80B10). All light fitting components shall carry the SANS or IEC mark. The light fitting shall be Rubicon Light Fitting Type Saxa Tri-proof or similar and equivalent, approved.

Type LE: 36W Surface mounted linear vapour-proof LED light fitting with aluminium body and shock and pressure proof polycarbonate diffuser. The light fitting shall be supplied complete with a battery backup pack suitable to provide backup power for at least 1 hour at a minimum of 20% of light fitting output. The light fitting shall have a minimum colour rendering index of 80+ and colour temperature of 4000K. The light fitting shall have an IP rating of IP65 and IK rating of IK10. The light fitting shall have an efficacy of 120lm/W and a minimum lumen

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maintenance of 50 000h (L80B10). All light fitting components shall carry the SANS or IEC mark. The light fitting shall be Rubicon Light Fitting Type Saxa Tri-proof or similar and equivalent, approved.

Type R: 65W Surface mounted dustproof linear LED light fitting. The light fitting body shall be co-extruded ABS with high impact polymethyl methacrylate PMMA diffuser. The light fitting shall have a minimum colour rendering index of 80+ and colour temperature of 4000K. The light fitting shall have an IP rating of IP54 and IK rating of IK06. The light fitting shall be grey in colour, have a built-in surge protection, and have a minimum lumen maintenance of 50 000h (L90B10). All light fitting components shall carry the SANS or IEC mark. The light fitting shall be Rubicon Light Fitting Type Protega or similar and equivalent, approved.

Type RE: 65W Surface mounted dustproof linear LED light fitting. The light fitting body shall be co-extruded ABS with high impact polymethyl methacrylate PMMA diffuser. The light fitting shall be supplied complete with a battery backup pack suitable to provide backup power for at least 1 hour at a minimum of 20% of light fitting output. The light fitting shall have a minimum colour rendering index of 80+ and colour temperature of 4000K. The light fitting shall have an IP rating of IP54 and IK rating of IK06. The light fitting shall be grey in colour, have a built-in surge protection, and have a minimum lumen maintenance of 50 000h (L90B10). All light fitting components shall carry the SANS or IEC mark. The light fitting shall be Rubicon Light Fitting Type Protega or similar and equivalent, approved.

Type S: 36W Surface mounted dustproof linear LED light fitting. The light fitting body shall be co-extruded ABS with high impact polymethyl methacrylate PMMA diffuser. The light fitting shall be supplied complete with a battery backup pack suitable to provide backup power for at least 1 hour at a minimum of 20% of light fitting output. The light fitting shall have a minimum colour rendering index of 80+ and colour temperature of 4000K. The light fitting shall have an IP rating of IP54 and IK rating of IK06. The light fitting shall be grey in colour, have a built-in surge protection, and have a minimum lumen maintenance of 50 000h (L90B10). All light fitting components shall carry the SANS or

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IEC mark. The light fitting shall be Rubicon Light Fitting Type Protega or similar and equivalent, approved.

Type W: 100W LED highbay light fitting. The light fitting body shall be an aluminium alloy body complete with polycarbonate optical lens. The light fitting shall be black in colour and be suitable to be installed suspended with a chain. The light fitting shall have an efficacy of 153Lm/W and a minimum lumen maintenance of 50 000h (L80B70). The light fitting shall have a minimum colour rendering index of 80+ and colour temperature of 4000K. The light fitting shall have an IP rating of IP54 and IK rating of IK07. All light fitting components shall carry the SANS or IEC mark. The light fitting shall be Rubicon Light Fitting Type Artemis or similar and equivalent, approved.

Type X: 81W Wall mounted LED floodlight light fitting. The light fitting body shall be a marine grade high-pressure die-cast aluminium with glass protector. The light fitting shall be black in colour and be suitable to be installed suspended with a chain. The light fitting shall have an efficacy of 153Lm/W and a minimum lumen maintenance of 50 000h (L80B70). The light fitting shall have a minimum colour rendering index of 80+ and colour temperature of 4000K. The light fitting shall have an IP rating of IP54 and IK rating of IK07. All light fitting components shall carry the SANS or IEC mark. The light fitting shall be Rubicon Light Fitting Type Artemis or similar and equivalent, approved.

Type D: Single sided Emergency Exit Sign complete with 2W LED. The sign shall have an anodized aluminium frame and a glass diffuser. The Exit sign shall have maintained 5-hour battery duration. The fitting shall comply with SANS 1464-22.


Type D: Double sided Emergency Exit Sign complete with 2W LED. The sign shall have an anodized aluminium frame and a glass diffuser. The Exit sign shall have a maintained 5-hour battery duration. The fitting shall comply with SANS 1464-22.

15.21 Schedule Of Power Points

The schedule of power points shall be as shown in the layout drawings.

15.22 Schedule Of Cables, Conduit and Wiring

The schedule of cables, conduit and wiring shall be as shown on drawings, bill of quantities and as specified elsewhere in this specification.

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15.23 Schedule Of Distribution Boards

The indicated fault current rating (kA) is the minimum value that the switchgear must comply with for connecting to the busbars of the respective distribution boards. A clear labelled legend card shall be provided per each distribution board. The distribution boards shall be as shown on the attached single line drawings.

15.24 Summary of Switchgear and Circuits

Switchgear and circuits shall be as shown on distribution boards single line diagrams.

15.25 Builders Work

Builder's work shall include making penetrations through the floor slabs and walls or beams, cutouts on ceilings and making good where there might have been chasing work.

15.26 Project Technical Specification

15.26.1 General Description

This Technical Specification covers the general electrical installation for the Upgrading and Extension of Durban Yard Lifting Shed.

15.26.2 Quality Of Material

Only material of high quality and suitable for the climatic conditions of the site shall be used and shall be subject to approval of the ENGINEER. All material shall conform in respect of quality, manufacture, tests and performance, with the requirements of the SABS or where no such standards exist, conform to the appropriate current Specification of the British Standards Institution. Materials manufactured in South Africa shall as far as possible be used and where applicable shall bear the SABS mark. Imported materials shall comply with the requirements of the appropriate B.S. or I.E.C. specification. All materials shall be suitable for the conditions under which the materials are installed and used. Should the materials or components not be suitable for temporary use under site conditions, then the Domestic Sub-Contractor shall at his own cost provide suitable protection until these unfavourable site conditions cease to exist.


15.26.3 Fixing Of Materials

15.26.3.1 Responsibility

It is the responsibility of the Domestic Sub-Contractor to position and securely fix conduits, trunking, cables and cable ladders, switchboards, fittings and all other equipment or accessories as required for the installation. The Domestic Sub-Contractor shall provide and fix all supports, clamps, brackets, hangers and other fixing materials.

15.26.3.2 Welding

Supports, brackets, hangers, etc. may only be welded to steel structural members where prior permission has been obtained.

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15.26.3.3 Screws and bolts

Where holes in equipment to be fixed already exist, bolts and fixing screws shall be used.

15.26.3.4 Wall plugs

Where the fixing holes in brick or concrete walls are similar than 10mm diam. and where the mass of the equipment is less than 15kg, wall plugs may be used to fix conduits, cables and other equipment. Aluminium, fibre or plastic plugs only may be used. Wooden plugs are not acceptable. Plugs installed in seams between bricks are not acceptable. A masonry drill of the correct size shall be used to drill holes for plugs. Round-headed screws shall be used throughout.

15.26.3.5 Anchor bolts

Where the fixing holes are 10mm and larger or where the mass of the equipment is 15kg or more, equipment shall be fixed by means of expanding anchor bolts.

15.27 Switchboards

15.27.1 Supply of switchboards

The Domestic Sub-Contractor shall supply and install all the boards shown on the drawings.

15.27.2 General

All switchboards shall be of ample size to accommodate all the specified switchgear with allowance of 30% of space for future switchgear.

The Domestic Sub-Contractor shall ascertain the exact position of switchboards and shall arrange timeously for the installation of cable sleeves, openings in the structure and flush draw trays behind switchboards where applicable.

In general wall mounted switchboards shall be mounted 1400mm above finished floor level - measured to the centre of the switchboard. The upper ends of switchboards may not be higher than 2.2 metres above finished floor level.

15.27.2.1 Construction of flush mounted switchboards

Bonding tray

Bonding trays for flush mounted switchboards shall be of rigidly constructed 1.6mm thick galvanized steel, braced and re-enforced. Formed gussets shall be provided at the corners. All the tray joints shall be properly welded. A brass or cadmium plated steel earth connecting stud and nut shall be provided. No flush mounted switchboards shall be installed in walls less than 230mm in thickness.

Architrave frame

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The architrave frame shall be of 1.6mm thick sheet steel with bevelled edges. The architrave frame shall accommodate the chassis, panels and doors. The architrave shall overlap the bonding tray by at least 25mm on each side. The architrave frame shall be fixed to the tray in such a fashion to allow for depth adjustment and irregularities of the wall.

Chassis

The chassis for mounting of switchgear shall be of rigid construction and shall be fixed securely to the architrave frame or bonding tray by means of bolts screwed into tapped holes or bolts and nuts. Self-tapping screws are not acceptable. The chassis position shall be adjustable in the horizontal plane.

Panel

A stiffened panel manufactured of 2.00mm thick sheet steel shall be installed in the architrave frame for flush mounting of switchgear. The panels shall have machine punched slots for housing the specified and future switchgear, instruments, fuse holders, isolating switches, indicator lamps, etc.

Blanking plates shall be provided in positions where future switchgear will be installed. The distance between the inside of the closed doors and the panel shall be not less than 40mm. No equipment may be mounted on the panel.

Fixing of panels

The panel for each switchboard shall be secured to the architrave frame by means of 6mm chromium plated studs. Alternatively, the panel may be secured to the architrave frame by means of two pins at the bottom and a latch or lock at the top of the panel. Self-tapping screws will not be allowed. Where it is required that equipment be mounted on the panel, the panel shall be securely hinged to the switchboard frame.

Doors

Where specified, switchboards shall be equipped with doors. The doors shall be of a smooth flat finish suitably braced to ensure stiffness and when in the closed position, shall be flush with the architrave frame. The doors shall be of 1.6mm sheet steel. The door width shall not exceed 600mm. Doors exceeding 450mm in width or height shall on all four sides be bent inwards to ensure stiffness. The corners shall be welded and smoothed.

Door handles and catches

All switchboard doors shall be equipped with lockable handles and catches. Where lockable doors are required and, in all cases, where the switchboard doors are higher or wider than

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450mm, handles consisting of a pushbutton-and-handle combination with spring loaded latch or rotary handle-and- catch combination shall be installed.

Switchboard doors smaller than 450mm in height and width may be equipped with spring loaded flush mounted ring type latches. Square key operated catches are not acceptable.

15.27.2.2 Construction of surface mounted switchboards

Switchboard tray

Surface mounted switchboards shall be equipped with a 1.6mm sheet steel re- enforced tray. Securing lugs shall be provided to fix the tray to walls or any other structure. A solid brass or cadmium plated steel connection stud and nut shall be provided.

Construction

All joints shall be securely welded. The tray shall be square and neatly finished without protrusions. The front tray sides shall be rounded with an edge of at least 20mm to accommodate flush doors.

The requirements for chassis, panels and doors shall be as specified for flush mounted switchboards. The doors shall be hinged and shall fit flush in the frame in the closed position.

Wall-mounted surface switchboards shall accommodate top or bottom entry incoming and outgoing cables and circuits

15.27.2.3 Mounting of equipment

Access

All equipment, busbars and wiring shall be completely accessible when the front panels are removed.

Mounting of chassis

The chassis of flush mounted and surface mounted boards shall be mounted on the tray, leaving sufficient space for wiring between rows of equipment and on the sides. This space shall also be adequate to pass the supply cable behind the chassis to connect to the main switch without making use of sharp bends.

Mounting of circuit breakers

All moulded case circuit breakers shall be flush mounted with the toggles only protruding. Miniature circuit breakers may be installed in clip-in trays mounted on the frame. All other circuit breakers shall be bolted to the frame. Special provision shall be made for large main switches when designing the framework. Circuit breakers shall be installed so that the toggles are in the up position when "ON" and down when "OFF".

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All metering instruments shall be mounted flush in the front panel unless otherwise specified. In certain instances, it may be required that instruments be mounted flush in the door. In these instances, the back of meters shall be covered by removable covers of isolating material fixed to the door to protect the terminals of instruments and to prevent accidental contact.

Fuses for instrumentation shall be mounted in an easily accessible position and marked clearly. Equipment mounted normally in an easily accessible position and marked clearly. Equipment mounted normally on the surface, e.g. time switches and relays, shall be mounted behind the front panel. In these cases, hinged access panels shall be provided in the front panel.

Mounting of fuses

Fuse holders shall be mounted semi-recessed in the front panel so that fuses can readily be changed without removing the front panel.

Control equipment

All equipment performing control functions, e.g. control relays, not requiring adjustments, shall be mounted behind the front panel.

Mounting of busbars

All busbars shall be installed horizontally or vertically with the longer side of the section in the vertical plane. Busbars must be supported on resin insulators. It is of prime importance that mechanical stressing under short circuit conditions be considered when busbar supports are designed.

All busbars other than main busbars shall be mounted on suitable insulators or directly on circuit breaker terminals. Busbars shall be mounted at least 150mm away from the nearest equipment. Special attention should be given to spacing between fuse switches and busbars.

Covering

The main busbars shall be covered with coloured heat-shrinkable PVC. The colour shall correspond to the colour of the supply phase. Busbars may alternatively be covered with two coats of coloured insulation paint if approved by the Engineer.

15.27.2.4 Connections

All conductor ends shall be fitted with crimped lugs which are bolted to the busbar.

Neutral busbars

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Neutral conductors for circuits protected by a single pole circuit breaker or fuse switch shall be connected to a neutral busbar mounted in a suitable position. The neutral busbar shall have a cross-section of at least 6 x 25mm and shall be long enough for the lugs of all the neutral conductors to be bolted separately to the busbar without overlapping the lugs.

Earth bars

Each switchboard shall be provided with a normal "Building" earth bar and a separate insulated "Clean" earth bar. Earth bars shall be installed in convenient positions along the entire length of the switchboard. "Building" Earth bars shall be bolted directly to the framework, but "Clean" Earth bars shall be mounted on resin insulators. Earth busbars shall have a minimum cross-section 6 x 20mm and shall be installed in a suitable and easily accessible position over the full width of the board. 6mm Diam. holes shall be provided in the busbar at 25mm centres. All earth conductors shall be connected individually to the earth busbars. The holes provided shall be drilled on site to accommodate the bolts and nuts. Spare bolts and nuts need not be supplied.

All non-current carrying metal parts of the board, e.g. framework, panels, transformer cores, metal covers, etc. shall be bonded to the "Building" Earth bar.

The earthing reticulation shall be installed as part of this scope of work, with the termination of the earthing reticulation cables in the sub-distribution boards falling within the scope of this contract.

Bolts and nuts

Cadmium-plated steel bolts only may be employed at connecting points. All bolts shall be provided with spring washers. Hexagonal nuts shall be used. The largest possible size of bolts that will fit into holes in lugs and fixing holes of equipment, shall be used in every instance. Bolts shall be of sufficient length so that no more than two threads protrude beyond the nut.

Switchgear

All switchgear supplied and installed by the Contractor shall be MERLIN GERIN or CBI switchgear rated minimum 5kA r.m.s, or as specified on the schematic diagrams.

15.27.2.5 Wiring

Current ratings

The current rating of conductors for the internal wiring shall be sufficient to carry the maximum continuous current that can occur in the circuit. This value shall be determined from the circuit breaker or fuse protection of the circuit.

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Standard 600V grade PVC insulated stranded annealed copper conductors to SABS 150 shall be employed for the internal wiring of switchboards.

All wiring shall be arranged in horizontal and vertical rows and shall be bunched and strapped using "Hellerman" or similar strapping.

Under no circumstances may PVC adhesive tape be used for the bunching of conductors or for the colour identification of conductors.

Bunched conductors shall be neatly formed to present a uniform appearance without twisting or crossing the conductors. Conductors leaving harnesses shall be so arranged that they are adjacent to the chassis. These conductors shall first be led in the same direction as the conductors in the harness and shall then be bent over the top of the harness and progress to its destination.

Conductors to hinged panels and doors shall be secured on both the door and the frame and shall be looped between the two points. The loop shall be arranged to produce a twisting motion when the door is opened or closed. A flexible protection sleeve shall be installed over the conductors.

All wiring between different panels within the same switchboard shall be separately bunched. Grommets shall be installed in each hole in the metalwork through which conductors pass.

All wiring shall be installed away from terminals, clamps or other current carrying parts. Wiring shall also be kept away from exposed metal edges or shall be protected where they cross metal edges.

Conductors may be joined at equipment terminals or numbered terminal strips only. Ferruled and taped or other connections are not acceptable.

Where conductors change direction, smooth bends shall be formed with a radius of at least 5 times the outside diameter of the conductor or harness.

Where neutral connections are looped between the terminals of instruments, it is essential that the two conductor ends be inserted into a common lug and are crimped or soldered together in order that the neutral connection is not broken when the conductors are removed from one of the instruments

Wiring should be confined to the front portions of switchboards as far as possible for ease of access. This requirement is important for wiring between circuit breakers with a rating of less than 30Amp and the associated main circuit breaker as well as the wiring from circuit breakers to lighting and socket outlet circuits.

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The supply end connections to equipment shall as a rule be at the top and the load end connections at the bottom. Where the load and supply ends of the mains circuit breaker of a switchboard are not indicated the load may be connected to the top end only if the wording "LINE" and "LOAD" is correctly indicated on the circuit breaker.

Wiring to circuit breakers

Loop connections may only be installed for a maximum of two outgoing circuits. Where there are more than two outgoing circuit busbars shall be used and equipment connected individually to busbars. Where MCB's are mounted in a continuous row and supplied by busbars connected to each MCB, each busbar shall be supplied by a separate conductor. This conductor shall be connected to the busbar by means of a separate lug and not via an MCB terminal.

Conductor terminations

All conductors terminating on meters, fuse holders and other equipment with screwed-on terminals shall be fitted with lugs. The lugs shall be soldered or crimped to the end of the conductor. Sufficient insulation shall only be stripped for the end to fit into the terminal. Strands may not be cut from the end of the conductor.

Identification

The colour of the conductors for all 230V circuits shall correspond to the colour of the supply phase for that circuit. Neutral conductors shall be black. All other conductors in the board, supplying control circuits, etc. shall be coded in colours other than those specified above. A colour code shall be devised for each board and the colour code shall be shown on the wiring diagrams. All conductors that terminate at terminal strips and all conductors used for the internal wiring of the switchboard, shall further be identified at both ends by means of double cable marking ferrules. PVC or other tape is not acceptable. The numbers on the markers shall also be shown on the wiring diagrams.

15.27.2.6 Paint finish*Finish Required*

Metal components of the framework, panels and chassis shall be finished with a high-quality paint applied according to the best available method. Baked enamel, electro-statically applied powder coating or similar proven methods may be used. Care shall be taken to ensure that all edges and corners are properly covered.

Colour

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The colour shall be as requested by the Engineer.

Before the installation is handed over the Domestic Sub-Contractor shall ensure that all paint surfaces are clean and undamaged.

Labelling

Care shall be taken to ensure that all equipment is fully and accurately labelled. Engraved plastic or ivory strips shall be used throughout. The strips shall bear black lettering on a white background.

Equipment identified

All equipment on switchboards shall be identified with the necessary labels. The circuit numbers shall appear at all grouped single pole circuit breakers. The abovementioned circuits shall be identified on a legend card, which shall be installed on the inside of the switchboard door, or in any other position where it can conveniently be observed. All fuses including instrument fuses shall have labels stating function, fuse rating and duty or type where applicable. All other equipment shall be identified separately, and their functions shall be clearly indicated.

Where cascading of circuit breakers occurs in a distribution board, a suitable label of notification must be provided.

Fixing of labels

Engraved strips shall be secured by means of brass nuts and bolts or slotted label holders. Self-tapping screws will not be allowed. Labels shall not be glued to the switchboard or stuck onto the switchboard with double-sided tape. Sufficient fixing bolts shall be provided to prevent labels from warping.

Testing

The Engineer shall be notified when the mechanical construction of the switchboard i.e. frame, panels and base frame, is completed in order that he or his representative may inspect it at the factory.

Function tests of all equipment, control and interlocking circuits shall be conducted to the satisfaction of the Engineer. The proper functioning of all protection relays and ammeters shall be proved by means of current injection on the primary side of the relevant current transformers.

Testing equipment and facilities including instruments, dummy loads and additional switchgear and cables, at the factory or on site, shall be provided by the Domestic Sub-Contractor at no extra cost. The Engineer shall be notified in writing two weeks in advance of

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any tests to be conducted, to allow him or his representative to be present at such tests. A complete report on the tests shall be handed to the Engineer. The Domestic Sub-Contractor shall allow in his tender for all costs of travel and accommodation out of inspection by the Engineer.

15.27.2.7 Drawings**Drawings for approval**

A set of three prints of the shop drawings for the switchboards shall be submitted to the Engineer for approval before the boards are manufactured. The following information shall be present:

- A complete wiring diagram of the equipment on the boards.
- A complete layout of the arrangement of the switchboards indicating all equipment dimensions and the construction of the boards. The positions and method of fixing of busbars shall be shown.
- All labelling information on a separate sheet.
- The make, catalogue number and capacity of all equipment such as isolators, circuit breakers, fuses, contactors, etc.
- The approval of drawings shall not relieve the Sub-Contractor of his responsibility to the Owner to supply the switchboards according to the requirements of this Specification.

Final Drawings

A complete set of "as-built" transparent drawings of all switchboards shall be submitted to the Engineer immediately after completion of the installation.


Manuals

Two sets of manuals for all switchboards shall be forwarded to the Engineer at no extra cost. These manuals shall include the following information:

- Complete information on the operation of the equipment,
- Complete information for maintenance of the equipment,
- Brochures and ordering information, and
- Complete material list indicating quantities and relevant catalogue numbers.

Completion

The Contract shall be regarded as incomplete unless all tests have been conducted successfully and all drawings and manuals have been handed to the Engineer.

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15.28 Cables

The Sub-contractor shall supply and install all the low voltage cables as indicated on the drawings & cable schedules. This contract will include the termination of these cables into the sub-distribution boards. Any additional cables that may be required as part of this contract will comply with the following requirements.

15.28.1 Manufacture

All cables shall consist of high conductivity annealed or hard-drawn stranded copper conductors, PVC insulated, twisted together, bedded, sheathed with PVC (preferably black), armoured with a single layer of galvanized steel wire, bedded and served with an extruded PVC outer sheath. The cables shall be manufactured to SANS 1507 of 1990 as amended.

15.28.2 Cable glands

Glands to be used for terminating PVC/SWA/PVC insulated cables, shall be of the adjustable type, suitable for general purpose 600/1000-volt cable.

Non-watertight glands shall easily be converted to watertight glands by means of a waterproofing shroud.

The glands shall be of copper plated heavily tinned bronze or brass and shall consist of a barrel with a cone nut carrying a cone bush screwed into one end, and a hot tinned steel nipple with a heavy galvanized steel locknut screwed into the other end.

A round groove shall be provided on the cable entrance side of the barrel to accommodate the upper rim of the waterproofing shroud.

15.28.3 Installation of Cables

15.28.3.1 Competence of personnel

It is a definite requirement that the Domestic Sub-Contractor shall only instruct competent personnel to install and connect the various cable types.

15.28.3.2 Standards


All cables used shall conform to the relevant SABS specifications and shall be installed, protected and terminated according to approved methods in compliance with the manufacturer's requirements.

15.28.3.3 Minimum sizes

Cables with conductors smaller than 2.5mm² may not be used except for control wiring. Where cables are grouped together the minimum conductor size shall be 2.5mm².

15.28.3.4 Joints

All cables shall be supplied and installed without joints unless written approval is obtained from the Engineer.

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Where joints are allowed the best available technique for the specific cable type shall be applied.

Cables shall be joined in cable boxes filled with hard-setting compound or with epoxy-resin cast joints. All joints shall be fully water and airtight.

15.28.3.5 Termination

All cable ends shall be terminated with approved glands ensuring a watertight connection between the sheath, gland and equipment.

The glands to be used shall be constructed so that the armouring of the cable is clamped between two bevelled cones with a screw-clamp.

The cable gland shall be screwed to the gland plate or equipment and fixed with a locknut. Cable cores shall be connected to the equipment with suitable lugs.

Cable ends shall be supplied with the necessary earth connections.

15.28.3.6 Slack

Slack of at least 2m shall be allowed at both ends on cable routes with a length more than 15m.

15.28.3.7 Grouping of cables

Cables have been sized in accordance with the grouping correction factors applicable to SANS 10142. Cables may therefore be bunched on cable trays or in sleeves.

15.28.3.8 Cables on different levels

Where parallel cable runs are installed at different levels (e.g.: on parallel cable trays) and where the spacing of the layers is not specified, a minimum spacing of 300mm shall be maintained.

15.28.3.9 Cables for other services

Cables for telephone, communication systems and other low voltage systems (less than 50V) shall be separated from power cables. Where armoured cables are used for such other services, they shall be installed in separate cable trays or shall otherwise be at least 1m away from power cables. Where unarmoured cables are used for these other services, they shall be installed in separate conduits or metal channels.

15.28.3.10 Fixing of cables

Cables may be installed in one of the following ways:

Clamps

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Suitable clamps (cleats) which will secure cables without damage shall be used. Clamps shall consist of adjustable metal wings which clamp to a metal support or consist of two halves that are bolted together. The correct clamp size to fit the cable shall be used. Cables of different sizes may only be fixed by a common clamp if the clamp is specially made to accommodate the various cables.

Distance between fixings

The maximum spacing between cleats (clamps) to which cables are fixed in horizontal and vertical cable routes shall be determined from the table below. Additional cleats shall be installed at each bend or offset in the cable run. The maximum distance between supports or cleats for multicore control cables shall be 30 times the outside diameter of the cable with a maximum spacing of 900mm for the armoured cables.

Sleeves

Where cables penetrate floors, walls or other structural elements, suitable sleeves shall be provided. Both ends of the sleeves shall be sealed with a non-corrosive, watertight non-hardening compound.

15.28.3.11 *Earth conductor*

Earth continuity conductors shall be installed with all cables. The earth continuity conductor shall consist of a bare stranded copper conductor for the "Building" Earth, and a PVC insulated stranded conductor where a "CLEAN" Earth is required.

Unless otherwise specified, the cross-sectional area of the earth conductor shall be equal to one half that of one current carrying conductor but shall not be less than 2.5mm² and need not be more than 70mm². A single conductor may be used where parallel cables supply the same load. A single conductor may be installed serving a group of underground cables.

The earth conductors shall be connected to the appropriate earth bars of the switchboards to which the associated cables are connected


15.28.3.12 *Identification of cables*

All cables shall be identified at both ends and at all joints according to a code or number system. These numbers shall appear on the as-built drawings.

Cables shall be marked with non-deteriorating bands with raised or punched numbers.

15.28.4 Cable Trays, Ladders and Wire Mesh Trays

The Domestic Sub-Contractor shall supply and install all cable trays or ladders required for electrical cables as well as all wire mesh trays required for electronics services cables and the necessary supports, clamps, hangers, fixing materials, bends, angles, junctions, reducers, T-pieces, etc.

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15.28.4.1 Tray type

Unless otherwise specified, all cable trays shall be heavy duty type perforated galvanized cable trays.

15.28.4.2 Wire mesh trays

Wire mesh trays shall be medium duty hot-dipped galvanized type.

15.28.4.3 Supports

Trays and ladders shall be supported at maximum intervals of 900mm. In addition, trays and ladders shall be supported at each bend, off-set and T-junction.

15.28.4.4 Joints

Joints shall be smooth without projections or rough edges that may damage the cables. The Domestic Sub-Contractor will be required to cover joints with silicon or other hardening rubberised or plastic compounds if in the opinion of the Engineer joints may damage cables. Joints shall as far as possible be arranged to fall on supports. Where joints do not co-coincide with supports, joints shall be made by means of wrap- around splices of the same thickness as the tray and at least 450mm long.

The two cable tray ends shall butt tightly at the centre of the splice and the splice shall be bolted to each cable tray by means of at least 8 round head bolts, nuts and washers. Splices shall have the same finish as the rest of the tray.

15.28.4.5 Fixing


Trays shall be securely bolted to supports to avoid cables being damaged during installation.

Fixing of the structure

The supports for cable trays and ladders shall in all cases be securely fixed to the structure by means of heavy duty, expansion type anchor bolts. It is the responsibility of the Domestic Sub-Contractor to ensure that adequate fixing is provided since cable trays and ladders that work loose shall be rectified at his expense.

15.28.5 Accessories

Purpose-made horizontal and vertical bends, T-junctions and cross connections shall be supplied by the Domestic Sub-Contractor. The dimensions of these connections shall correspond to the dimensions of the linear sections to which they are connected. The inside dimensions of bends shall be large enough to ensure that the allowable bending radius of the cables is not exceeded. Sharp angles shall have a 45° cornice. All accessories shall be galvanized.

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15.28.6 Installation of cables

Electrical cables shall be installed by the Domestic Sub-Contractor adjacent and parallel to each other on the trays. Horizontal trays and ladders shall in general be installed 450mm below slabs, ceilings, etc. to facilitate access during installation.

Data/telephone cables shall be supplied and installed by others.

15.28.7 Earthing

Metal trays and ladders shall be bonded to the “Building” Earth bar of the switchboard to which the cables are connected. Additional bare copper stranded conductors or copper tape shall be bolted to the tray or ladder where the electrical continuity cannot be guaranteed.

15.28.8 Painting

No painting of trays or ladders shall be required.

15.28.9 Trunking Installation

Trunking shall be installed as indicated on the drawings. All trunking and trunking accessories shall be similar or equal Cape Support Systems and shall be galvanized. Trunking shall be installed complete with clip-on galvanized metal covers. Adjoining lengths shall be correctly aligned and securely joined by means of connection pieces that are pop-riveted to both abutting sections. All adjoining sections shall be of identical rectangular section and shall butt tightly. Covers shall fit tightly across the joint.

Trunking shall be installed open end up wherever possible, but where it is installed on its side or in vertical runs all conductors shall be retained by means of metal clips or metal spacer bars at not less than 1m centres. All trunkings shall be vermin proof after installation. All holes shall be covered by metal plugs or by means of metal strips that are pop-riveted to the channel.

Electrical and mechanical continuity shall be maintained throughout the trunking installation. A tinned copper bonding strip shall be installed across each joint and secured to both adjoining lengths by means of brass bolts, nuts and washers. The trunking shall be bonded to the earth bar of the associated switchboard.

All bends shall be of easy sweep design with 45° cornices. Burrs and sharp edges shall be removed, and the inside edges of all joints shall be lined with silicon or other suitable rubberised compound to prevent conductor insulation laceration.

Trunking shall be large enough to ensure that the combined total cross-sectional area (including insulation) of all conductors does not exceed 40% of the cross-sectional area of the trunking.

The Sub-Contractor shall supply and install all hangers, supports or fixings required for the trunking. Trunking up to 127mm x 75mm shall be supported at maximum intervals of 1500mm

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and where trunking is suspended from roof structures this shall be done using CS3300 and threaded galvanized rods. Trunking runs shall be carefully planned to avoid clashes with other services and to ensure that all covers can be removed after completion of the entire installation.

All conduit connections shall be terminated by means of a female bush. All holes which conductors pass through shall be equipped with grommets.

15.29 Conduit Installation**15.29.1 General**

Conduit may be installed as follows:

- In open roof spaces - PVC conduit may be installed.
- surface mounted - PVC & Bosal conduit where specified may be installed.
- in wall chases - PVC conduit may be installed.
- Cast in concrete - PVC conduit may be installed.

Where conduits are to be installed in concrete, this shall be done while the building work is still in progress. Surface mounted conduit shall only be installed after the Engineer has given his written consent to do so.

15.29.2 Other Services

Conduits shall be installed at least 150mm away from pipes which are intended for gas, steam, hot water or any other material which may affect the conduit. Where doubtful situations of this nature occur or where there are installation incompatibilities the matter shall be reported to the Engineer without delay.

15.29.3 Debris


Care shall be taken to prevent any debris or moisture from entering the conduit during and after installation of the conduits. All conduit ends shall be sealed.

15.29.4 Defects

Each length of conduit shall be inspected for defects and all burrs shall be removed. All conduits that are split, dented or otherwise damaged or any conduits with sharp internal edges shall be removed from site. The Sub-Contractor shall ensure that conduits are not blocked.

15.29.5 Continuity

Mechanical and electrical continuity shall be maintained throughout the conduit installation for galvanized steel conduits. Conduits may not be relied upon for earth continuity.

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15.29.6 Inspection Type Accessories

Inspection type couplings, elbows and tees shall not be used except with the written consent of the Engineer. All outlet boxes and draw boxes shall however be of the inspection type.

15.29.7 Positions of Outlets

All accessories such as socket outlets, switches, lights, etc. shall be accurately positioned. It is the responsibility of the Sub-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 Sub- Contractor to determine the correct final floor, ceiling and roof levels in conjunction with the Contractor.

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.

15.29.8 Draw Wires

Galvanized steel draw wires shall be installed in all unwired conduits e.g. conduits for future extensions, telephone/data installations and other services.

15.29.9 Bends


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 9m in straight conduit runs. All bends shall be made without heating the conduit or without reducing the diameter of the conduit.

Wall Sockets

Where more than one socket outlet is connected to the same circuit, the conduit shall be looped from one outlet box to the following on the same circuit. Where a metal channel is used, the conduit may be installed from the channel directly to the outlet box on condition that the conductors can be looped from one outlet to the next without making any joints in the wires.

15.29.10 Light Fittings

Where the conduit end is used to support light fittings, a ball-and-socket type lid shall be fitted to the pendant box in all cases where the conduit is longer than 500mm. In all other cases a dome lid may be used. Where light fittings are specified which are fixed directly to the pendant box, the pendant box shall be fixed independently of the conduit installation except where the pendant box is cast into concrete.

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15.29.11 **Withdrawal of Conductors**

To ensure that all electrical conductors shall be easily withdrawable from conduits, the Engineer reserves the right to have the conductors of any circuit removed at his discretion and replaced at the cost of the Sub-Contractor. If the conductors are damaged during removal, the damaged conductors shall be replaced, and the cost of the replacement shall be borne by the Sub-Contractor.

15.29.12 **Flush Mounted Outlet Boxes**

The edges of flush mounted outlet boxes shall not be deeper than 10mm from the final surface. Where this is not the case, an extension box which ends flush with the surface, shall be screwed to the outlet box. This method shall be used in partitions and cladded surfaces.

15.29.13 **Excess Holes**

All excess holes in draw boxes, distribution boxes, switchboards, 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 accessories.

15.29.14 **Open Roof Spaces**

15.29.14.1 *Sequence of Work in Open Roof Spaces (where applicable)*

Conduit and wiring in open roof spaces above ceilings other than ceilings of concrete, shall be installed before the ceilings and walls are painted and before removable ceiling tiles are installed. In roof spaces where access is limited after installation of the ceiling, conduits and wiring shall be installed prior to installation of the ceiling. It is the responsibility of the Sub-Contractor to ensure close liaison with the Contractor in connection with the above-mentioned work.

15.29.14.2 *Fixing*

All conduits in open roof spaces shall be installed parallel and at right angles to the roof members and shall be fixed to the structure at intervals not exceeding 1 metre. Approved saddles shall be used throughout. Clout nails, clamps or wood screws shall be used to secure the saddles to wooden roof members. Suitable saddles shall be used to secure conduits against concrete slabs.

Written permission shall be obtained to secure conduits to steel beams in which case saddles shall be fixed by means of bolts, nuts and lock washers or purpose made saddles shall be used.

15.29.14.3 *Draw Boxes*

Draw boxes with PVC cover plates shall be installed where required. 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.

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All conduit ends for lighting outlets in ceilings shall be securely supported.

15.29.14.4 Incandescent Light Fittings

Where fittings are secured directly to draw boxes in false ceilings or where ceiling roses or special connections are used, flush mounted, rear-entry round draw boxes which are independently fixed to roof beams, shall be provided.

15.29.14.5 Fluorescent Light Fittings

5A Socket outlets shall be installed in ceiling spaces for connection to fluorescent fittings.

15.29.15 Installation in Concrete

In order not to delay building operations, the Sub-Contractor shall ensure that all conduits and accessories which are to be cast in concrete are placed in position in good time. The Sub-Contractor or his representative shall be in attendance when the concrete is cast.

15.29.15.1 Draw Boxes

Draw boxes, expansion joints and round ceiling boxes shall be installed where required and shall be neatly finished to match the finished slab and wall surfaces. Ceiling draw boxes shall be of the deep type. In hollow tile slabs, rear-entry draw boxes shall be used. In columns where flush mounted draw boxes are installed, the conduits shall be offset from the surface of the column immediately after leaving the draw box.

15.29.15.2 Elbows

Elbows for conduits of 32mm dia. and smaller and sharp bends will not be allowed in concrete slabs.

15.29.15.3 Cover Plates

Draw boxes and/or inspection boxes shall where possible, be grouped together under a common approved cover plate. The cover plate shall be secured by means of screws.

15.29.15.4 Neutral Axis

All conduits shall be installed as close as possible to the neutral axis of concrete beams, slabs and columns. The conduits shall be rigidly secured to the reinforcing to prevent movement towards the surface of the concrete.

15.29.15.5 Fixing to the Shuttering

All conduits, draw boxes, etc. shall be securely fixed to the shuttering to prevent displacement when concrete is cast. Draw boxes and outlet boxes shall preferably be secured by means of a bolt and nut installed from the back of the box through the shuttering. Fixing lugs may also be used to screw the boxes to the shuttering.

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Wire will not be accepted for securing boxes to the shuttering where off-shutter finishes are required. All draw boxes and outlet boxes shall be plugged with wet paper before they are secured to the shuttering.

15.29.15.6 *Expansion Joints*

As far as possible, conduits shall not be installed across expansion joints. Where this is unavoidable an expansion joint shall be provided.

15.29.15.7 *Screeds*

The installation of conduits in floor screeds shall be kept to a minimum. Where conduits are installed in screeds, the top of the conduit shall be at least 20mm below the surface of the screed. Where the screed is laid directly on the ground, galvanized conduits shall be used. This ruling will always be applicable to the lowest floor of a building. A minimum distance of twice the outside diameter of the conduit shall be left free between adjoining conduits.

Conduits shall be secured to the concrete slab at intervals not exceeding 2.0 metres. The Sub- Contractor shall ensure that conduits are not visible above the screed where the conduits leave the screed.

15.29.15.8 *Structural Steel*

Supports, brackets, hangers, etc. may only be welded to structural steel members where prior permission of the Engineer has been obtained. "CADDY" or similar fasteners may be used to fix equipment to structural steel members.

15.29.15.9 *Surface Conduits*

Surface conduits shall only be allowed when authorised in writing by the Engineer.

15.29.15.10 *Flexible Conduit*


- In installations where the equipment must be moved frequently to enable adjustments during normal operation, for the connection of motors or any other vibrating equipment, for the connection to thermostats and sensors on equipment, for stove connections and where otherwise required by the Engineer, flexible conduit shall be used for the final connection to the equipment.
- The lengths of flexible conduit shall be as short as possible to comply with the requirements of the connection but shall not exceed 600mm, except when specified or approved by the Engineer.
- Flexible conduit shall preferably be connected to the remainder of the installation by means of a draw box. The flexible conduit may be connected directly to the end of a conduit if an existing draw box is available within 2000mm of the junction and if the flexible conduit can easily be rewired.

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- Flexible conduit shall consist of metal-reinforced plastic conduit or PVC covered metal conduit with an internal diameter of at least 15mm, unless approved to the contrary. Connectors for coupling to the flexible conduit shall be of the gland or screw-in type, manufactured of either brass or cadmium or zinc plated mild steel.
- Where the possibility exists that the conduit can come into contact with moisture, suitable covering and/or packing shall be installed to isolate the conduit from the moisture.
- Flexible conduit connections shall be provided with an internal or external earth wire connection as required by the local Supply Authority, with preference given to internal earth wires where no specific local regulations apply.

15.29.15.11 Expansion Joints

- Where conduits cross expansion joints in the structure, approved type draw boxes which provide a flexible connection in the conduit installation shall be installed.
- The draw box shall be installed adjacent to the expansion joint of the structure and a conduit sleeve, one size larger than that specified for the circuit, shall be provided on the side of the draw box nearest the joint. The one end of the sleeve shall terminate at the edge of the joint and the other shall be secured to the draw box by means of locknuts.
- The circuit conduit passing through the sleeve shall be terminated 40mm inside the draw box and the conduit end fitted with a brass bush. The gap between the sleeve and the conduit at the joint shall be sealed to prevent the ingress of wet cement. An earth clip shall be fitted to the conduit projection inside the draw box and the conduit bonded to the box by means of
- 2.5mm² bare copper earth wire and a brass bolt and nut.
- The other end of the circuit conduit shall be secured to the draw box by means of locknuts and a brass bush.
- In addition to an earth wire which may be specified for the circuit, a 2.5mm² bare copper wire shall be provided between the first conduit box on either side of the joint. The conduit boxes shall be drilled and tapped, and the earth wire shall be bonded to the boxes by means of lugs and brass screws.
- Draw boxes at the expansion joint shall be provided with a suitable steel cover plate fixed to the box by means of screws. The cover plates shall be installed before the ceilings are painted by others.
- Where a number of conduits are installed in parallel, they shall cross the expansion joint of the structure via a single draw box. A number of draw boxes adjacent to each other will not be allowed.

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15.29.15.12 *Chases and Builder's Work*

- The Sub-Contractor shall be responsible for the builder's work connected with conduits, outlet boxes, switchboard trays, bonding trays and other wall outlet boxes as well as the necessary chasing and butting of walls and the provision of openings in ceilings and floors for light fittings and other electrical outlets. The Sub-Contractor shall notify the Main Contractor of his requirements, and the responsibility lies with the Sub-Contractor to ensure that these requirements are met.
- Electrical materials to be built in must be supplied, placed and fixed in position by the Sub- Contractor when required by the Main Contractor. The Sub-Contractor shall also ensure that these materials are installed in the correct positions.
- When the Main Contractor is not on site the Sub-Contractor is required to cover conduits installed in chases by a layer of 4:1 mixture of coarse sand and cement, finished 6mm below the face of the plaster and roughened. In all cases the conduits shall be deep enough to ensure that the top of the conduits is at least 12mm below the finished plaster surface.
- The Electrical Sub-Contractor will be held responsible for all damage as a result of chasing work and will be required to make good to the satisfaction of the Engineer. Chases shall be made by means of a cutting machine.
- Under no circumstances shall face brick walls or finished surfaces be chased or cut without the written permission of the Engineer. Where it is necessary to cut or drill holes in the concrete structure, the prior permission of the Structural Engineer shall be obtained to ensure that the structure is not weakened.

15.29.16 **Power Skirting**

Two compartment power skirting shall be supplied and installed in the positions indicated on the relevant drawings. The Domestic Sub-Contractor shall be responsible for the complete supply and installation of all power skirting accessories and associated connections. The power skirting shall be Execuct Type or equivalent.

All 900 bends, tees and end caps shall be purpose manufactured units and all sections of ducts and lids shall be cut square and have their edges "faced" to the approval of the Engineer.

Socket outlet, telephone outlets and infill plates shall be purpose made accessories stamped to receive respective outlets, all as detailed on the drawings.

Power skirting will only be installed after all wet trades have been completed and the Domestic Sub- Contractor shall be responsible for protecting the power skirting to the approval of the Engineer.

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Conduit links indicated on the drawings shall drop down the walls from the ceiling directly behind the power skirting. Linking conduits shall not be closer than 150mm throughout their length.

Where applicable all cut-outs for service connections shall be grommeted with "U" section neoprene trim secured to the Engineer's approval.

15.29.17 Wiring

Except in cases where cables are specified, all wiring shall be PVC insulated, single core stranded copper conductors and bare stranded or green PVC insulated copper conductors for earth continuity in compliance with SANS 150.

All conductors shall be installed in conduits, trunking or power skirting and shall under no circumstances be installed without mechanical protection.

Wiring shall only be carried out after the conduit or trunking installation and plaster work is completed, but before painting has commenced. No conductors shall be installed before the conduits have been cleaned of all debris and moisture.

Conductors that are connected to different switchboards, shall not be installed in the same conduit or trunking.

The wiring of one circuit only will be allowed in 20mm diam. conduit with the exception of the wiring between switchboards and fabricated sheet metal boxes close to switchboards in which case more than one circuit will be allowed.

All wiring shall be carried out according to the loop-in system. If a conductor joint is found necessary in an isolated case, jointing will only be accepted in trunking and not in conduits. Conductor jointing shall be executed by approved ferruling, properly covered with heat shrink sleeving.

The number of conductors that may be drawn through a conduit, shall comply with the requirements of the SANS 10142. The total cross-sectional area of the conductors (including insulation) in trunking or power skirting shall not exceed 40% of the cross-sectional area thereof.

In cases where the conductors of more than one circuit are installed in trunking or power skirting, the conductors of each separate circuit (earth conductor inclusive) shall be taped at intervals of one metre with PVC insulation tape. The conductors of different circuits shall however remain separate in order that any given circuit can be withdrawn. Conductors entering switchboards or control boards shall be grouped and bound by means of plastic binding.

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When conductors are drawn through conduit, care shall be taken that they are not kinked or twisted. Care shall also be taken that the conductors do not come into contact with materials or surfaces that may damage or otherwise adversely affect the durability of the conductor.

With the exception of three phase outlets, circuits of different phases shall not be present in lighting, switch or socket outlet boxes.

Conductors installed in vertical conduit or trunking shall be secured at intervals not exceeding 15m to support the mass of the conductors. Clamps shall be provided in suitable draw boxes for this purpose.

The insulation of conductors shall only be removed over the portion of the conductors which enter the terminals of switches, plugs or other equipment. When more than one conductor enters a terminal, the strands shall be securely twisted together.

When earth continuity conductors are looped between terminals or equipment, the looped conductor ends shall be twisted together and then soldered or ferruled to ensure that earth continuity is maintained when the conductors are removed from a terminal.

Cutting away of conductor strands will not be allowed.

The colours of conductor insulation for wiring purposes shall comply with the wiring regulations. The colours of conductors for sub-circuits shall as far as possible correspond with the colour of the supply phase. The colours of conductors for wiring to two-way and intermediate switches shall differ from phase conductors.

Single pole switches shall be connected to the phase conductor and not to the neutral conductor. The following minimum conductor sizes shall be used:

- Lighting circuits - 1.5mm² plus 1.5mm² earth conductor
- Plug circuits - 2.5mm² plus 2.5mm² earth conductor
- Stove circuits - 10mm² plus 10mm² earth conductor
- Motor circuits - 4mm²
- HWC - 4mm²

When wiring is installed in partitioning, the vertical and/or horizontal supports of the walls may be utilized for fixing conduit and outlet boxes.

15.29.18 Connections**15.29.18.1 Connections to light fittings****Connectors**

Connections to the wiring of the light fittings and other appliances where connectors are used, shall be affected by means of brass screw couplers shrouded in porcelain, neoprene or PVC

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or by means of approved spring steel locking connectors insulated in unbreakable material. Other types of connectors are not acceptable.

Knockouts

Where knockouts are used for the wiring of light fittings and other appliances, brass bushes or gripper glands shall be used.

Incandescent fittings

Connections to fittings with incandescent lamps shall be installed in a box situated behind the fitting.

Fluorescent fittings

Connections to fittings with fluorescent lamps other than those provided with flexible leads and plugs may be installed inside the metal body on condition that the frame and/or diffuser holder where applicable can be removed without disconnecting the conductors.

Screwed lamp holders

The central terminal of Edison Screw (E.S.) lamp holders shall be connected to the phase conductor (i.e. conductor with red insulation) and the screwed housing to the neutral conductor (i.e. conductor with black insulation).

Stove and kitchen appliance connections

The connection to each stove or similar appliance unless specified to the contrary, shall consist of 10mm² insulated conductors and a 10mm² bare copper earth wire in a 25mm conduit.

A 60A double pole micro gap isolator shall be flush mounted in a wall outlet box behind or adjacent to the stove or appliance in the run of the conduit at least 1350mm but not more than 1700mm above the finished floor level. The cover plate shall either fall entirely within the tiles surface or entirely within the plastered surface.

The conduits shall terminate 450mm above the floor behind the stove or appliance with the end set out of the wall pointing downwards.

The connection from the conduit end shall be by means of flexible conduit of sufficient length to enable the stove or appliance to be moved 600mm from its normal position for cleaning of maintenance purposes.

Crimped lugs shall be provided on all conductors or cable cores for connections to stoves or appliances. Soldered lugs may not be used.

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Each stove or similar appliance shall be connected to a separate circuit, and each shall have a separate earth conductor.

15.29.19 Switches And Socket Outlets

All switches and socket outlets shall be of the Clipsal or Crabtree range.

15.29.19.1 Flush wall switches

All flush wall switches shall comply with SANS 163 of 1951 as amended and shall bear the SANS mark. Switches shall be rocker or toggle action and shall be rated at minimum 16A.

Single or double gang switches shall be installed in such a fashion that the toggle or rocker action is vertical.

15.29.19.2 Surface mounted switches

Surface mounted switches shall consist of single or multi-gang switch units mounted in a common box. Rocker or toggle action shall be vertical.

The box and cover shall be of heavy gauge approved metal with all corners and sides rounded. The cover shall fit neatly over the box and shall be fixed by means of at least two chromium plated counter-sunk screws. The switch toggle or rocker shall be shrouded where it protrudes through the cover.

The switch units shall bear the SANS mark and shall comply with SANS 164 of 1953 as amended and SANS 163 of 1951 as amended where applicable and with the test requirements of SANS 109 of 1950 as amended.

15.29.19.3 Watertight switches

Watertight switches shall be 5 Amp single pole, suitable for surface mounting. The unit shall consist of a circular or square galvanized cast iron or PVC box with watertight lid and handle.

The handle shall either be at the front or side of the box. The "on" and "off" positions shall be clearly indicated. Entry shall be through holes that have been drilled with 20mm electrical thread.

The switch interior shall be a 5 Amp switch with quick acting spring mechanism, with heavy gauge brass contacts.

15.29.19.4 Installation of light switches**Mounting height**

All light switches shall be installed 1400mm above the finished floor level unless specified to the contrary. Mounting heights given shall be measured from the finished floor level to the centre of the switch.

Doors

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Unless otherwise specified switches adjacent to doors shall be installed on the side containing the lock. If the position of the lock is not shown on the drawings, the position shall be verified before the switch box is installed. Switch boxes in brick or concrete walls, shall be installed 150mm from the doorframe. Light switches installed in partitions or doorframes shall be of the type designed for that purpose.

Walls

Where the wall is plastered, light switches must be installed flush with the plaster finish.

Cover plates

Bevelled cover plates which overlap the switchbox, and which fit tightly against the wall finishes shall be installed in the case of flush mounted switchboxes. Suitable spiral type steel wire spacers shall be used to fix the cover plate to deep set flush switchboxes. All fixing screws in cover plates and switch grids shall be supplied and securely fitted. The colour of cover plates shall be to the Architect's choice.

Cover plates shall under no circumstances be cut unless specifically authorised in exceptional cases by the Engineer.

Switch boxes and cover plates shall be installed parallel to the relevant horizontal and vertical building lines.

Partitions

Light switches installed in partitions shall be of the type designed for this purpose to be accommodated in the partition design. Switches installed in the metal support do not require switch boxes. Switches may not be flush mounted in partition walls without switch boxes.

Waterproof switches


Switches exposed to the atmosphere or installed in damp areas, shall be category IP55.

Multiple switches

Where specified, multi-gang switches shall be installed in a common box. Switches controlling different circuits shall be installed in separate switch boxes.

Appearance

The sides of adjacent switches, plugs, pushbuttons, etc. shall be parallel or perpendicular to each other and uniformly spaced. A common escutcheon plate shall be used for flush mounted outlets and accessories where the cover plates do not cover the cut-outlets in the finishes.

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15.29.19.5 *Socket outlets*

The following different types of socket outlets will be supplied by the Domestic Sub-Contractor and installed in the building as shown on the drawings.

Dedicated socket outlets for workstations

Where these are installed in power skirting or alternatively in pedestal boxes or 100 x 100 conduit boxes, they shall be flush mounted shaven-earth-pin SSO's with red covers.

The earth conductors connected to the earth pins of all of these sockets will be Green/Yellow insulated PVC earth conductors wired back to the Clean (insulated) Earth bar on the nearest switchboard. The metal casings of these socket outlets will be connected to the normal Building Earth bar on the nearest switchboard by means of appropriately sized bare copper earth conductors.

General purpose socket outlets

These shall be 16 Amp 3-pin switched type to SABS 164. They shall each be flush mounting or surface mounting as described below. The earth conductors for these socket outlets will be bare copper earth conductors wired back to the normal Building Earth bar in the nearest switchboard.

Unless otherwise specified, outlets shall be installed at the following heights above finished floor level: Refer to power and lighting drawings for heights.

All mounting heights shall be measured from finished floor level.

Flush socket outlets (SANS Type)


Flush socket outlets shall each consist of a switch and 3 pin plugs receptacles with 2 shuttered poles and an earth socket suitable for mounting in a standard pressed steel box under a common cover plate.

Sockets and switches shall be rated at 250V. 15A unless clearly specified to the contrary. Switches shall comply with SABS 163. The sockets shall comply with SABS 164.

Surface mounted socket outlets (SANS Type)

Surface mounted socket outlets shall consist of a switch and 3 pin plugs receptacles with 2 shuttered poles and an earth socket contained in a pressed steel box suitable for surface mounting.

The box and cover plate shall be manufactured of 1.6mm steel with all corners rounded. The lid shall fit neatly over the box and shall be fixed by means of two counter-sunk screws. A knock-out shall be provided on each side of the box for the termination of 20mm conduits.

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The switch toggle shall be shrouded where it protrudes through the cover plate.

Sockets and switches shall be rated at 250V, 15A. The unit shall comply with SANS 163 and SANS 164 where applicable and shall be tested in accordance with SABS 109 of 1950 as amended.

15.30 Light Fittings

15.30.1 Supply of light fittings

The sub-contractor shall allow in the tender for the cost of administration, offloading on site, storage, handling, installation, cleaning and commissioning of all indoor and outdoor light fittings, as indicated on the drawings. The Sub-contractor shall be held liable for any damage to luminaires from the date of receipt until the date of handover to the Employer.

15.30.2 Installation of light fittings

The various types of light fittings required in the execution of the sub-contract are shown on the drawings.

15.30.2.1 Positions

The mounting positions of light fittings shall be verified on site. All fittings shall be placed symmetrically with respect to ceiling panels, batons, beams, columns or other architectural features of the space. The layout as shown in the Drawings shall generally be adhered to but any discrepancies or clashes with structural or other features must be referred to the Engineer before commencing erection of the installation. Should the Domestic Sub-Contractor neglect to refer such discrepancies to the Engineer, cost incurred as a result of subsequent alterations to suit the architectural features will be to the Domestic Sub-Contractor's account.

15.30.2.2 Hangers and supports

Where provision has not been made for the support of fittings, the Domestic Sub-Contractor shall supply the necessary supports, hangers, conduit extensions, angle brackets or any fixing method approved by the Engineer.

15.30.2.3 Ceilings

In all cases where light fittings are installed in ceilings, the ceiling shall be capable of carrying the weight of the fittings. Ceilings shall either be of the concealed 'T' acoustic tile or plaster board type. When installing fluorescent fittings in ceilings, a gap shall not be visible between the fitting and the ceiling. Fittings shall be constructed for installation from below.

15.30.2.4 Continuous rows of light fittings

In cases where fluorescent fittings are installed in tandem, only one connection point need to be supplied per circuit. All fittings shall be coupled to one another by means of nipples or

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bushes and lock nuts to ensure that the wiring is not exposed, and that earth continuity is maintained. Fittings on the same circuit may be wired through the channel formed by the fitting canopies. In this case silicon- rubber insulated conductors shall be used and internal connections shall be made at terminal blocks, Screw connectors are not acceptable. The wiring for any other circuits or outlets, even though these may be in the same row may not be installed through the fitting canopies. The Domestic Sub- Contractor shall ensure that continuous rows are straight and parallel to the relevant building lines.

15.30.2.5 Recessed light fittings

Where recessed light fittings are indicated the Domestic Sub-Contractor shall maintain close liaison with the Ceiling Contractor. In the case of tiled ceilings, the fittings shall be installed while the metal supports are being installed and before the tiles are place in position.

The Domestic Sub-Contractor shall be responsible for the co-ordination of the cutting of ceiling tiles or plasterboard with the Ceiling Contractor. All mounting rings and other accessories shall fit closely into cut-outs to ensure a proper finish.

15.30.2.6 Waterproof light fittings

Waterproof and flameproof fittings shall be screwed directly to the conduit end. Draw boxes that may be required must be approved by the Engineer beforehand.

15.30.2.7 Bulkhead fittings

Surface mounted bulkhead fittings shall not be screwed directly to conduit ends. The conduit shall terminate in a round draw box at the back of the fitting. The PVC insulated conductors shall terminate in a porcelain terminal block in the draw box. Asbestos or silicon-rubber insulated conductors shall be used from the terminal block to the fitting lamp holder. Screw connectors will not be allowed.

15.30.2.8 Fluorescent Luminaires fixed to Ceilings

In all cases where luminaires are fixed to false ceilings, the Contractor shall ensure that the ceiling is capable of carrying the weight of the luminaires before commencing installation. Should any doubt exist in this regard, the matter shall be referred to the Engineer.

In cases where the weight of the luminaire is not carried by the ceiling but by a support or other suspension method, provision shall be made to prevent relative movement between the ceiling and luminaire, ceiling rose or connection point.

Surface mounted fluorescent luminaires shall fit firmly against the ceiling brandering without leaving gaps between luminaire and ceiling. The luminaire shall be fixed directly to the ceiling by means of brass plated round-head wood screws and washers or butterfly screws.

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In case of tiled ceilings with exposed or concealed T-section supports, surface mounted luminaires shall be fixed only to the tiles by means of butterfly screws. The tiles shall be suitably reinforced. Luminaires may alternatively be fixed to metal cross-pieces resting in the ceiling tees.

Drilling of holes in ceiling tees to support luminaires will not be allowed. Luminaires shall be fixed in neat relation to the ceiling layout.

15.30.2.9 Type of Conductor

PVC insulated conductors, unless protected by an approved heat-resistant sheathing, shall not be used where the temperature of the insulation is likely to exceed 70°C. In unventilated luminaires or luminaires capable of housing incandescent lamps over 60W, the interconnecting wiring from the lamp holder to the circuit wiring shall consist of silicon-rubber insulated conductors. Silicon-rubber insulated conductors shall be used exclusively in the case of high bay fittings.

15.30.3 Electronic Systems Installation

This specification covers only the supply and installation of outlet points, wire mesh trays, trunking and conduits for data, and telephone points. These wire ways shall be installed as per future drawings. The supply and installation of equipment, cabling and terminations will be carried out by others.


A welded wire mesh cable tray shall be installed as a backbone for electronic systems wireways. The installation of the welded wire mesh cable tray shall be done as per the manufacturer's recommendations.

All conduits supplied and installed by the Contractor shall be provided with galvanized steel draw wires

Conduit connections to power skirting shall be made by means of a 100 x 50 x 50mm or 60mm round draw boxes which is flush mounted immediately behind the duct or channel in which the telephone cables are to be installed. A hole shall be cut in the back of the duct or channel, immediately opposite the draw box. The edges of the hole shall be grommeted. The draw box shall be accessible from the front when the power skirting cover is removed.

Telephone outlets in walls or partitioning shall consist of flush mounted 100 x 100 x 50mm draw boxes with blank cover plates.

Where power skirting is shown the Domestic Sub-Contractor need only install the skirting with covers since the data/telephone socket outlet will be fixed directly to the cover. No other cables may be installed in the section intended for data/telephone cables and the separation between the sections shall be maintained throughout the installation.

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15.30.3.1 *Electronic Systems outlets on wire mesh trays*

Cabling and the installation of the Electronic Systems sockets fixed the sides of wire mesh trays shall be by others.

15.30.4 **Air Conditioning**

The electrical subcontractor shall be responsible for the electrical supply to each isolator unit in the vicinity of the compressors. The position of these points will be coordinated on site between the electrical and A/C contractors.

The final connection from the isolator to the Air Conditioning unit shall be done by the AC contractor.

15.30.5 **Earthing**

15.30.5.1 *General*


The installation shall be earthed properly in accordance with the latest revision of SANS 10142 and separate earthing systems shall be provided for the Building Earth and the Clean Earth. All earth conductors for the Building Earth shall be bare stranded copper conductors or stranded conductors with Green/Yellow PVC insulation when installed in power skirting. Earth conductors for the Clean Earth system shall be stranded conductors with Green/Yellow insulation.

A separate earth connection shall be supplied between the Building Earth busbar in each switchboard and the earth busbar in the Main LV Board. These connections shall consist of bare stranded copper. Similarly, a separate earth connection will be supplied between the Clean Earth busbar in each switchboard and the Clean Earth busbar in the Main LV Distribution Board.

The earth conductors of all circuits shall be connected to the appropriate earth busbar of the supply board. All single-phase plug circuits shall be supplied with 2.5mm² earth conductors. All fluorescent lighting circuits shall be supplied with 2.5mm² earth conductors. All single phase and three phase outlets, electrical appliances, equipment, electrical motors, etc. shall be earthed as stipulated in SANS 10142. All outlets in the building identified on the drawings as dedicated socket outlets shall be provided with Green/Yellow insulated earth wires and earthed to the Clean Earth bar in the appropriate switchboard.

15.30.5.2 *Connections*

Under no circumstances shall any connection points, bolts, screws, etc. used for earthing be utilized for any other purpose. It will be the responsibility of the Domestic Sub-Contractor to supply earth terminals or clamps where these are not provided by others. All earth connections shall be tin plated and fixed with approved ferrules. The entire connection shall then be soldered.

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15.30.5.3 Wiring, trunking cable trays and ladders

The ends of all metal trunking, cable trays and ladders containing cables or conductors under load shall be earthed to the Building Earth busbar in the nearest switchboard with copper strapping or

2.5mm² stranded conductors. Adjoining sections shall be connected at joints with copper strapping or 2.5mm² conductors.

15.30.5.4 Conduit

All metal conduits shall be earthed. An external earth conductor shall be installed together with all non-metal's flexible conduit. The earth conductor shall be connected securely to the metal parts on both ends.

15.30.5.5 Water pipes

Metal cold water mains shall be connected with solid 12 x 1.6mm copper strapping to the earth busbar in the Main LV Board. All other hot and cold-water pipes shall be connected with 12 x 0.8mm perforated or solid copper strapping (not conductors) to the nearest switchboard. The strapping shall be fixed to the pipework with brass nuts and bolts and against walls with brass screws at 150mm centres. In all cases where metal water pipes are positioned within 1.6m of switchboards an earth connection consisting of copper strapping shall be installed between the pipework and the board. In the vertical building ducts accommodating water pipes all the pipes shall be earthed to the nearest switchboard.


15.30.5.6 Medium Voltage Switchgear

An earth resistance of maximum 2 ohm is required. All MV switchgear shall be connected to the substation earth bar by a 35mm², bare earth copper conductor. No joints in this earthing conductor shall be allowed.

15.30.5.7 Mini substations

An earth resistance of maximum 2 ohm is required, measured with all contributing earth wires connected to the earth bar.

2 x 30m lengths of 70mm² bare copper earth conductors shall be connected to the earth bar, one on the MV and one on the LV side of the transformer and shall be installed together with the cables running in the trenches in opposite directions from the transformer. If the earth resistance as measured should prove to be more than 2 ohm, one or more 2,4m long Copperweld earth spikes shall be installed and connected to the earth bar by means of 70mm² bare copper conductors.

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15.30.5.8 Medium Voltage Cable

The cable armouring shall be connected to the earth bar of the equipment at each cable termination. Where jointing between lengths of MV cable occurs, the cable armouring of both cables shall be effectively connected.

15.30.5.9 Distribution and/or Metering Kiosks

An earth resistance of maximum 5 Ohm is required, with all the contributing earth wires connected to the earth bar.

2 x 10mm² bare copper earth conductors shall be installed with the supply cable in the same trench from the kiosk. The earth conductor(s) shall be connected to the earth bar of the kiosk.

15.30.5.10 Transformer Fencing (If Applicable)

All metal parts of the fence surrounding the transformer site, shall be bonded to earth and connected to the transformer LV earth terminal with a 35mm² bare copper conductor.

15.31 Existing Services

The contractor shall acquaint himself with the positions of all the existing services such as stormwater pipes, water mains, gas pipes, telephone cables, etc. before any excavations commence. For this purpose, he shall approach the Engineer, the Local Authority, the Local Supply Authority, and any other authority that may be involved, in writing.

In the event of damage to other services or structures during operations the contractor shall immediately notify the Engineer and institute repairs. The Contractor will be held responsible for damage to any existing services brought to his attention by the relevant authorities and shall be responsible for the cost of repairs.

15.31.1 Precautions, Warnings, and Inconveniences


The contractor shall take all the necessary precautions and provide the necessary warning signs, tapes and/or lights to ensure that the public and/or employees on Site are not endangered. The requirements of the Occupational Health and Safety Act, Act 85 of 1993 (as amended) shall be strictly adhered to.

The contractor shall ensure that the site operations will not endanger existing structures, personnel, other Site construction activities, or other property.

15.31.2 Mechanical Excavators

Power driven mechanical excavators may be used for trenching operations, provided that they are not used in close proximity to other plant, services or other installations likely to be damaged by the use of such machinery.

The use of power-driven mechanical excavators shall be subject to the approval of the Engineer. Should the excavator produce trenches that exceed the required dimensions,

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payment based on volumetric excavation rates will be calculated on the required dimension only.

15.31.3 Blasting

No guarantee is given or implied that blasting will not be required.

Should blasting be necessary and approved by the Engineer, the Contractor shall obtain all the necessary authority from the relevant Government Departments and Local Authorities. The Contractor shall take full responsibility and observe all conditions and regulations set forth by the above authorities.

15.31.4 Routes

Trenches, if any shall connect the points shown on the drawings in a straight line. Any deviations due to obstructions or existing services shall be approved by the Engineer beforehand.

The Engineer reserves the right to alter any cable route or portion thereof in advance of cable laying. Payment in respect of any additional or wasted work involved shall be at the documented rates.

The removal of obstructions along the cable routes shall be subject to the approval of the Engineer.

15.31.5 Shoring and Waterlogging

The Contractor shall provide shoring for use in locations where there is a danger of the sides of the trench collapsing due to waterlogging or other ground conditions. Refer to the Occupational Health and Safety Act, Act 85 of 1993 (as amended).

The strength of the shoring must be adequate for Site conditions prevailing and the shoring must be braced across the trench.

The Contractor shall provide all pumps and equipment required to remove accumulated water from the trenches. Water or any other liquid removed shall be disposed of without any nuisance or hazard.

15.31.6 Surveyor's Pegs (If Applicable)

Extreme care shall be taken not to disturb the surveyor's pegs. If the surveyor's pegs are disturbed, they shall be replaced by a qualified surveyor only and the Contractor will be liable for the cost involved, which cost the Contractor shall not recover from the Employer.

15.31.7 Cable Sleeves

Where cables cross under roads, other services areas, etc., cables shall be installed in PVC, or earthenware pipes as cable sleeves. Pitch fibre pipes are not acceptable because of

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adhesion that occurs after a period between the pipe and the sheathing or outer serving of the cables.

Cable sleeves for road crossings will be supplied and installed by the principal contractor. The Contractor shall supply and install all other cable sleeves required for the Contract Works.

Sleeves shall be joined in accordance with the manufacturer's specification to ensure a smooth inner surface along the full length of the sleeves. Sleeves shall cross roadways and railway tracks at right angles. All sleeves shall be graded 1:400 for water drainage.

Sleeves shall have a minimum diameter of 110mm for LV cables and 160mm for MV cables. They shall extend at least 1m beyond the outer road/kerb edge on both sides of the road.

Cable sleeves shall be installed to the spacings, and depths required for the cables as specified for trenching above, or as follows:

- Under roads:
 - All cable sleeves : 1200mm (Minimum 1000mm covering)
- Other locations:
 - MV cable sleeves : 1000mm (Minimum 800mm covering)
 - LV cable sleeves : 800mm (Minimum 600mm covering)

Prior to the installation of cable sleeves and pipes, the ends thereof shall be sealed to prevent the insides from being soiled during the installation process. PVC or other suitable wrapping shall be wrapped around the ends and secured by means of galvanized steel binding wire.

The wrapping shall only be removed when the cables are being installed. During the installation of cables, care shall be taken to prevent soil from being dragged into the sleeves and pipes by the cables. Upon completion of the installation of the cables, the ends of all sleeves and pipes shall be sealed with a non-hardening watertight compound. Sleeves and pipes intended for future use, shall retain the wrapping around the ends, or alternatively, be sealed with the same non-hardening watertight compound.

All sleeves intended for future use, shall be provided with 2mm diameter non-corrosive draw-wires which shall extend at least 1m on both ends of the sleeves. The excess lengths in the draw-wires shall be coiled and buried at the sleeve ends.

15.32 Testing and Commissioning Documentation

On completion of the testing and commissioning, a set of documents shall be compiled and presented to the Engineer. This set shall include:

- Drawings marked up "as built". (If on CAD, a memory stick must be issued)

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- Completed set of workshop drawings.
- Completed set of test and commissioning sheets.
- Set of schematic wiring and function diagrams.
- File of distribution board legends.
- Operating and maintenance instructions on all electrical equipment.

15.32.1 Completion of Installation

Before the commencement of any tests or commissioning procedures, the Contractor is to ensure that all nuts and bolts are securely fastened, and that paintwork on all items supplied has been touched up where damaged has occurred.

After successful completion of all the required tests, the Contractor shall issue the necessary certificates and submit same to the Engineer. In the case of the certificate of compliance by installation electricians which shall be issued in terms of the Act on Occupational Health and Safety, the original of the certificate shall be submitted to the local Supply Authority and a copy to the Engineer.

15.32.2 Inspection and Testing

On completion of the entire installation or any particular section thereof, as may be decided by the Engineer, tests shall be carried out in full accordance with the current edition of the SANS 10142 "Code of Practice for the Wiring of Premises", in the presence of the Engineer or his authorized Representative.

The Contractor should note that where applicable at least the following tests must be carried out:

15.32.2.1 LV Installation

- Insulation test
- Continuity test
- Loop Line Earth Impedance test
- Polarity test
- Earth Leakage Circuit Breaker test
- Any further test to meet the local Supply Authority requirements or as deemed necessary by the Engineer.
- Earth termination test

Note:

- All instrumentation necessary for testing shall be provided by the Electrical Sub-Contractor.
- The results of the above tests must be clearly recorded, signed and handed to the Engineer.

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- Once the Engineer has inspected the complete installation and satisfied himself that all testing has been completed and the Contract is complete in all respects, may the Engineer be approached in writing with the above documentation with a view to arranging a hand-over date.
- On completion of the Contract, the Electrical Sub-Contractor shall provide the Engineer with a completed and signed Certificate of Compliance for Electrical Installations as required by the Occupational Health and Safety Act as amended.
- Inspections by the Engineer will take place on a sampling basis only. The Engineer is not responsible for ensuring that the Contractor meets with the requirements of the Specification but will assist the Contractor in an effort to identify problem areas at an early stage. At no time will an inspection by the Engineer alleviate the Contractor of his responsibility to provide the Employer with a Contract Works which conforms in all respects with the requirements of the Specification.

15.32.3 Commissioning

The Contractor shall commission the Contract Works upon approval thereof by both the Engineer and the Local Authority, after which the Taking Over of the Contract Works takes place.

Where necessary, the Contractor shall supply a generator for testing and commissioning of the Contract Works.

15.32.4 Certificates

The Contractor shall hand over the original copies of the required test certificates to the Engineer on completion of the project:


- Test certificates with the results of DC pressure tests, as performed by the Contractor.
- Test certificates for outdoor switchgear, as issued by the manufacturer (as required by the Local Supply Authority) to prove the integrity of the switchgear.
- Certificates, as issued by the manufacturer, for the CT and VT ratios and tests done on these.
- Test certificates for the measurements of earth resistance for each substation earthing system.

15.33 Bill Of Quantities**15.33.1 Preamble**

- The conditions of contract and the application of the Contract Price Adjustment Provisions (if applicable) shall be as set out in Main Contract: Preliminaries.
- The descriptions in these bills of quantities shall be read in conjunction with the specification.

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- The unit rate for each item in the Bills of Quantities shall include for all materials, labour, profit, transport, etc., everything necessary for the execution and complete installation of the work in accordance with the description.
- The Bills of Quantities shall not be used for ordering purposes. The Contractor shall check the lengths of cables and overhead conductors on site before ordering any of the cables. Any allowance for off-cuts shall be made in the unit rates.
- The rates shall exclude Value-Added Tax, and the total carried over to the final summary.
- All material covered by this Specification shall, wherever possible, be of South African manufacture.

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15.34 Electrical Work Material Schedule

The Contractor shall complete the following schedules and submit them to the Representative/Agent within 21 days of the date of the acceptance of the tender.


The schedules will be scrutinised by the Representative/Agent and should any material offered not comply with the requirements contained in the specification, the Contractor will be required to supply material in accordance with the contract at no additional cost.

NB: Only one manufacturer's name to be inserted for each item.

Item	Material	Make or Trade Name	Country of Origin
1	Distribution boards		
2	Circuit breakers 1P, 2P, 3P		
3	On load isolators without trips		
4	Contactors 1P, 2P, 3P		
5	Earth leakage relays 1 & 3 phase		
6	H.R.C. fuse switches		
7	Kilowatt hour meter (Smart meter)		
8	Current transformers		
9	Voltmeter		
10	Maximum demand ammeter		
11	Daylight sensitive switch		
12	Time switch		
13	Conduit		

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Item	Material	Make or Trade Name	Country of Origin
14	Conduit boxes		
15	Power skirting		
16	Surface switches		
17	Watertight switches		
18	16A flush socket outlets		
19	16A surface socket outlets		
20	16A watertight socket outlets		
21	Linear LED light fittings:		
	Type H, K, L, R & S		
22	Pendants or suspended light fittings:		
	Type W		
23	Wall mounted light fittings:		
	Type B & X		
24	Downlights:		
	Type D & D1		
25	Convection Heater		
26	Fan Heater		
27	Fans		

TECHNICAL SPECIFICATIONS	 <small>PASSENGER RAIL AGENCY OF SOUTH AFRICA</small>
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Item	Material	Make or Trade Name	Country of Origin
28	Clocks		
29	PVCAS cable		
30	Cable trays		

Table 15-1 Electrical Work Material Schedule

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15.35 Particulars of Electrical Contractor

Registration with the CIDB in the category 5EB or higher is compulsory for companies wishing to submit tenders for electrical installation.

(To be completed by Contractors and submitted together with the tender form).

TENDER NO: _____

REFERENCE: _____

SERVICE: _____


NAME OF ELECTRICAL CONTRACTOR:

ADDRESS

ELECTRICAL CONTRACTOR'S REGISTRATION NUMBER AT THE ELECTRICAL CONTRACTING BOARD OF S.A.:

DATE

SIGNATURE

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16 TECHNICAL SPECIFICATIONS – ICT INSTALLATION

16.1 General Requirements for Subcontractor

All prices to include ordering, transport loading, off-loading, storing, fixing, fitting, constructing, finishing off, testing and commissioning, except where explicitly stated otherwise. All joints, screws, fixing material, etc., and labour in this connection to be included.

- The term “works” used in this Specification shall be as set out in the General Conditions of Contract.
- Notwithstanding the general conditions of Contract, works shall be carried out in accordance with the following:
 - Any Site Instruction issued to the Contractor by the Engineer or his representative.
 - This Project Technical Specification and PRASA specific standard technical specifications.
 - The Drawings, as listed in this document.
 - The Occupational Safety and Health Act, Act No. 85 of 1993, as amended.
 - The laws and by-laws of PRASA, inclusive of the Electrical Safety Instructions.
 - The laws and by-laws of PRASA and TFR, inclusive of the E7/1 document.


Notwithstanding the General Conditions of Contract, it is noted that the order of precedence is taken as item (a) having the highest priority and item (c) having the lower priority.

16.2 Scope of Work Items

The Contractor shall be responsible for the supply, transport, delivery on site reception, off-loading, storage, placing, fixing, fastening, installation, erection, making-off, connecting up, testing, commissioning, guarantees and maintenance-on-guarantees of the equipment, materials and labour on the following aspects of the works (to be read in conjunction with the drawings listed in Schedule B and specific PRASA specifications).

The Works shall include:

- The provision of new electronic pipe and chamber system including manholes.
- The provision of a new integrated CCTV System.
- The provision of a new integrated Access Control System.
- The provision of a new integrated Data and Voice Network.
- The provision of a new integrated Public Address System.
- The provision of a new integrated Fire Detection System.
- Clearing of site in terms of standard environmental guidelines and specifications.
- Testing, issuing of test certificates and commissioning of works.

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- All materials and labour needed to complete the project for final handover in complete working order, according to the attached specifications, drawings, and schedules.
- The supply of operating manuals, electrical diagrams, as-built drawings, and other documentation.
- Provision of training on the installed systems for PRASA personnel.

16.3 Electronic Pipe and Chamber Network Specifications

16.3.1 Trenching

- It is the Contractor's responsibility to establish the locality of sub-surface services such as copper co-axial communications cable, signal cables, power cables, water pipes etc. running along or crossing the trenching route. Where these services affect the positions of the sleeves, excavations shall be by hand to avoid damage to these services.
- Cable sleeves shall be laid as straight as possible between manholes.
- The cable sleeves to be 110mmØ Kabelflex, the number of sleeves is as per drawings.
- Cable sleeves shall be laid at a depth of 800mm – 900mm below finished ground level measured to the top of the 100mm bedding.
- During trenching, care shall be taken when placing the excavated soil so as not to cause damage or nuisance of any description and the contractor shall take all precautions necessary to prevent damage to any other cables, stormwater drainage systems, etc.
- Should it be necessary to remove accumulated water from a trench, this shall be undertaken by the contractor at his expense this should be considered at the time of tendering. The contractor shall provide all pumps and appliances required to carry out this operation.
- Any shoring which may be required to prevent the collapse of trench walls before cable and conductor laying and danger tape laying are completed.
- Prior to laying the conduit, the trenches shall be inspected thoroughly to ensure that they are free from any objects likely to damage the conduit either during or after laying operations.
- Once commenced, the conduit laying operation shall be followed through to completion as quickly as possible to avoid causing any inconveniences and obstructions.

16.3.2 Bedding, Padding and Main Backfill

- The 3 layers of material in the backfilled trench are classified as bedding, padding and main backfill.

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- The bedding and padding material should not be too fine and should be free of large stones (it shall be evenly graded between 0,6mm and 19mm). Clay type material is not suitable (the PI should not exceed 12 and compact ability factor should not exceed 0,4).
- The bottom of the trench shall be filled across the full width with a 100 mm bedding of imported sand or a 100mm layer of suitable soil sifted through a 6mm mesh and levelled off.
- After sleeve installation blanket/padding layer of compacted imported sand shall be provided to extend to 300mm above the sleeves before covering with compacted backfill.
- The material excavated from the trench can be used as main backfill if it is free from stones greater than 150mm, and if the possible subsidence of the trench is not an issue. If subsidence is an issue, then selected materials may have to be used.

16.3.3 Manholes

- Supply and install 800mm x 800mm by 1000mm(deep) manhole to detail

16.3.4 CCTV System Requirements**16.3.4.1 Technical specifications**

Refer to Schedule D for detailed PRASA technical specifications included with this tender as follows:

- PRASA Specification Document V5 310102_11 May 2016
- Detailed Security Specification_2018-06-11
- Annexure 14_PRASA CCTV System
- NGS_2014 – 11 – 07

16.3.4.2 Compatibility

The system shall be able to integrate with Babylon sub-systems. The appointed bidder to confirm compatibility in a tender covering letter.


Where the PRASA specification/s calls for/specifies OEM's to be used, the bidders shall interpret this to mean "equivalent approved".

The system to be integrated with fire detection, Public Address, Access Control and CCTV systems.

16.3.4.3 Installation

The required CCTV locations are indicated on the accompanying tender drawings.

Where CCTV positions are shown, and no trunking is provided at these locations, equipment shall be mounted onto the ceiling tile and/or on the wire mesh basket/tray directly.

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The contractor to make provisions for optic fibre cable installation to link the various buildings. The optic fibre cable shall terminate onto switches in the buildings indicated on the drawings.

The contractor shall make provision for linking into the existing fibre network via the existing PRASA patch panel. This link shall link the server room with the Central Control Room at JOC (Joint Operations Centre) located at the Durban Station complex.

16.3.4.4 *Additional Requirements*

Video streaming shall be done at the JOC. The contractor to make provision for the installation of equipment at this location. The contractor shall via the Electronics services Engineer liaise with PRASA for access to the central control room and for works to be done there.

16.3.5 **Access Control System**

Technical specifications

Refer to Schedule D for detailed PRASA technical specifications included with this tender as follows:

- PRASA Specification Document V5 310102_11 May 2016
- Detailed Security Specification_2018-06-11
- Annexure 14_PRASA CCTV System
- NGS_2014 – 11 – 07

16.3.5.1 *Compatibility*

The contractor shall provide a Babylon based access control system.

The system to be integrated with fire detection, CCTV, Public Address and CCTV systems.

16.3.5.2 *Installation*

Door equipment to be installed in the positions as indicated on the tender drawings provided.

Fingerprint readers to be installed at a height of 1200mm above finished floor level and must be suitable for outdoor use.


The contractor to make provision for a double knock access control system to the server room door. Magnetic lock release shall only occur once a secondary pin or key is used following fingerprint scan.

All conduits to be chased in walls, unless shown otherwise.

Cabling to be laid in wire-mesh basket/tray or as indicated on the drawing.

16.3.5.3 *Additional Requirements*

Access control server to be installed in the server room cabinets located in the Office building.

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The system shall be linked to JOC building.

16.3.6 Data and Voice Network

16.3.6.1 Technical specifications

Refer to Schedule D for detailed PRASA technical specifications included with this tender as follows:

- PRASA Specification Document V5 310102_11 May 2016
- Detailed Security Specification_2018-06-11
- Annexure 14_PRASA CCTV System
- NGS_2014 – 11 – 07

16.3.6.2 Compatibility

PRASA is in the process of upgrading their network switches to Huawei at the Durban Yard. For ease of integration the Contractors to consider the use of similar hardware or include provisions for complete system integration where this equipment will not be used.

16.3.6.3 Installation

The contractor to make provision for network, distribution, and access layer switches in data cabinets in the server room.

Optic fibre cables to be installed in kabelflex sleeves, trunking and wire mesh baskets/trays.

The contractor to make provision for meshed Wi-Fi, Data and Telephone access points positioned as shown on the drawings.

Data points to be installed on power skirting, in ceiling voids with ceiling connectors.

Where there is no ceiling access, points shall be installed to the underside of the wire mesh basket/tray complete with brackets and junction boxes.

16.3.6.4 Additional Requirements


A fibre network is required to connect the various buildings, and this network shall have a ring configuration.

16.3.7 Public Address System

16.3.7.1 Technical specifications

Refer to Schedule D for detailed PRASA technical specifications included with this tender as follows:

- PRASA Specification Document V5 310102_11 May 2016
- Detailed Security Specification_2018-06-11
- Annexure 14_PRASA CCTV System
- NGS_2014 – 11 – 07

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16.3.7.2 *Compatibility*

Where the PRASA specification/s calls for/specifies OEM's to be used, the bidders shall interpret this to mean "equivalent approved".

The Public Address system must seamlessly integrate with the Babylon Building Management System.

Systems to be integrated with access control system include the fire detection, CCTV, Access Control and CCTV systems.

16.3.7.3 *Installation*

Cabling to be installed in wire mesh basket/tray, trunking, and PVC conduits as may be required.

Compact speakers to be installed flush with ceilings. Horn speakers to be installed to the underside of trunking, against the wall, or wire mesh basket/tray with universal Cablofil multi-fix plates or similar brackets.

Cabling from boardroom audio visual system to floor boxes to be installed in 50mmØ conduit, chased into the floor screed.

16.3.8 **Fire Detection System**

16.3.8.1 *Technical specifications*

Refer to Schedule D for detailed PRASA technical specifications included with this tender as follows:

- 20180611 Detailed Security Specification
- NGS – 2014 – 11 – 07

16.3.8.2 *Compatibility*

Where the PRASA specification/s calls for/specifies OEM's to be used, the bidders shall interpret this to mean "equivalent approved". Systems to be integrated with, the Fire Detection System in the CCTV, Access Control and Public address systems.

16.3.8.3 *Installation*

Fire and mimic panels are to be installed surface against the wall as indicated on drawings.

Where there is no ceiling the fire detectors shall be surface fixed on beams and fixed to walls and trunking where beam detectors are used.

Detector bases shall be installed over a 62mmØ galvanized steel round boxes in areas with no ceiling, and 62mmØ round PVC boxes where fixed to the ceiling.

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Conduits installed along the beams to be supported with beam clips/snap in conduit clip combinations or similar. These clips are to be installed on either end of the galvanized round boxes. Clips shall be provided at intervals not exceeding 1m.

Strobe sirens shall surface fixed to walls over/onto a 62mmØ flush mounted round box with PVC conduits chased into the wall. Manual break glass units to be installed onto flush mount 100mm X 100mm PVC boxes with PVC conduits chased in walls.

16.4 As-Constructed Drawings

The Contractor shall correctly mark-up drawings. If any changes are made during construction these changes shall be added to the drawings and supplied to the Electrical Engineer to assist the Contractor with the capturing of these changes onto a drawing.

Marking shall be in the following colours:

- Yellow items omitted
- Red items newly brought on

Such changes shall, regularly during the construction period, be brought under the attention of the Electrical Engineer.

All such changes, correctly marked up, shall have been handed over to the Electrical Engineer at the date of commissioning.

No handing over shall be done before the Electrical Engineer has received such as-constructed drawings.


16.5 Workmanship

A very high level of workmanship will be required in this instance to ensure that the installation is vandal resistant.

All joints must be full closed to ensure that no sharp objects can be pushed inside.

16.6 Contractors Responsibility**16.6.1 The Works**

The Contractor shall be responsible for the supply, factory testing, delivery to site, offloading, storage until required, installation, erection, site testing, commissioning, and handing over in working order the electronic equipment detailed by this Specification and the accompanying drawings. The Contractor shall provide all materials, equipment and services necessary for the complete, safe and efficient progress and completion of the Contract. The works shall be carried out in a sequence to be determined by the Main Contractor and approved by PRASA.

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16.6.2 Commissioning Test and Completion

The PRASA staff, in conjunction with the Contractor, shall carry out the final commissioning test. The Contractor shall carry out any remedial work, if necessary.

All cost for commissioning tests shall be for the Contractors account, inclusive of PRASA costs.

16.6.3 Guarantee

All work undertaken by the Contractor shall be subject to a guarantee for a period of one year against faulty and/or inferior workmanship and material.

The guarantee period shall commence the day the installation is formally handed over to and accepted by the local PRASA staff.

The Contractor shall undertake to repair all faults or defects due to bad workmanship and/or faulty materials during the guarantee period within the duration allowed for this activity stipulated in the Contract Document.

Any defects that may become apparent during the guarantees period shall be rectified to the satisfaction of and free of cost to PRASA.

The Contractor shall undertake work on the rectification of any defects that may arise during the guarantee period within the time noted in the Contract Document, from the time of being notified by the Client or his representative.

Should the Contractor fail to comply with the requirements stipulated above, PRASA shall be entitled to undertake the necessary repair work or effect replacement of defective apparatus or material, and the Contractor shall reimburse PRASA the total cost of such repair or replacement, including the labour costs incurred in replacing defective material.

16.6.4 Handing Over


Two handing-over dates shall be set:

The first handover when the Electrical System is commissioned to the satisfaction of the Engineer, in accordance with the details as set out in the handing over documentation of PRASA.

All non-consumable equipment and labour shall be guaranteed for 12 months after the expiry of the retention period.

The retention period shall be 12 months from the date of First Handover.

A final inspection and Final Handover shall end the retention period.

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17 TECHNICAL SPECIFICATIONS – HEALTH AND SAFETY SPECIFICATION AND BASELINE RISK ASSESSMENTS

17.1 Specific Project Information

17.1.1 Introduction And Definitions

The requirements of the construction regulations 2014 (and guidance notes of 2017) have been in effect since 7th august 2014. The regulations place legal duties upon principal contractors and contractors. Although this health and safety specification includes much of the content of the regulations, the contractor will be deemed to be familiar with the requirements of these regulations, and other associated health and safety regulations, and to have factored in all the duties placed upon contractors and principal contractors in the tender. A copy of the regulations can be viewed on the department of labour's website.

Please note that the terms "contractor" and "principal contractor" have the same meaning as that in the construction regulations and are used interchangeably in this document, i.e., references to "contractor" refer to principal contractor and/or contractor as the regulations pertain to their functions.

This Health and Safety Specification contains clauses that are generally applicable to construction activities, as well as imposing pro-active controls associated with activities that impact on Health and Safety as it relates to work on site. Compliance to the requirements of the Occupational Health and Safety Act 1993 is an additional requirement of this Health and Safety Specification and is part of the Contractor's responsibility. The Client, and/or their agents, will monitor that all Contractors comply with the requirements of such legislation.

All references to client in this health and safety specification also refer to safety agent, where so appointed.

Definitions (as per the Construction Regulations 2014) applicable to this Health and Safety Specification:

"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 any person for whom construction work is being performed;

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"competent person" means a person who 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 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 supervising construction activities 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 -

the construction, erection, alteration, renovation, repair, demolition or dismantling of or addition to a building or any similar structure; or

the construction, erection, maintenance, demolition or dismantling of any bridge, dam, canal, road, railway, runway, sewer or water reticulation system; or the moving of earth, clearing of land, the making of excavation, piling, or any similar civil engineering structure or type of work;

- "Construction work permit" means a document issued in terms of regulation 3.
- "contractor" means an employer who performs construction work.

Note:

a) Includes organizations and or self-employed person that contracts with a client, principal contractor, or a contractor to carry out 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;

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"designer" means a competent person who-

- prepares a design;
- checks and approves a design;
- 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
- designs temporary work, including its components;
- an architect or engineer contributing to, or having overall responsibility for a design;
- a building services engineer designing details for fixed plant;
- a surveyor specifying articles or drawing up specifications;
- a contractor carrying out design work as part of a design and building project; or
- an interior designer, shopfitter, or landscape architect.

"ergonomics" means the scientific discipline concerned with the fundamental understanding of interactions among humans and other elements of a system, and the profession that applies theory, principles, data, and methods to design in order to optimise human well-being and overall system performance.

"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;

"falsework" means a combined system of formwork and support work;

"formwork" means temporary or permanent shutters used to form wet concrete into elements of a structure, and includes both horizontally and vertically placed shutters;

"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 guard-rails, screens, barricades, anchorages or similar equipment;

"fall protection plan" means a documented plan, which includes and provides for -
all risks relating to working from a fall risk position, considering the nature of work undertaken;
the procedures and methods to be applied in order to eliminate the risk of falling; and
a rescue plan and procedures;

"fall risk" means any potential exposure to falling either from, off or into;

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"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 health and safety specification;

"health and safety specification" means a site, activity or project specific document prepared by the Client pertaining to all health and safety 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 regulation 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.

"National Building Regulations" means the National Building Regulations made under the National Building Regulations and Building Standards Act, 1977 (Act No. 103 of 1977), and promulgated by Government Notice No. R. 2378 of 30 July 1990, as amended by Government Notices No's R. 432 of 8 March 1991, R. 919 of 30 July 1999 and R. 547 of 30 May 2008.

"person day" means one normal working shift of carrying out construction work by a person on a construction site.

"principal contractor" means an employer appointed by the Client to perform construction work.

"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.

"provincial director" means the provincial director as defined in regulation 1 of the General Administrative Regulations, 2003.

"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.

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"structure" means-

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;

any falsework, scaffold or other structure designed or used to provide support or means of access during construction work; or

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.

"support work" means the temporary structure erected to support the formwork before the casting of a concrete element of a structure.

"suspended platform" means a working platform suspended from supports by means of one or more separate ropes from each support;

"temporary works" means any falsework, formwork, support work, scaffold, shoring or other temporary structure designed to provide support or means of access during construction work;

"the 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.

Reference should be made to the following documentation in conjunction with this Safety Specification (including existing surveys, drawings, and reports):

- Tender documents once prepared
- Drawings once prepared

IMPORTANT NOTE:

This Health and Safety Specification has been prepared to comply with the requirements of the Construction Regulations 2014.

17.1.2 Background to the Health and Safety Specification

Historically, the Construction Industry has had a poor health and safety record. Due to the complex and potentially dangerous operations being undertaken, there is a high risk of

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incidents, accidents, and injuries. In many instances poor adherence to the Act and Regulations has resulted in severe consequences for Health and Safety performance. The Client is determined that the highest Health and Safety standards will prevail throughout the Contract and that there will be full commitment from all parties involved.

To achieve this goal the Client has arranged for the preparation of this Health and Safety Specification. The Health and Safety Specification sets out guidelines and minimum levels of awareness and guidance for Health and Safety requirements for the project. Contractual responsibility for adhering to these requirements rests with the Contractors. All employees are encouraged to be pro-active in compliance.

The Client is committed to ensuring the highest Health and Safety standards for all work undertaken within the Contract.

Contractors as employers are fully responsible and accountable for compliance with all Health and Safety requirements.

IMPORTANT NOTE:

Compliance with the Occupational Health and Safety Act and Regulations shall not be limited to this Health and Safety Specification and definitions contained in this document.


Contractors shall be conversant with the requirements and effects of Health and Safety legislation upon their activities, in particular the Construction Regulations, 2014, and the Occupational Health and Safety Act, 1993, and to have made adequate resource in their tender submission to comply with all legislative requirements.

Failure to comply with the requirements of this Safety Specification will result in severe sanction and the severity of the sanction will depend on the severity of the noncompliance.

The Contractor's personnel will be responsible for the auditing of the implementation of the Health and Safety Specification and maintaining the document control and record systems associated with the Health and Safety Specification. The Client will arrange for Health and Safety audits to be conducted on site on their behalf to monitor health and safety compliance by contractors.

17.1.3 Purpose of the Health and Safety Specification

The purpose of this site-specific Health and Safety Specification is to comply with legal requirements and to provide health and safety information about specific project risks known by the Client, Designer and Safety Agent to be applicable to this project. This document also provides minimum health and safety requirements, standards, and expectations that the contractor must adhere to.

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The Contractor must take into account all information in this specification and ensure that their tenders include adequate resource and competence to deal with the matters detailed herein so that all relevant contents are dealt with in a way which is in compliance with legislation and the ethical concerns for the safeguarding of employees, contractors and other persons affected by the construction activities. Please note that a detailed OHS bill of quantities must be provided by the contractor on all Construction Work Permit projects. The Bill of Quantities will form part of the Construction Work Permit application presented to Department of Labour for approval.

The Health and Safety Specification will be implemented during construction of the works and any construction activity that the Client has control over.

This will also assist in ensuring that all the costs related to the compliance with Occupational Health Act 85 of 1993 and the Construction Regulations 2014, as well as this Health and Safety Specification, are taken into consideration at Tender stage

No advice, approval of any document required by the Health and Safety Specification such as hazard identification and risk assessment action plans or any other form shall be construed as an acceptance by the Client of any obligation that absolves the Contractor from achieving the required level of performance and compliance with legal requirements.

Further, there is no acceptance of liability by the Client which may result from the Contractor failing to comply with the Health and Safety Specification unless the Client has issued an instruction to any requirement, i.e. the Contractor remains responsible for achieving the required performance levels.

17.1.4 Implementation of the Health and Safety Specification

This Health and Safety Specification forms an integral part of the Contract, and Contractors shall make it an integral part of their Contracts with other Contractors and Suppliers. Contractors employed by the Client are to ensure that the provisions of the Health and Safety Specification are applied both on the site and in respect of all off site activities relating to the project, in particular in transport activities and project dedicated off site fabrication works.

The Contractor shall enforce the provisions of the Health and Safety Specification amongst all Contractors and suppliers for the project.

The Contractor shall sign the acknowledgment on the last page of this safety specification that he/she has familiarized him/herself with the content of the Health and Safety Specification and shall comply with all obligations in respect thereof.

The successful Contractor will be required to compile a Health and Safety Plan based on the requirements of the Occupational Health Act 85 of 1993 and these Specifications, which will

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need to be approved by Client (or their appointed safety agent) prior to commencement with construction work.


17.1.4.1 Client Duties

In terms of the Construction Regulations 2014 the Client (or their Agent, where appointed) has legal duties. Where an Agent (refer to “definitions” section of this document) is appointed in terms of this project, these Health and Safety duties assigned will also apply.

All references to “Client” will apply to their appointed “Safety Agent”, where so appointed, in this Health and Safety Specification.

The Client must:

- Prepare a baseline risk assessment for the construction work
- Prepare a suitable, sufficiently documented, and coherent site specific Health and Safety specification for the intended construction work, based on the baseline risk assessment
- Include the health and safety specification in the tender documents
- Ensure that potential principal contractors submitting tenders have made adequate provision for the cost of health and safety measures
- Ensure that the principal contractor to be appointed has the necessary competencies and resources to carry out the construction work safely
- Take reasonable steps to ensure co-operation between all contractors appointed by the Client to enable each of those contractors to comply with the regulations
- Ensure, before work commences, 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)
- Appoint each principal contractor in writing for the project, or part thereof
- Discuss and negotiate with the principal contractor the contents of the principal contractor’s safety plan and thereafter finally approve that plan for implementation
- Ensure that a copy of the principal contractor’s health and safety plan is implemented and maintained
- Ensure that periodic health and safety audits and document verification are conducted at intervals mutually agreed upon between the principal contractor and any contractor, but at least once every 30 days
- Ensure that a copy of the health and safety audit report is provided to the principal contractor within 7 days after the audit

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- Stop any contractor from executing a construction activity which poses a threat to the health and safety of persons which is not in accordance with the principal contractor's health and safety plan for site
- Where changes are brought about to the design or construction work, make sufficient health and safety information and appropriate resources available to the principal contractor to execute the work safely
- Ensure that the health and safety file is kept and maintained by the principal contractor.
- Where the Client requires additional work to be performed as a result of a design change or error in construction due to the actions of the Client, the Client must ensure that sufficient safety information and appropriate additional resources are available to execute the required work safely.
- Where more than one principal contractor is appointed, the Client must take reasonable steps to ensure co-operation between all principal contractors and contractors to ensure compliance with the Regulations
- Where the Client has appointed a Safety Agent for the project, their details for this project are contained in the Project Directory section of this health and safety specification.

17.1.4.2 Designer Duties

It must be noted that the Designer also has Health and Safety duties assigned in terms of the Construction Regulations. Where the contractor fulfils a design function in terms of this project (refer to "definitions" section of this document), these duties will also apply. Please refer to Regulation 6 of the Construction Regulations 2014.

Please note that the designer of temporary works must ensure that:

- all temporary works are adequately designed so that it will be capable of supporting all anticipated vertical and lateral loads that may be applied.
- the designs of temporary works are done with close reference to the structural design drawings issued by the contractor, and in the event of any uncertainty consult the contractor.
- all drawings and calculations pertaining to the design of temporary works are kept at the office of the temporary works designer and are made available on request by an inspector; and
- the loads caused by the temporary works and any imposed loads are clearly indicated in the design.

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17.1.5 Existing Environment

17.1.5.1 Hazards particular to this project by virtue of location

- Site is located in an existing Shunting Yard with associated infrastructure and facilities in close proximity to the works, including buildings and traffic movement.
- Client staff and visitors may be in vicinity of the works. Buildings where work to take place will be occupied by staff members.
- Existing services on site.
- Working in railway yard with associated train movement hazards and other PRASA work activities.
- Area prone to security, protest action or crime issues that the contractor must take into account
- Asbestos containing products may be present

17.1.5.2 Overhead, Above Ground and Underground Services crossing the site:


- Overhead: Yes, Principal Contractor to check area and take precautions against damage to services and risk of injury to employees. Overhead electrical cables present.
- Underground: Principal Contractor to check area and take precautions against damage to services and risk of injury to employees. Electrical, water, sewer, telecoms, etc. Present.
- Ground level: Principal Contractor to check area and take precautions against damage to services and risk of injury to employees. Substation present on site and other PRASA infrastructure.
- Service Drawings available: TBA
- Wayleaves required: TBA
- Permits required: Principal Contractor to discuss with the Client.
- Isolations required: Yes, Principal Contractor to liaise with Client.

17.1.5.3 Existing structures on site and surrounding land use (with a significant impact on Health & Safety):

- Site is located in an existing Shunting Yard with associated infrastructure and facilities in close proximity to the works, including buildings and traffic movement. Moses Mabhida Stadium is located close to the perimeter of the Shunting Yard (this will not impact on the project but may result in traffic disruption on occasion).
- Existing services on site.

17.1.5.4 Existing ground conditions and ground survey report:

- Geotech report available.
- Not known if there are any issues with ground contamination in the yard areas.
- Max excavation depth will be 3m.

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- Shoring and dewatering thought to be required.

17.1.5.5 Existing Traffic Systems

- Condition: Existing surfaced roads to site.
- Restrictions to access: None known.
- Speed restrictions: Usual urban speed limits apply, speed limit on site to be maximum of 20 kph or less.

17.1.6 Project Health and Safety Requirements

17.1.6.1 Construction Work Permit Required for the Project: Yes

17.1.6.2 Significant health and safety hazards identified by Client, Designer and Safety Agent:

Risk of criminal activities & protest action – possible risk of crime & protest action with potential risk to contractors. The safety of the workers must be taken into consideration. Emergency procedures must form part of induction training. Contractor must ensure safe entry into the area and vacate the area immediately in event of incidents and notify professional team.

Protection of members of public and road users – The health and safety of members of public, road users, rail users, PRASA staff and workers must be a priority at all times and all necessary steps must be taken to protect them. Existing roads will remain open during works. Buildings where work to take place will be occupied by staff members. The PRASA premises are fenced off at the perimeter.

Note that existing fire exits, corridors, fire alarms, evacuation procedures and other fire and emergency related issues for each building and PRASA area where works are taking place may not be tampered with or otherwise interfered with without the permission of the Project Manager beforehand.

Excavations – Max 3m – method statement to be in place. All workers must receive induction prior to commencement of works. Excavations must slope to a safe repose. If sloping is not possible, it must be adequately supported and maintained by a competent person so that they are capable of supporting all anticipated vertical and lateral loads that may be applied to them. Excavations must be backfilled by end of each shift as far as is reasonably practicable. If this cannot be done then appropriate safety measures must be put in place by the contractor to prevent unauthorized entry to excavations, including barriers and warning signage. Ensure there is a safe distance between employees and plant when digging excavations. Shoring and dewatering will be required.

ALL EXCAVATIONS MUST HAVE A MINIMUM OF ORANGE PLASTIC BARRIER MESH IN PLACE.

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Excavated soil is to be placed at a sufficiently safe distance from the excavation itself.

Use of delivery or support trucks used for the delivery and removal of material and equipment on open roadways – plant must be effectively separated from members of public and unauthorized personnel. Trained flag persons wearing high visibility clothing to be in place as required. Exclusion zone to be in operation when the support vehicles are in use next to the roadways.

Noise and Dust control: Measures to be put in place by the appointed contractor to minimize the dust and noise on site. Contractor must take sufficient steps to reduce the production of noise and dust.

Work in PRASA area – Contractor must ensure that all required inductions, permits and safety documentation have been evaluated by the client and professional team and approved. All required safety protocols are in place as well as all required PPE worn. When working next to railway lines all required PRASA and site access permit protocols to be closely followed.

Warning Notices: Construction warning signage must be prominently displayed to avoid access to site areas by unauthorized persons.

Risk of fires caused by construction works and / or Smoking – ensure correct measures are in place for fire control to ensure no fires will break out. Fire extinguishing equipment to be readily available at all times especially during high-risk activities. The smoking of cigarettes is also to be monitored and adequate smoking areas and smoking control measures to be put in place.

Use of hazardous Substances – MSDS to be available. Contractor must exercise caution as there is always a potential for fires. Suitable fire extinguisher to be in place at all times. Gloves and suitable respiratory protection must be provided and worn as well as other appropriate personal protective equipment (PPE) required by risk assessments.

Demolition – All works must be conducted under competent supervision and after safe means of work agreed with client. PPE to be worn.

Plant and Equipment – all operators must provide copies of their up-to-date competency and medical certificates and driver's license. Loads must be slung by person with appropriate training and competence. Daily plant inspection registers to be completed and records kept in the safety file. Valid load test certificates and record of inspections by competent personnel must be available and maintained throughout the project. Rotating amber lights and reverse alarms to be active when operating all plant on site. Plant must be effectively separated from members of public and unauthorized personnel. Use trained flag persons as applicable. Exclusion zone under lifting operations to be enforced as applicable. Particular attention must be paid to lifting operations in windy conditions.

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Working at height (>5m – 3 and 4 storey buildings) – All temporary works and access equipment to be built and maintained in a safe condition by competent and trained personnel. Workers working at height must have appropriate and sufficient safety equipment and licenses as applicable. Safety harnesses with securely attached lanyards must be worn in areas where safety while working at height cannot be assured by other means. Edge protection must be provided where feasible to prevent materials and people from falling. Note that exclusion zones under the works at ground level will be required when working over vehicle or pedestrian trafficked areas. Note that wind will make working at heights riskier. Scaffolding will be required on this project too.

Lifting Operations – all operators must provide copies of their up-to-date competency and medical certificates and driver's license. Loads must be slung by person with appropriate training and competence. Daily plant inspection registers to be completed and records kept in the safety file. Valid load test certificates and record of inspections by competent personnel must be available and maintained throughout the project. Rotating amber lights and reverse alarms to be active when operating all plant on site. Plant must be effectively separated from members of public and unauthorized personnel. Use trained flag persons as applicable. Exclusion zone under lifting operations to be enforced as applicable. Particular attention must be paid to lifting operations in windy conditions.

Electrical commissioning works – may only be undertaken by competent and experienced personnel. Power supply must be made safe before any commissioning make take place. A permit to work system may be enforced for this activity.

Confined Space Work – including inspection pits 130m long x 1m wide x 2No. off – confined space work must be monitored by competent appointed person, to include but not restricted to, ensuring that the confined space is sufficiently ventilated prior to entry. Oxygen levels to be tested in confined space to ensure that it is safe for entry. Permit system to be in place to declare confined space safe for entry. PPE to be worn (such as proper masks) if air supply insufficient or not of sufficient quality. Emergency procedures to be in place to incorporate evacuation procedures. Sufficient training must take place in use of equipment prior to any works commencing in such confined space.

Hot works – All hot works will require a method statement. A permit to use equipment is required after it has been inspected and found to be in good condition and task specific documents are in place. All hot works will require a fire extinguisher at less than 20 meters on hand.

Presence of Asbestos (as applicable) – Works with asbestos must be done in strict accordance with the Asbestos Abatement Regulations of 2020. Asbestos register to be referred to for each building prior to works commencing.

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Working in vicinity of overhead live services as well as other services at ground and below ground levels - all necessary precautions must be taken to prevent accidental contact with these services, to prevent damage or risk of causing of injury during construction process. All services to be treated as live.

Use of Troxler – To be operated by trained and competent individuals and stored, used in accordance with the requirements of health and safety radiation legislation.

Other construction hazards that the contractor can reasonably expect are as follows:

- Compacting and Filling
- Compactor Operations
- Cutting Off Disc
- Electric Tools and Electrical Installations
- Flammable Liquids / Gas
- Hand tools
- Manual Handling of General Items

NOTE: Please refer to end of this Health and Safety Specification for the baseline risk assessment for these hazards and risks.

17.1.6.3 Activities Requiring Approved Method Statements (For Health and Safety):

Pre-Construction Phase Method Statements

- Site establishment

Construction Phase Method Statements

- Excavations (including inspection pits 130m long x 1m wide x 2 No. off)
- Working at height
- Lifting operations
- Work in rail precinct
- Electrical commissioning works
- Demolition
- Confined spaces
- etc.

17.1.6.4 Activities Requiring Permits (For Health and Safety Purposes)

- Permit to Dig: Yes, existing services to be located and made safe before formal excavation works take place.
- Permit to Enter Excavations: The Principal Contractor is to formally manage all excavation work.
- Road Works Permit: To be advised.

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- PRASA Permits – Yes, Principal Contractor to liaise with PRASA for site access permit.
- Permit to Work with Electricity: The Principal Contractor is to formally manage all electrical work.
- Confined Space Permit: The Principal Contractor is to formally manage all confined space work.
- Hot Works Permit: The Principal Contractor is to formally manage all hot work.
- Permit to Work under Power Lines: The Principal Contractor is to formally manage all works under overhead services.
- Blasting: n/a
- Client issued permit for work in restricted areas: To be advised.
- Temporary Works: The Principal Contractor is to formally manage all temporary works.

17.1.6.5 Contractor Safety Officer Provision

The requirement for this site is that a full-time SACPCMP registered Safety Officer must be appointed to the project by the Principal Contractor.

17.1.6.6 Traffic Management and Traffic Safety Officer Provision (As Applicable)

Not thought to be applicable to this project.

17.1.6.7 Environmental Conditions

Contractors must consider adverse weather conditions on site activities and implement control measures to mitigate risk. This includes risk of exposure to excessive heat, cold, rain, lightning and wind.

The open nature of the site works will not preclude any of the above.


17.1.6.8 Arrangements For Access, Parking, Deliveries, Etc.

- Access to site by Construction Vehicles: Off existing road network.
- Access to site by Construction Workers and Visitors: Via existing roads.
 - All service providers must sign a 37.2 Mandatory Agreement and must be inducted before they can be allowed on site.

17.1.6.9 Arrangements For Site Camp, Ablutions and Yard**Site camp location and set up**

Contractor to advise in consultation with Engineer / Professional Team:

- Restrictions / requirements
- Storage areas
- Security

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17.1.6.10 Ablutions and Welfare Arrangements

Contractor to supply ablutions and facilities in line with the Construction Regulations 2014. Toilets should be provided with built in facilities for hand washing. Please note further that control measures form an important part of ablutions provision on site ref soap and water/hand sanitizer, signage, etc.:

- Contractor to provide as per Regulations:
- Toilets
- Washing facilities
- Drinking Water
- Shelter
- Showers

Mobile site facilities requirements:

A mobile toilet will be required for sites that cannot facilitate a permanent location for abluion units and must be available for each gender per location.

The use of a mobile toilet must be prepared and setup correctly with additional anchors and available toiletries prior to each working day and to be first priority when changing location of works along a set working path

Teams are to ensure that the toilets are cleaned correctly and suitable for easy and hygienic uses and recorded on a daily register.

17.1.6.11 Protection Of Site Against Unauthorised Access by Public

Excavation Fencing: excavations are to be fenced off to protect the public, deep excavations (as applicable) must be properly supported to prevent collapse. At interface with public the fencing will need to be robust to prevent unauthorized access and falls into excavations.

General Fencing of Site: Requirements are to be discussed with the Project Client.


- Pedestrian foot traffic is to be redirected in a safe manner where applicable – Pedestrian safety is to be observed.
- Ensure site works are fenced off to prevent unauthorised access by members of public.

Warning Notices: Construction warning signage must be prominently displayed to avoid unauthorized access to site and to warn of dangers associated with construction works.

Lookouts: TBA

17.1.6.12 Personal Protective Equipment (PPE)

The Client requires the Contractor to ensure that employees (and others under his/her control) wear the following minimum PPE:

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Overalls: Yes.

Safety Harnesses: Yes – as per risk assessment

Hard Hats: As per risk assessment.

Reflective Vests: Yes.

Goggles / gloves / ear defenders / respiratory protection: Yes – as per risk assessment.

Safety Footwear: Yes.

Specialist Equipment (e.g. for confined Spaces): As per risk assessment, especially for working with electricity.

17.1.6.13 Hazardous Substances

The following materials and substances have, or may have, to be used in the works and are identified as potentially posing special health and / or safety hazards during the project. Appropriate measures will need to be specified for their control:

Fuels – oils – solvents – cement - etc.

17.1.7 Interface And Restrictions by Client

Contractor must note that the following Client activities will continue during construction:

- PRASA operations and shunting yard operations will continue while construction operations are undertaken.

17.1.7.1 The following Client safety rules and/or requirements are to be observed:

- All workers are to receive induction prior to commencement of work on site.
- Other safety rules and requirements to be advised at induction.
- Please also refer to tender document.

17.1.7.2 Restrictions on times, access or other restrictions by Client

- Please refer to tender document.
- Other restrictions may be advised at induction.

17.1.8 Project Close Out

The Health and Safety files for the Principal Contractors and all Contractors require closure and handover to the Client at the completion of the project in the form of a consolidated safety file. The following list is an example of what should be included but is not exhaustive. The Safety Agent or the Client may require further information at the time of completion and the Principal Contractor is to ensure that all instructions are responded to. Documentation would include all health and safety related records from the start of the project. All records to be in

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hard copy or electronic format and submitted to the Safety Agent for approval in adequately formatted lists and folders. Layout should be logical and in the same order as in the site files.


Consolidated Health and Safety close out file requirements include:

- Health and safety specification (most recent version)
- Principal Contractor's health and safety plan/s
- Site safety organograms
- Legal appointments
- Notification to Department of Labour of commencement of work / Construction Work Permit
- Workman's Compensation Letters of Good Standing for the project
- Full safety files for all contractors as well as their close out reports
- List of all contractors who worked on site
- Letters of safety plan approval of contractors by the Principal Contractor
- Mandatory agreements (section 37.2 agreements)
- Incident and accident records / Occupational Disease records
- Contractor Nonconformance records
- Safety agent's audit reports
- Safety Officer reports
- Method Statements
- Risk assessments
- Safe work procedures
- Medical surveillance certificates of fitness. Medical records are to be kept according to the Occupational Health and Safety Act, as amended.
- All temporary works drawings (suspended beams/scaffolds, etc.)
- Copies of test results, policies, and procedures for environmental monitoring (silica, noise, dusts, etc.)
- Detailed registers of all material used
- Copies of all Checklists completed

17.1.8.1 Safety File Return to Client

The consolidated Health and Safety Files for the Project is to be handed over by the Principal Contractor to the Client upon Project Completion in either hard copy or electronic format.

Both the Client and the Contractor have a duty in terms of health and safety legislation to do all that is reasonably practicable to make members of the public and others being affected by the construction processes aware of possible risks and put preventative measures in place to mitigate the risks. The public and/or visitors shall go through a brief health and safety

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induction detailing hazards and risks they may be exposed to and what measures are in place to control these hazards and risks.

17.2 Further Requirements

17.2.1 Duties of Principal Contractor / Contractor in terms of Construction Regulations 2014

A Principal Contractor must:

- provide and demonstrate to the Client a suitable, sufficiently documented and coherent site-specific health and safety plan, based on the Client's documented health and safety specifications, which plan must be applied from the date of commencement of and for the duration of the construction work and which must be reviewed and updated by the principal contractor as work progresses.
- open and keep on site a health and safety file, which must include all documentation required in terms of the Act and these Regulations, which must be made available on request to an inspector, the Client, the Client's Safety Agent, or a Contractor; and
- on appointing any other contractor, in order to ensure compliance with the provisions of the Act –
 - provide contractors who are tendering to perform construction work for the principal contractor, with the relevant sections of the health and safety specifications pertaining to the construction work which must be performed.
 - ensure that potential contractors submitting tenders have made sufficient provision for health and safety measures during the construction process.
 - ensure that no contractor is appointed to perform construction work unless the principal contractor is reasonably satisfied that the contractor that he or she intends to appoint, has the necessary competencies and resources to perform the construction work safely.
 - 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.
 - appoint each contractor in writing for the part of the project on the construction site
 - take reasonable steps to ensure that each contractor's health and safety plan is implemented and maintained on the construction site.
 - ensure that the periodic site audits and document verification are conducted at intervals mutually agreed upon between the principal contractor and any contractor, but at least once every 30 days.

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- stop any contractor from executing construction work which is not in accordance with the Client's health and safety specifications and the principal contractor's health and safety plan for the site or which poses a threat to the health and safety of persons.
- where changes are brought about to the design and construction, make available sufficient health and safety information and appropriate resources to the contractor to execute the work safely.
- discuss and negotiate with the contractor the contents of their health and safety plan and finally approve that plan for implementation.
- ensure that a copy of both the principal contractor and contractor's health and safety plan is available on request to an employee, an inspector, a contractor, the Client, or the Client's Safety Agent.
- hand over a consolidated health and safety file to the Client upon completion of the construction work, to include a record of all drawings, designs, materials used and other similar information concerning the completed structure.
- in addition to the documentation required in the health and safety file include and make available a comprehensive and updated list of all the contractors on site accountable to the principal contractor, the agreements between the parties and the type of work being done.
- ensure that all his or her employees 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 Annexure 3.

A contractor must prior to performing any construction work-

- provide and demonstrate to the principal contractor a suitable and sufficiently documented health and safety plan, based on the relevant sections of the Client's health and safety specification and provided by the principal contractor, which plan must be applied from the date of commencement of and for the duration of the construction work and which must be reviewed and updated by the contractor as work progresses.
- open and keep on site a health and safety file, which must include all documentation required in terms of the Act and these Regulations, and which must be made available on request to an inspector, the Client, the Client's Safety Agent or the principal contractor.
- before appointing another contractor to perform construction work be reasonably satisfied that the contractor that he or she intends to appoint has the necessary competencies and resources to perform the construction work safely.
- co-operate with the principal contractor as far as is necessary to enable each of them to comply with the provisions of the Act.

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- as far as is reasonably practicable, promptly provide the principal contractor with any information which might affect the health and safety of any person at work carrying out construction work on the site, any person who might be affected by the work of such a person at work, or which might justify a review of the health and safety plan.

Where a contractor appoints another contractor to perform construction work, the duties that apply to the principal contractor will apply to the contractor as if he or she were the principal contractor.

A principal contractor must take reasonable steps to ensure co-operation between all contractors appointed by the principal contractor to enable each of those contractors to comply with these Regulations.

No contractor may allow or permit any employee or person to enter any site unless that employee or person has undergone health and safety induction training pertaining to the hazards prevalent on the site at the time of entry.

A contractor must ensure that all visitors to a construction site undergo health and safety induction pertaining to the hazards prevalent on the site and must ensure that such visitors have the necessary personal protective equipment.

A contractor must always keep on his or her construction site records of the health and safety induction training and such records must be made available on request to an inspector, the Client, the Client's Safety Agent or the Principal Contractor.

A contractor must ensure that all his or her employees 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 Annexure 3 (a template of which can be found in the Construction Regulations, 2014).

17.2.2 Management and Supervision of Construction Work

A principal contractor must, in writing, appoint one full-time competent person as the construction manager with the duty of managing all the construction work on a single site, including the duty of ensuring occupational health and safety compliance, and in the absence of the construction manager an alternate must be appointed by the principal contractor. Proof of all-inclusive assessment of the Construction Manager's Competency in construction management and H & S competency must be available in the Safety File. The Construction Manager must, as a minimum, have a Construction Regulation course. No contractors may be left unsupervised on site by the principal contractor.

A principal contractor must upon having considered the size of the project, in writing appoint one or more assistant construction managers for different sections thereof: Provided that the

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designation of any such person does not relieve the construction manager of any personal accountability for failing in his or her management duties in terms of this regulation.

Where the construction manager has not appointed assistant construction managers, or, in the opinion of an inspector, enough of such assistant construction managers have not been appointed, that inspector must direct the construction manager in writing to appoint the number of assistant construction managers indicated by the inspector, and those assistant construction managers must be regarded as having been appointed.

No construction manager appointed in terms of the Regulations may manage any construction work on or in any construction site other than the site in respect of which he or she has been appointed.

A contractor must, after consultation with the Client and having considered the size of the project, the degree of danger likely to be encountered or the accumulation of hazards or risks on the site, appoint a full-time or part-time construction health and safety officer in writing to assist in the control of all health and safety related aspects on the site: Provided that, where the question arises as to whether a construction health and safety officer is necessary, the decision of an inspector is decisive.

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

A construction manager must in writing appoint construction supervisors responsible for construction activities and ensuring occupational health and safety compliance on the construction site. Proof of all-inclusive assessment of the Construction Supervisor's competency in construction supervision and H&S competency must be available in the Safety File. The Construction Supervisor must, as a minimum, have a supervision course as per Unit Standard 262845 (Civil Engineering), 119080 (Building Construction) and 262884 (Civil Engineering).

A contractor must, upon having considered the size of the project, in writing appoint one or more competent employees for different sections thereof to assist the construction supervisor, and every such employee has, to the extent clearly defined by the contractor in the letter of appointment, the same duties as the construction supervisor: Provided that the designation of such employee does not relieve the construction supervisor of any personal accountability for failing in his or her supervisory duties.

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Where the contractor has not appointed such an employee, or, in the opinion of an inspector, enough of such employees have not been appointed, that inspector must instruct the employer to appoint the number of employees indicated by the inspector.

No construction supervisor appointed may supervise any construction work on or in any construction site other than the site in respect of which he or she has been appointed: Provided that if enough competent employees have been appropriately designated on all the relevant construction sites, the appointed construction supervisor may supervise more than one site.

17.2.3 Notification of Intention to Commence Construction Work

Not applicable to this project, however a Construction Work Permit is applicable.

17.2.4 Construction Work Permit

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 on projects that will –

- 1. exceed 365 days and will involve more than 3600 person days of construction work; or
- 2. the tender value limit is grade 7, 8 or 9 of the Construction Industry Development Board (CIDB) grading.
 - Grade 7 = R60 000 000
 - Grade 8 = R 200 000 000
 - Grade 9 = No limit

A client may appoint a Construction Health and Safety Agent or Construction Health and Safety Manager to apply for this permit from the Provincial Director and construction work may not commence until the permit has been issued by the Provincial Director.

A copy of this permit will be required to be kept in the principal contractor's safety file, and the site-specific number issued by the Provincial Director must be displayed at the site entrance.

A client may appoint a Construction Health and Safety Agent, or Construction Health and Safety Manager based on the scope and risk profile of construction work to represent him/her on matters of health and safety. Provided that, where the question arises as to whether a Construction Health Safety Agent or a Construction Health and Safety Manager is necessary, the decision of an inspector is decisive.

The following minimum documentation will be required during the permit application process:

- Principal Contractor's Health and Safety Plan CR 5(1)(m)

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- Baseline Risk Assessment CR 5(1)(a)
- Appointed Principal Contractor's Letter for Good Standing as per CR 5(1)(j)
- Issue Register signed by Designer CR 5 (1)(c)
- Issue Register signed by Principal Contractor
- Declaration signed by Designer CR 5(1)(d) and CV
- Principal Contractor made adequate provision for the cost of health and safety measures (Bill of Quantities) CR 5(1)(g)
- Proof of Principal Contractor's competency and resources to carry out the construction work safely CR 5(1)(h)
- Appointment Letter for Construction Manager, CV, Certificates and List of projects
- Appointment Letter of Safety Officer & Safety Officer's Registration for SACPCMP
 - Principal Contractor's Appointment Letter CR 5(1)(k), Company Profile and CIDB grading

After approval of the Construction Work Permit any changes made to the appointed persons on the annexure 1 must be submitted to Department of Labour for approval before the appointed persons are allowed to commence with their tasks.

PLEASE NOTE THAT THE CONSTRUCTION MANAGER (8(1)) NAMED ON THE CONSTRUCTION WORK PERMIT MUST BE THE SAME PERSON THAT ACTS AS THE CONSTRUCTION MANAGER ON SITE. IF THIS WILL NOT BE THE CASE FOR SOME REASON THEN THE SAFETY AGENT MUST BE NOTIFIED OF THE CHANGE BY THE PRINCIPAL CONTRACTOR AT LEAST 7 DAYS BEFORE THE CHANGE IS MADE SO THAT THE SAFETY AGENT CAN AMEND THE CONSTRUCTION WORK PERMIT APPLICATION AND ADVISE THE DEPARTMENT OF EMPLOYMENT AND LABOUR ACCORDINGLY.

Requirements from the Principal Contractor for the Work Permit Application:**17.2.4.1 Deliverables required from Principal Contractor**

- Name, Telephone Number & Postal Address
- Company Profile
- List of previous and current projects (incl project values)
- Health and Safety Plan (signed)
- Full Risk Assessment (signed)
- Valid Letter of Good Standing
- CIDB Grading Registration – 7, 8 or 9 grading level
- Signed Issue Register of the Health & Safety Specification (last page of safety spec)
- Bill of Quantities - Proof of Cost for Health and Safety requirements on company letterhead and signed

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- Appointment of Safety Officer
- CV & Certificates of Safety Officer
- Safety officers SACPCMP registration
- Construction Manager's CV and Certificates of Competency (short courses alone will not be accepted by the DoL)
- Appointment Letter of Construction Manager 8(1)
- Appointment letter of Temporary works designer Please note this is NOT the Project Client's appointed Engineer) Applicable if there are temporary works.
- CV & Certificate of Temporary works designer
- Name and Mobile number to Appointed Construction Manager
- Name and Mobile number of Appointed Safety Officer
- Name and Mobile number for Appointed Health and Safety Manager
- Start and Finish date of Project
- Physical address of site office
- Nature of work
- Estimated maximum people on site
- Number of subcontractors on site
- Names of subcontractors on site

17.2.5 Assignment of Contractor's Responsible Persons to Manage Health and Safety on Site

The Contractor shall submit management and supervisory appointments as well as any relevant appointments in writing (as stipulated by the Construction Regulations 2014 and the Occupational Safety and Health Act 1993), prior to commencement of work (refer to Annexure B at the end of this Health and Safety Specification).

17.2.6 Competency for Contractor's Responsible Persons


The Contractor's responsible persons shall be competent in health and safety and be familiar with the Occupational Health and Safety Act 1993, and applicable regulations. Valid proof of pertinent health and safety courses attended by such persons will be required to be presented to the Client.

17.2.7 Compensation of Occupational Injuries and Diseases Act 130 of 1993 (COIDA)

The successful Contractor shall submit to the Client a valid letter of good standing with the Compensation Insurer prior to appointment.

17.2.8 Occupational Health and Safety Policy

The Contractor shall submit their Health and Safety Policy, prior to construction commencement, signed by the Chief Executive Officer. The Policy must outline objectives and how they will be achieved and implemented within the company operations. The Policy

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must be communicated to all employees and proof thereof must be available in the Safety File.

17.2.9 Health and Safety Organogram

The Contractor shall submit an organogram, prior to construction commencement, outlining the Health and Safety Site Team that will be assigned to the project, if successful with the tender. In cases where appointments have not been made, the organogram shall reflect the position. The organogram shall be updated when there is a change in the site team.

17.2.10 Risk Assessments

17.2.10.1 Baseline Risk Assessment

The Client shall cause a baseline risk assessment to be conducted by a competent person before the design process and tender process commence, and the assessed risks shall form part of the health and safety specifications.

The Contractor must, before commencement of any construction work, and during construction work, have risk assessments performed by a competent person appointed in writing, which risk assessments form part of the health and safety plan to be applied on the site and must include:

- The identification of the risks and hazards to which persons may be exposed to.
- An analysis and evaluation of the risks and hazards identified; based on a documented method
- A documented plan and applicable safe work procedures to mitigate, reduce or control the risks and hazards that have been identified.
- A monitoring plan; and
 - A review plan

The Contractor must ensure that, as far as is reasonably practicable, ergonomic related hazards are analyzed, evaluated, and addressed in a risk assessment.

The Contractor must ensure that all employees under his control are informed, instructed and trained by a competent person regarding any hazard and the related work procedures and/or control measures before any work commences and thereafter at the times determined in the risk assessment monitoring and review plan of the relevant site.

The Principal Contractor must ensure that all contractors are informed regarding any hazard that is stipulated in the risk assessment before any work commences and thereafter at the times determined in the risk assessment monitoring and review plan of the relevant site.

The Contractor must consult with the health and safety committee or with a representative trade union or representative group of employees if no health and safety committee exists, on the monitoring and review of the risk assessments for the site.

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The Contractor must ensure that copies of risk assessment for this site are available on site for inspection purposes by interested parties (inspector, the Client, Client's Safety Agent, any contractor, any employee, a representative trade union, a health and safety representative or safety committee member.

A Contractor must review the relevant risk assessment where changes are affected to the design and/or construction that result in a change to the risk profile, or when an incident has occurred.

Preventative measures must first address the elimination of the hazard or risk. Should PPE be required to reduce risk, the equipment or clothing to be used must be SABS approved.

In general, the Contractor must ensure that the Risk Assessment involves identifying the hazards present in a work activity on site. This is followed by an evaluation of the extent of the risk involved considering those precautions already being taken.

The following general principle should be followed when conducting a risk assessment:

- All relevant risks and/or hazards should be systematically addressed.
- The risk assessment should address what happens in the workplace during the work activity.
- All employees and those who may be affected must be considered, including maintenance staff, security guards, visitors, and Contractors.
- The risk assessment should highlight those groups and individuals who may be required to work alone or who have disabilities.
- The risk assessment process should consider the existing safety measures and controls.
- The level of detail on a risk assessment should be appropriate to the level of risk.

17.2.11 Health and Safety Representative(s)

The Contractor shall ensure that Health and Safety Representative(s) is/are elected and trained to carry out his / her functions. The Safety Representative(s) must be democratically nominated, elected, and appointed in writing. The Health and Safety Representative(s) shall carry out regular inspections, keep records and report to the supervisor to take appropriate action. The Safety Representative(s) shall attend Health and Safety Committee Meetings. The Health and Safety Representative shall be part of the team that will investigate incidents, accidents, and non-conformances. The Safety Representative(s) must be (a) full time employee(s) who is/are acquainted with conditions and activities at that workplace or section thereof. The Safety Representatives must have Safety Representative training and must be capable of performing their duties.

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Where two or more health and safety representatives have been appointed on site, the Contractor shall ensure that monthly health and safety meetings are held with such representatives and minutes are kept on record. Meetings must be organized and chaired by the Contractor's Health and Safety Committee Chairperson. Minutes of these meetings must be available for the employees of the contractor to refer to.

PLEASE NOTE THAT THE SAFETY AGENT MAY REQUIRE THAT THE PRINCIPAL CONTRACTOR CONVENES A SAFETY COMMITTEE MEETING ON SITE IN THE INTERESTS OF HEALTH AND SAFETY ON SITE. SUCH COMMITTEE MEETING MAY REQUIRE ATTENDANCE OF CONTRACTORS SAFETY OFFICERS/SAFETY REPRESENTATIVES, CONSTRUCTION SUPERVISION AND THE SAFETY AGENT.

17.2.13 Medical Certificate of Fitness

The contractor must ensure that their employees on site have a valid medical certificate of fitness, specific to the construction work being performed, issued by an occupational health practitioner in the form of an Annexure 3 template (refer to the Construction Regulations 2014 on the Department of Labour website for a sample of this form).

Employees required to perform work at heights or from fall risk position must be medically fit to perform such work, such employee's medicals must specify "Fall Risk" or "Working at heights" in the exposure section of the annexure 3 template.

17.2.14 Health and Safety Training


The Contractor shall quarterly conduct a training needs analysis to ascertain what health and safety training is required. A plan of action should be devised and forwarded to the Client for records. Once the identified people have attended the training, the Contractor must provide the Client with copies of certificates obtained.

17.2.15 Induction

No Contractor may allow or permit any employee or person to enter site unless they have undergone health and safety induction training pertaining to the hazards prevalent on site at the time of entry. This includes visitors to site. The Contractor must ensure that visitors to site have the necessary protective equipment (PPE). A copy of attendance registers of all employees who attend inductions shall be kept.

17.2.16 Awareness

The Contractor shall conduct periodic toolbox talks on site, weekly or before any hazardous work takes place. The talks shall cover the relevant activity, and an attendance register must be signed by all attendees. This record of who attended and the content of the topic will be kept on the site health a safety file as evidence of training.

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17.2.17 Competency

After the Contractor has identified the training to be conducted as part of the competency requirement, and based on Risk Assessment, he shall send the relevant persons on appropriate courses and keep certificates of training for reference. Familiarity with the Health and Safety Act and Regulations is an integral part of the definition of competence. All training must be conducted by an accredited training provider and the certificates must display the applicable unit standards and the expiry dates thereof.

17.2.18 General Record Keeping

The Contractor shall keep and maintain Health and Safety records to demonstrate compliance with the Health and Safety Specification and the Occupational Health and Safety Act. The contractor shall ensure that all records of incidents, spot fines, training, etc. are kept on site. All documents shall be available for inspection by the Client, or the Department of Labour's Inspectors.

17.2.19 General Inspection, Monitoring and Reporting

The Contractor shall carry out inspections as required by this Health and Safety Specification, as well as by health and safety legislation.

17.2.20 Emergency Procedures


The Contractor shall submit a detailed Emergency Procedure for approval by the Client prior to commencement on site. The procedure shall detail the response plan including the following:

- List of key personnel.
- Details of emergency services.
- Actions or steps to be taken in the event of the emergency; and
 - Information on hazardous materials / situations, including each material's hazardous potential impact or risk on the environment or human and measures to be taken in the event of an accident.

Emergency procedure(s) shall include, but shall not be limited to, fire, spills, accidents to employees, use of hazardous substances, dangers because of riot / service delivery protests / intimidation, etc. The Contractor shall advise the Client in writing of any on-site emergencies, together with a record of action taken, within 24 hours of the emergency occurring. A contact list of all service providers (Fire Department, Ambulance, Police, Medical and Hospital, etc.) must be maintained and available to site personnel.

17.2.21 First Aid Box and First Aid Equipment

The Contractor shall provide first aid box/es and appoint, in writing, First Aider(s) for this project in line with the results of the Contractor's risk assessment for the project, this health and safety specification as well as the provisions of the General Safety Regulations. The

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appointed First Aider(s) are to be sent for accredited first aid training before starting on site. Valid certificates are to be kept on site.

- First Aid box/es must be adequately always stocked, accessible and be controlled by a qualified First Aider.
- Perishables to be checked and replaced when expired.
- Stock per content list as per the General Safety Regulations Annexure.
- Signage to be in place.
- To be numbered and sealed with name of first aider on or above the First aid box.
- Dressing logbook to be available in the first aid box.
- If more than 5 employees are present, there must be a first aid box available.
 - Register to be checked by a Competent person.

If required by the Client, the Contractor shall have a stretcher on site to be used in case of a serious incident.

17.2.22 Accident / Incident Reporting and Investigation

The Contractor shall, in addition to the prescribed requirements of the Occupational Health and Safety Act and General Safety Regulations, investigate, record, and report all Section 24 reportable incidents to the Client within 24 hours of the incident occurring. Incident investigations shall be conducted by the Contractor's appointed Accident Investigator – this Investigator must be a competent person or persons who have sufficient knowledge to carry out an investigation.


In the event of a fatality or a permanent disabling injury the Contractor must submit proof of reporting of incident to Department of Labour as well as proof of preventative measures to the Client. The Client reserves the right to conduct investigations into any incidents that they deem fit, and the Contractor is required to provide full co-operation in this regard.

17.2.23 Hazards and Potential Situations

The Contractor shall immediately notify other Contractors of any hazardous or potentially hazardous situations, which may arise during performance of the activities.

17.2.24 Occupational Health and Safety Signage

The Contractor shall ascertain and provide adequate on-site health and safety signage. This signage shall include, but shall not be limited to, Hard Hat / Helmet Area; Safety Shoes to be worn on site; Dust Masks to be worn in areas where there might be exposure to excessive dust; Ear Plugs / Muffs to be worn where there might be noise exposure over 85 dB; Gloves; Safety Goggles; Safety Harness, Workers in Excavation, etc. The Contractor shall be responsible to maintain the quality and replacement of signage. Signage must comply with the requirements of SABS.

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17.2.25 Management of Contractors by Principal Contractor

The Principal Contractor shall ensure that all contractors under his control are complying with the respective Health and Safety Plans, as well as Health and Safety Legislation.

17.2.26 Stacking of Materials

In addition to the provisions for the stacking of articles in the General Safety Regulations, 2003, the contractor must ensure that –

- a competent person is appointed in writing with the duty of supervising all stacking and storage on a construction site.
- adequate storage areas are provided.
- there are demarcated storage areas; and
- storage areas are kept neat and under control.

17.2.27 Housekeeping and General Safeguarding on Construction Sites

A contractor must, in addition to compliance with the Environmental Regulations for Workplaces, 1987, promulgated by Government Notice No. R. 2281 of 16 October 1987, ensure that suitable housekeeping is continuously implemented on each construction site, including-

- the proper storage of materials and equipment.
- the removal of scrap, waste and debris at appropriate intervals.
- ensuring that materials required for use, are not placed on the site to obstruct means of access to and egress from workplaces and passageways.
- ensuring that materials which are no longer required for use, do not accumulate on and are removed from the site at appropriate intervals.
- ensuring that waste and debris are not disposed of from a high place with a chute, unless the chute complies with the requirements set out in the regulations.
- ensuring that construction sites in built-up areas adjacent to a public way are suitably and sufficiently fenced off and provided with controlled access points to prevent the entry of unauthorized persons; and
- ensuring that a catch platform or net is erected above an entrance or passageway or above a place where persons work or pass under or fencing off the danger area if work is being performed above such entrance, passageway, or place to ensure that all persons are kept safe in the case of danger or possibility of persons being struck by falling objects.

2.26 Construction Vehicles and Mobile Plant

A contractor must ensure that all construction vehicles and mobile plant-

- are of an acceptable design and construction.

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- are maintained in a good working order.
- are used in accordance with their design and the intention for which they were designed, having due regard to safety and health.
- are operated by a person who-
 - has received appropriate training, is certified competent and in possession of proof of competency and is authorized in writing to operate those construction vehicles and mobile plant.
 - has a medical certificate of fitness to operate those construction vehicles and mobile plant, issued by an occupational health practitioner in the form of Annexure 3.
- have safe and suitable means of access and egress.
- are properly organized and controlled in any work situation by providing adequate signaling or other control arrangements to guard against the dangers relating to the movement of vehicles and plant, to ensure their continued safe operation.
- are prevented from falling into excavations, water, or any other area lower than the working surface by installing adequate edge protection, which may include guard-rails and crash barriers.
- are fitted with structures designed to protect the operator from falling material or from being crushed should the vehicle or mobile plant overturn.
- are equipped with an acoustic warning device which can be activated by the operator.
- are equipped with an automatic acoustic reversing alarm.
- are equipped with fire extinguishers (2.5 – 4.5 kg); and
 - are inspected by the authorized operator or driver daily using a relevant checklist prior to use and that the findings of such inspection are recorded in a register kept in the construction vehicle or mobile plant.

A contractor must ensure that-

- no person rides or is required or permitted to ride on a construction vehicle or mobile plant otherwise than in a safe place provided thereon for that purpose.
- every construction site is organized in such a way that, as far as is reasonably practicable, pedestrians and vehicles can move safely and without risks to health.
- the traffic routes are suitable for the persons, construction vehicles or mobile plant using them, are sufficient in number, in suitable positions and of sufficient size.
- every traffic route is, where necessary, indicated by suitable signs.
- all construction vehicles and mobile plant left unattended at night, adjacent to a public road in normal use or adjacent to construction areas where work is in progress, have appropriate lights or reflectors, or barricades equipped with appropriate lights or reflectors, to identify the location of the vehicles or plant.

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- all construction vehicles or mobile plant when not in use, have buckets, booms, or similar appendages, fully lowered, or blocked, controls in a neutral position, motors stopped, wheels chocked, brakes set, and ignition secured.
- whenever visibility conditions warrant additional lighting, all mobile plant are equipped with at least two headlights and two taillights when in operation.
- tools, material, and equipment are secured and separated by means of a physical barrier to prevent movement when transported in the same compartment with employees.
- vehicles used to transport employees have seats firmly secured and adequate for the number of employees to be carried; and
- all construction vehicles or mobile plant travelling, working, or operating on public roads comply with the requirements of the National Road Traffic Act, 1996.
- all plant and vehicles are to be fitted with amber rotating beacons and reverse alarms.
- ALL construction site vehicles must be inspected daily especially if it has dangerous "items" (fuel, explosives, etc.) on vehicle, completed inspection registers must also be available for inspection.
- the vehicles must resemble the original manufacturer's product. Levers, alarms, and amber lights to be fitted to construction vehicle for notification of vehicle.
- fire extinguishers, signage, and license disc to be correctly mounted and displayed.
- when the vehicle is stationary no key to be left in or on vehicle or plant.
- Drip tray must be present when stationary.

17.2.28 Electrical Installations and Machinery on Construction Sites

A contractor must, in addition to compliance with the Electrical Installation Regulations and the Electrical Machinery Regulations, ensure that –

- before construction commences and during the progress thereof, adequate steps are taken to ascertain the presence of and guard against danger to workers from any electrical cable or apparatus which is under, over or on the site.
- all parts of electrical installations and machinery are of adequate strength to withstand the working conditions on construction sites.
- the control of all temporary electrical installations on the construction site is designated to a competent person who has been appointed in writing for that purpose.
- all temporary electrical installations used by the contractor are inspected at least once a week by a competent person and the inspection findings are recorded in a register kept on the construction site; and
- all electrical machinery is inspected by the authorized operator or user daily using a relevant checklist prior to use and the inspection findings are recorded in a register kept on the construction site.

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A contractor must, in addition to compliance with the provisions for the use and storage of flammable liquids in the General Safety Regulations, 2003, ensure that –

- where flammable liquids are being used, applied, or stored at the workplace concerned, it is done in a manner that does not cause a fire or explosion hazard, and that the workplace is effectively ventilated.
- no person smokes in any place in which flammable liquid is used or stored, and the contractor must affix a suitable and conspicuous notice at all entrances to any such areas prohibiting such smoking.
- an adequate amount of efficient fire-fighting equipment is installed in suitable locations around the flammable liquids store with the recognized symbolic signs.
- only the quantity of flammable liquid needed for work on one day is taken out of the store for use.
- all containers holding flammable liquids are kept tightly closed when not in actual use and, after their contents have been used up, are removed from the construction site and safely disposed of.
- where flammable liquids are decanted, the metal containers are bonded and earthed; and
- no flammable material, including cotton waste, paper, cleaning rags or similar material is stored together with flammable liquids
- proper containers are to be used for fuel. Marked and labelled as per the content.
 - diesel on site; more than 800 litres must have a certificate, fire safe certificate. Locked in a ventilated, secure area with a drip tray and have a designated, responsible person to use it.

17.2.30 Water environments

Not thought to be applicable to this project.

17.2.31 Fire precautions on Construction Sites

A contractor must, in addition to compliance with the Environmental Regulations for Workplaces, 1987, ensure that –

- all appropriate measures are taken to avoid the risk of fire.
- sufficient and suitable storage is provided for flammable liquids, solids, and gases.
- smoking is prohibited and notices in this regard are prominently displayed in all places containing readily combustible or flammable materials.
- in confined spaces and other places in which flammable gases, vapours or dust can cause danger-

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- only suitably protected electrical installations and equipment, including portable lights, are used.
- there are no flames or similar means of ignition.
- there are conspicuous notices prohibiting smoking.
- oily rags, waste, and other substances liable to ignite are without delay removed to a safe place; and
- adequate ventilation is provided.
- combustible materials do not accumulate on the construction site.
- welding, flame cutting, and other hot work are done only after appropriate precautions have been taken to reduce the risk of fire.
- suitable and sufficient fire-extinguishing equipment is placed at strategic locations or as may be recommended by the Fire Chief or local authority concerned, and that such equipment is maintained in a good working order.
- the fire equipment contemplated above is inspected by a competent person, who has been appointed in writing for that purpose, in the manner indicated by the manufacturer thereof.
- a sufficient number of workers are trained in the use of fire-extinguishing equipment.
- where appropriate, suitable visual signs are provided to clearly indicate the escape routes in the case of a fire.
- the means of escape is kept clear at all times.
- there is an effective evacuation plan providing for all -
 - persons to be evacuated speedily without panic.
 - persons to be accounted for; and
 - plant and processes to be shut down; and
 - siren is installed and sounded in the event of a fire.

17.2.32 Construction Employees' Facilities

A contractor must, in terms of the Construction Regulations 2014, provide:

- Shower facilities after consultation with the employees or employees' representatives, or at least one shower facility for every 15 persons.
- at least one sanitary facility for each sex and for every 30 workers.
- Toilets to be within walking distance
- Hygiene registers to be completed
- Proof of safe disposal of effluent waste disposal certificates to be obtained
- changing facilities for each sex.
- and sheltered/shaded eating area.
- Protection from the Elements and raised off the ground.

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Every employer shall provide sanitary facilities at the workplace in accordance with the provisions of Parts F, P and Q of the National Building Regulations.

- Sufficient clean water for all employees. 500ml to each employee every hour.

A contractor must provide reasonable and suitable living accommodation for the workers at construction sites who are far removed from their homes and where adequate transportation between the site and their homes, or other suitable living accommodation, is not available.

17.2.33 Fall protection.

The Contractor must:

- designate a competent person to be responsible for the preparation of a fall protection plan
- ensure that the fall protection plan contemplated above is implemented, amended where and when necessary and maintained as required; and
- take steps to ensure continued adherence to the fall protection plan.

A fall protection plan contemplated above must include-

- 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.
- the processes for the evaluation of the employees' medical fitness necessary to work at a fall risk position and the records thereof.
- a programme for the training of employees working from a fall risk position and the records thereof.
- the procedure addressing the inspection, testing, and maintenance of all fall protection equipment; and
- 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 the rescue procedure is implemented immediately following the incident.

A contractor must ensure that a construction manager appointed under regulation 8(1) is in possession of the most recently updated version of the fall protection plan.

A contractor must ensure that all unprotected openings in floors, edges, slabs, hatchways, and stairways are adequately guarded, fenced, or barricaded or that similar means are used to safeguard any person from falling through such openings.

Also that no person is required to work in a fall risk position, unless such work is performed safely as contemplated in above and fall prevention and fall arrest equipment are approved as suitable and of sufficient strength for the purpose for which they are being used, having regard to the work being carried out and the load, including any person, they are intended to bear; and securely attached to a structure or plant, and the structure of plant and the means

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of attachment thereto are suitable and of sufficient strength and stability for the purpose of safely supporting the equipment and person who could fall, and fall arrest equipment is used only where it is not reasonably practicable to use fall prevention equipment.

17.2.34 Temporary works

A contractor must appoint a temporary works designer in writing to design, inspect and approve the erected temporary works on site before use.

A contractor must ensure that all temporary works operations are carried out under the supervision of a competent person who has been appointed in writing for that purpose.

A contractor must ensure that-

- all temporary works structures are adequately erected, supported, braced and maintained by a competent person so that they are capable of supporting all anticipated vertical and lateral loads that may be applied to them, and that no loads are imposed onto the structure that the structure is not designed to withstand.
- all temporary works structures are done with close reference to the structural design drawings, and where any uncertainty exists the structural designer should be consulted.
- detailed activity specific drawings pertaining to the design of temporary works structures are kept on the site and are available on request to an inspector, other contractors, the Client, the Client's Safety Agent, or any employee.
- all persons required to erect, move, or dismantle temporary works structures are provided with adequate training and instruction to perform those operations safely.
 - all equipment used in temporary works structure are carefully examined and checked for suitability by a competent person, before being used.
- all temporary works structures are inspected by a competent person immediately before, during and after the placement of concrete, after inclement weather or any other imposed load and at least daily until the temporary works structure has been removed and the results have been recorded in a register and made available on site.
- no person may cast concrete, until authorization in writing has been given by the competent person contemplated above.
- if, after erection, any temporary works structure is found to be damaged or weakened to such a degree that its integrity is affected, it is safely removed or reinforced immediately.
- adequate precautionary measures are taken in order to-
 - secure any deck panels against displacement; and
 - prevent any person from slipping on temporary works due to the application of release agents.
- as far as is reasonably practicable, the health of any person is not affected through the use of solvents or oils or any other similar substances.

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- upon casting concrete, the temporary works structure is left in place until the concrete has acquired sufficient strength to safely support its own weight and any imposed load, and is not removed until authorization in writing has been given by the competent person
- the foundation conditions are suitable to withstand the loads caused by the temporary works structure and any imposed load in accordance with the temporary works design.
- provision is made for safe access by means of secured ladders or staircases for all work to be carried out above the foundation bearing level.
- a temporary works drawing, or any other relevant document includes construction sequences and methods statements.
- the temporary works designer has been issued with the latest revision of any relevant structural design drawing.
- a temporary works design and drawing is used only for its intended purpose and for a specific portion of a construction site; and
- the temporary works drawings are approved by the temporary works designer before the erection of any temporary works.

No contractor may use a temporary works design and drawing for any work other than its intended purpose.

17.2.35 Excavation

A contractor must-

- ensure that all excavation work is carried out under the supervision of a competent person who has been appointed in writing for that purpose; and
- evaluate, as far as is reasonably practicable, the stability of the ground before excavation work begins.

A contractor who performs excavation work-

- must take reasonable and sufficient steps to prevent, as far as is reasonably practicable, any person from being buried or trapped by a fall or dislodgement of material in an excavation.
- may not require or permit any person to work in an excavation which has not been adequately shored or braced: Provided that shoring and bracing may not be necessary where-
 - the sides of the excavation are sloped to at least the maximum angle of repose measured relative to the horizontal plane; or
 - such an excavation is in stable material: Provided that-
 - permission has been given in writing by the appointed competent person contemplated above upon evaluation by him or her of the site conditions; and

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- where any uncertainty pertaining to the stability of the soil still exists, the decision from a professional engineer or a professional technologist competent in excavations is decisive and such a decision must be noted in writing and signed by both the competent person and the professional engineer or technologist, as the case may be.
- must take steps to ensure that the shoring or bracing contemplated above is designed and constructed in a manner that renders it strong enough to support the sides of the excavation in question.
- must ensure that no load, material, plant or equipment is placed or moved near the edge of any excavation where it may cause its collapse and consequently endangers the safety of any person, unless precautions such as the provision of sufficient and suitable shoring or bracing are taken to prevent the sides from collapsing.
- must ensure that where the stability of an adjoining building, structure or road is likely to be affected by the making of an excavation, steps are taken to ensure the stability of such building, structure or road and the safety of persons.
- must cause convenient and safe means of access to be provided to every excavation in which persons are required to work, and such access may not be further than six metres from the point where any worker within the excavation is working.
- must ascertain, as far as is reasonably practicable, the location and nature of electricity, water, gas or other similar services which may in any way be affected by the work to be performed, and must before the commencement of excavation work that may affect any such service, take the steps that are necessary to render the circumstances safe for all persons involved.
- must ensure that every excavation, including all bracing and shoring, is inspected-
 - daily, prior to the commencement of each shift.
 - after every blasting operation.
 - after an unexpected fall of ground.
 - after damage to supports; and
 - after rain,by the competent person, to ensure the safety of the excavation and of persons, and those results must be recorded in a register kept on site and made available on request to an inspector, the Client, the Client's Safety Agent, any other contractor or any employee.
- must cause every excavation which is accessible to the public or which is adjacent to public roads or thoroughfares, or whereby the safety of persons may be endangered, to be –

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- adequately protected by a barrier or fence of at least one metre in height and as close to the excavation as is practicable; and
- provided with warning illuminants or any other clearly visible boundary indicators at night or when visibility is poor or have resort to any other suitable and sufficient precautionary measure where this is not practicable.
- must ensure that all precautionary measures stipulated for confined spaces as determined in the General Safety Regulations, 2003, are complied with by any person entering any excavation.
- must, where the excavation work involves the use of explosives, appoint a competent person in the use of explosives for excavation, and must ensure that a method statement is developed by that person in accordance with the applicable explosive's legislation; and
- must cause warning signs to be positioned next to an excavation within which or where persons are working or carrying out inspections or tests.

17.2.36 Demolition Work

A contractor must appoint a competent person in writing to supervise and control all demolition work on site.

A contractor must ensure that before any demolition work is carried out, and to ascertain the method of demolition to be used, a detailed structural engineering survey of the structure to be demolished is carried out by a competent person and that a method statement on the procedure to be followed in demolishing the structure is developed by that person.

During a demolition, the competent person contemplated in above must check the structural integrity of the structure at intervals determined in the method statement contemplated in above, to avoid any premature collapses.

A contractor who performs demolition work must about a structure being demolished, take steps to ensure that-

- no floor, roof or other part of the structure is overloaded with debris or material in a manner which would render it unsafe.
- all reasonably practicable precautions are taken to avoid the danger of the structure collapsing when any part of the framing of a framed or partly framed building is removed, or when reinforced concrete is cut; and
- precautions are taken in the form of adequate shoring or other means that may be necessary to prevent the accidental collapse of any part of the structure or adjoining structure.
- ensure that no person works under overhanging material or a structure which has not been adequately supported, shored, or braced.

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- ensure that any support, shoring, or bracing contemplated above, is designed and constructed so that it is strong enough to support the overhanging material.
- where the stability of an adjoining building, structure or road is likely to be affected by demolition work on a structure, take steps to ensure the stability of such structure or road and the safety of persons.
- ascertain as far as is reasonably practicable the location and nature of electricity, water, gas or other similar services which may in any way be affected by the work to be performed, and must before the commencement of demolition work that may affect any such service, take the steps that are necessary to render circumstances safe for all persons involved.
- cause every stairwell used and every floor where work is being performed in a building being demolished, to be adequately illuminated by either natural or artificial means.
- cause convenient and safe means of access to be provided to every part of the demolition site in which persons are required to work; and
 - erect a catch platform or net above an entrance or passageway or above a place where persons work or pass under or fence off the danger areas if work is being performed above such entrance, passageway, or place to ensure that all persons are kept safe where there is a danger or possibility of persons being struck by falling objects.

A contractor must ensure that no material is dropped to any point, which falls outside the exterior walls of the structure, unless the area is effectively protected.

No person may dispose of waste and debris from a high place by a chute unless the chute-

- is adequately constructed and rigidly fastened.
- if inclined at an angle of more than 45 degrees to the horizontal, is enclosed on its four sides.
- if of the open type, is inclined at an angle of less than 45 degrees to the horizontal.
 - where necessary, is fitted with a gate at the bottom end to control the flow of material; and discharges into a container or an enclosed area surrounded by barriers.

A contractor must ensure that every chute used to dispose of rubble is designed in such a manner that rubble does not free-fall and that the chute is strong enough to withstand the force of the debris travelling along the chute.

A contractor must ensure that no equipment is used on floors or working surfaces unless such floors or surfaces are of sufficient strength to support the imposed loads.

Where a risk assessment indicates the presence of asbestos, a contractor must ensure that all asbestos related work is conducted in accordance with the Asbestos Abatement Regulations, 2020.

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Where a risk assessment indicates the presence of lead, a contractor must ensure that all lead related work is conducted in accordance with the Lead Regulations, 2001.

Where the demolition work involves the use of explosives, a method statement must be developed in accordance with the applicable explosive's legislation, by an appointed person who is competent in the use of explosives for demolition work and all persons involved in the demolition works must adhere to demolition procedures issued by the appointed person.

A contractor must ensure that all waste and debris are as soon as reasonably practicable removed and disposed of from the site in accordance with the applicable legislation.

17.2.37 Tunnelling

Not thought to be applicable to this project.

17.2.38 Scaffolding


A contractor must appoint a competent person in writing who must ensure that all scaffolding work operations are carried out under his or her supervision and that all scaffold erectors, team leaders and inspectors are competent to carry out their work as per the SANS 10085 of 2004.

A contractor using access scaffolding must ensure that such scaffolding, when in use, complies with the safety standards incorporated for this purpose into these Regulations under section 44 of the Act and SANS 10085. Scaffold must be.

- Level and balanced upon the correct footing such as base jacks, U-Jacks, and mobile wheels
- Have the correct Ledgers and bracing methods to secure the frames and Standards
- To be fully boarded with the correct edge protection on both the 0.500m and 1 metre height per working platforms.
- Working platforms to be in accordance with the Tables 4 and 5 of the SANS 10085 for weight restrictions
- Have the correct access that is fitted within the scaffold and grants access to the working platforms and must be fitted with a trap door system.
- Secured with fastening methods such Reveal and fixed ties according to table 7 of SANS 10085. Buttresses to be used when required.
- signage must be displayed to indicate if the scaffold is safe or unsafe to use.
 - Trestles to be built in accordance with section 10.16.1 of the SANS 10085 and safety requirements to be met by the scaffolding inspector and scaffold supervisors on site.

17.2.39 Bulk mixing plant

Not thought to be applicable to this project.

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17.2.40 Rope Access Work

A contractor must –

- appoint a competent person in writing as a rope access supervisor with the duty of supervising all rope access work on the site, including the duty of ensuring occupational health and safety compliance in relation to rope access work: Provided that the appointment of any such person does not relieve the construction manager of any personal accountability for failing in his management duties in terms of this regulation.
- ensure that all rope access work on the construction site is carried out under the supervision of a competent person; and
 - ensure that all rope access operators are competent and licensed to carry out their work.

No contractor may use or allow the use of rope access work unless –

- the design, selection and use of the equipment and anchors comply with the safety standards incorporated for this purpose into these Regulations under section 44 of the Act; and
- he or she is in possession of a site-specific fall protection plan developed by a competent person applicable to the specific work and environment prior to the commencement of the work, including records of maintenance and inspections of all the equipment used for the work operations.

A contractor must ensure that adequate measures are in place to allow rescue procedures to commence immediately in the event of a fall incident taking place.

17.2.41 Hazardous Chemical Substances (HCS)

In addition to the requirements in the HCS Regulations, the principal contractor must provide proof in the Health and Safety Plan that:

- Material Safety Data Sheets (MSDS's) of the relevant materials / hazardous chemical substances are available prior to use by the contractor. All MSDS's shall be available for inspection by the agent at all times.
- Risk assessments are done at least once every 6 months.
- Exposure monitoring is done according to OESSM and by an Approved Inspection Authority (AIA) and that the medical surveillance programme is based on the outcomes of the exposure monitoring.
- How the relevant HCS's are being/going to be controlled by referring to:
 - Limiting the amount of HCS
 - Limiting the number of employees
 - Limiting the period of exposure
 - Substituting the HCS

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- Using engineering controls
- Using appropriate written work procedures
- The correct PPE is being used.
- HCS are stored and transported according to SABS 072 and 0228.
- Training with regards to these regulations was given.

The Health and Safety plan should refer to the disposal of hazardous waste on classified sites and the location thereof (where applicable).

The First Aider must be made aware of the MSDS and trained in how to treat HCS incidents appropriately.

17.2.42 Noise Induced Hearing Loss

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 done within 1 month of commencement of work.
- That 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.

17.2.43 Explosives and Blasting


To be advised if applicable to this project.

17.2.44 Personal Protective Equipment (PPE)

The Contractor shall carry out PPE or clothing needs analysis in accordance with his risk assessment, to determine the necessary PPE or clothing to be used during construction. The Contractor shall make provision to keep adequate quantities of appropriate, SABS approved PPE or clothing on site always.

The Contractor must ensure that personnel are trained in the correct use of PPE to be used.

The Contractor must ensure that lost, stolen, worn out or damaged PPE is replaced as required and receipt signed for by employees on site.

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17.2.45 Asbestos (IF APPLICABLE)

The Contractor shall ensure that all asbestos work is done only by registered “Asbestos Contractor” as prescribed by the Asbestos Abatement Regulations, 2020 and in accordance with said Regulations. The Contractor shall submit an Asbestos Certificate from Department of Labour which refer to the prescribed requirements. The Contractor shall notify the Client if there are any asbestos materials encountered on site that have not been advised to be present on site by the Client or Professional Team.

17.2.46 Pressure Vessels (Including Gas Bottles)


The Contractor shall comply with Pressure Vessel Regulations, including:

- Providing competency and awareness training to the operators.
- Providing PPE or clothing.
- Providing and maintain appropriate signage in areas where pressure vessels are used, as applicable.
- Inspect equipment regularly and keep records of inspections.
- Providing appropriate firefighting equipment (Fire Extinguishers).
- Under pressure vessels to have the following in place.
 - Service date
 - Seals on valves with no leaks and not broken
 - flash arrestors
 - Should be stored and chained together
 - Oxygen / Acetylene bottles to have clips
 - Signage to be visible
 - Gauges in working condition and be visible
 - Permits for use
 - Pressure equip Regs 6. (1) The user shall ensure that the pressure equipment is operated and maintained within its design and operating parameters.

17.2.47 Fire Extinguishers and Fire Fighting Equipment

The Contractor shall provide adequate, regularly serviced fire extinguishers located at strategic points on site. The Contractor shall keep spare serviced portable fire extinguishers. The Contractor shall have adequate persons trained or competent to use the Fire Fighting Equipment.

Safety signage shall be posted up in all areas where fire extinguishers are located.

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17.2.48 Lifting Machinery and Tackle

The Contractor shall ensure that lifting machinery and tackle is inspected before use and monthly. The Contractor shall have lifting machinery and tackle inspector who will inspect the equipment at intervals required by the Driven Machinery Regulations, considering that:

- All lifting machinery and tackle have a safe working load clearly indicated
- Regular inspection and servicing are carried out
- Records are kept of inspections and of service certificates
- Thorough examinations are carried out by competent personnel at the frequencies required by legislation
- There is proper supervision in terms of guiding the loads which includes a trained banks man to direct and check lifting tackle if it is safe for use
- Forklift to be inspected every year and lift plan every 2 years
- Load test certificate to be no older than 6 months
- Sufficient props to be used and max weight to be displayed
- Slings to be checked regarding integrity, chains, serial numbers, checked for tears, cuts links and all other materials
- Hooks to be oiled, not in a fixed position and closed to prevent materials from slipping/falling off
 - Lifting equipment must be used for the scope of work carried out

17.2.49 Ladders and Ladder work

The Contractor shall ensure that all ladders are numbered and inspected regularly keeping record of inspections. It should be noted that Aluminum ladders are preferred to wooden ladders.

17.2.50 General Machinery


The Contractor shall comply with the Driven Machinery Regulations, which include inspecting machinery regularly, appointing a competent person to inspect and ensure maintenance, issuing PPE or clothing and training those that use machinery and enforce compliance.

17.2.51 Portable Electrical Tools

The Contractor shall ensure that use and storage of all explosive actuating fastening devices and portable electrical tools are in compliance with relevant legislation.

The Contractor shall consider that:

- A competent person undertakes routine inspections.
- Only authorized persons use the tools.
- There is safe working procedures applied;
- Awareness training is carried out and compliance is always enforced; and

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- PPE and clothing are provided and maintained.

17.2.52 High Voltage Electrical Equipment

The Contractor shall ensure that, where the work is under, on or near high-voltage electrical equipment the Electrical Installation Regulations, together with safety instructions (Regulations of the Owner of the Equipment) are complied with. Such equipment includes:

- Eskom and the Local Authority equipment
- The Contractor's own power supply; and
 - Electrical equipment being installed but not yet taken over from a Contractor by The Client.

17.2.53 Public Health and Safety

The Contractor shall ensure that each person working on or visiting a site, and the surrounding community, shall be made aware of the dangers likely to arise from onsite activities and the precautions to be observed to avoid or minimize those dangers. Appropriate health and safety signage shall be always posted.

17.2.54 Night Work

The Contractor shall not undertake any night work without prior arrangement and a written permit from the Client. The Contractor shall ensure that adequate lighting is provided for all night work and failure to do so shall result in work being stopped.

17.2.55 Environmental Conditions and Flora and Fauna


The Contractor must be mindful of adverse weather conditions upon the health and safety of the workforce. This includes inclement weather, strong wind, heat stress, extreme cold, etc. The Contractor's risk assessment process must consider the risks associated with such weather conditions. The same is true when working in an environment where there is a risk to employees' health and safety from presence of poisonous flora, or wildlife (including bees, snakes, etc.). The Contractor's risk assessment process must take these risks into account.

17.2.56 Occupational Health

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

The occupational hazards and risks may enter the body in three ways:

- Inhalation through breathing e.g. cement dust.
- Ingestion through swallowing maybe through food intake.
 - Absorption through the skin (pores) e.g. painting or use of thinners.

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The contractor is required to ensure that all his personnel are medically fit prior to being allowed onto the work site.

All Contractors should ensure that Occupational Hygiene surveys are conducted as per the Occupational Health and Safety Act to ensure employees are not exposed to hazards. Risk Assessments should identify areas where surveys are to be conducted.

17.2.57 Suspended Platforms

A contractor must appoint a competent person in writing who must ensure that all suspended platforms work operations are carried out under his or her supervision and that all suspended platform erectors, operators and inspectors are competent to carry out their work.

No contractor may use or permit the use of a suspended platform, unless-

- the design, stability and construction thereof comply with the safety standards incorporated for this purpose into these Regulations under section 44 of the Act.
- he or she is in possession of a certificate of system design issued by a professional engineer, certificated engineer, or a professional technologist for the use of the suspended platform system; and
- he or she is, before the commencement of the work, in possession of an operational compliance plan developed by a competent person based on the certificate of system design contemplated above and applicable to the environment in which the system is being used, which operational compliance plan must include proof of the-
 - appointment of the competent person.
 - competency of erectors, operators, and inspectors.
 - operational design calculations, which must comply with the requirements of the system design certificate.
 - performance test results.
 - sketches indicating the completed system with the operational loading capacity of the platform.
 - procedures for and records of inspections having been carried out; and
 - procedures for and records of maintenance work having been carried out.

A contractor making use of a suspended platform system must submit a copy of the certificate of system design, including a copy of the operational design calculations, sketches and test results, to the provincial director before commencement of the use of the system and must further indicate the intended type of work that the system will be used for.

A contractor must submit a copy of the certificate of system design as per regulations for every new project.

A contractor must ensure that the outriggers of each suspended platform-

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- are constructed of material of adequate strength and have a safety factor of at least four in relation to the load it is to carry; and
- have suspension points provided with stop devices or other effective devices at the outer ends to prevent the displacement of ropes.

A contractor must ensure that-

- the parts of the building or structure on which the outriggers of a suspended platform are supported, are checked by means of calculations to ensure that the required safety factor is adhered to without risk of damage to the building or structure.
- the suspension wire rope and the safety wire rope are separately connected to the outrigger.
- each person on a suspended platform is provided with and wears a body harness as a fall prevention device, which must always be attached to the suspended platform.
- the hand or power-driven machinery to be used for the lifting or lowering of the working platform of a suspended platform is constructed and maintained in such a manner that an uncontrolled movement of the working platform cannot occur;
- the machinery referred to above is so situated that it is easily accessible for inspection.
- the rope connections to the outriggers are vertically above the connections to the working platform; and
 - when the working platform is suspended by two ropes only, the connections of the ropes to the working platform are of a height above the level of the working platform to ensure the stability of the working platform.

A contractor must ensure that a suspended platform-

- is suspended as near as possible to the structure to which work is being done to prevent as far as is reasonably practicable horizontal movement away from the face of the structure.
- is fitted with anchorage points to which workers must attach the lanyard of the safety harness worn and used by the worker, and such anchorage connections must have sufficient strength to withstand any potential load applied to it; and
- is fitted with a conspicuous notice easily understandable by all workers working with the suspended platform, showing-
 - the maximum mass load.
 - the maximum number of persons; and
 - the maximum total mass load, including load and persons, which the suspended platform can carry.

A contractor must cause-

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- the whole installation and all working parts of a suspended platform to be thoroughly examined by a competent person in accordance with manufacturer's specification.
- the whole installation to be subjected to a performance test as determined by the standard to which the suspended platform was manufactured.
- the performance test contemplated above to be done by a competent person appointed in writing, with the knowledge and experience of erection and maintenance of suspended platforms or similar machinery, and who must determine the serviceability of the structures, ropes, machinery and safety devices before they are used, every time suspended platforms are erected; and
- the performance test contemplated above of the whole installation of the suspended platform to be subjected to a load equal to that prescribed by the manufacturer or, in the absence of such load, to a load of 110% of the rated mass load, at intervals not exceeding 12 months and in such a manner that every part of the installation is stressed accordingly.

A contractor must cause every hoisting rope, hook or other load-attaching device which forms part of the suspended platform to be thoroughly examined in accordance with the manufacturer's specification by the competent person before they are used every time they are assembled, and, in cases of continuous use, at intervals not exceeding three months.

A contractor must ensure that the suspended platform supervisor or the suspended platform inspector carries out a daily inspection of all the equipment prior to use, including establishing whether –

- all connection bolts are secure.
- all safety devices are functioning.
- all safety devices are not tampered with or vandalized.
- the total maximum mass load of the platform is not exceeded.
- the occupants in the suspended platform are using body harnesses which have been properly attached.
- there are no visible signs of damage to the equipment; and
- all reported operating problems have been attended to.

A contractor must ensure that all inspection and performance test records are kept on the construction site at all times and made available to an inspector, the Client, the Client's Safety Agent, or any employee upon request.

A contractor must ensure that all employees required to work or to be supported on a suspended platform are –

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- medically fit to work safely in a fall risk position or such similar environment by being in possession of a medical certificate of fitness.
- competent in conducting work related to suspended platforms safely.
- trained or received training, which includes at least-
 - how to access and egress the suspended platform safely.
 - how to correctly operate the controls and safety devices of the equipment.
 - information on the dangers related to the misuse of safety devices; and
 - information on the procedures to be followed in the case of-
 - an emergency.
 - the malfunctioning of equipment; and
 - the discovery of a suspected defect in the equipment; and
 - instructions on the proper use of body harnesses.

A contractor must ensure that where the outriggers of a suspended platform are to be moved, only persons trained and under the supervision of the competent person effect such move, within the limitation stipulated in the operational compliance plan, and that the supervisor must carry out an inspection and record the result thereof prior to re-use of the suspended platform.

A contractor must ensure that the suspended platform is properly isolated after use at the end of each working day in such a manner that no part of the suspended platform presents a danger to any person thereafter.

17.2.58 Material Hoists

Not thought to be applicable to this project.

17.2.59 Explosive Actuated Fastening Device

Not thought to be applicable to this project.

17.2.60 Confined Spaces

Confined space work must be closely monitored by a competent person appointed by the contractor, to include, but not restricted to, ensuring that the confined space is sufficiently ventilated prior to entry. Oxygen levels to be tested in confined space to ensure that it is safe for entry. Permit system to be in place to declare confined space safe for entry prior to entry. PPE must be worn (such as proper masks) if air supply is insufficient or not of sufficient quality.

Sufficient training must take place in use of all confined space monitoring and access equipment prior to any works commencing in such confined space. It is strongly recommended that a tripod and winch system be in place to afford easy access and egress and for emergency evacuation from the confined space (manholes and chambers). Please also refer to GSR5 on safety requirements for Work in Confined Spaces.

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General safety Regulations 5.

(1) An employer or a user of machinery shall take steps to ensure that a confined space is entered by an employee or other person only after the air therein has been tested and evaluated by a person who is competent to pronounce on the safety thereof, and who has certified in writing that the confined space is safe and will remain safe while any person is in the confined space, taking into account the nature and duration of the work to be performed therein.

(2) Where the provisions of sub regulation (1) cannot be complied with the employer or user of machinery, as the case may be, shall take steps to ensure that any confined space in which there exists or is likely to exist a hazardous gas, vapour, dust or fumes, or which has or is likely to have, an oxygen content of less than 20 per cent by volume, is entered by an employee or other person only when-- (a) subject to the provisions of sub regulation (3), the confined space is purged and ventilated to provide a safe atmosphere therein and measures necessary to maintain a safe atmosphere therein have been taken; and (b) the confined space has been isolated from all pipes, ducts and other communicating openings by means of effective blanking other than the shutting or locking of a valve or a cock, or, if this is not practicable, only when all valves and cocks which are a potential source of danger have been locked and securely fastened by means of chains and padlocks.

(3) Where the provisions of sub regulation (2)(a) cannot be complied with, the employer or user of machinery shall take steps to ensure that the confined space in question is entered only when the employee or person entering is using breathing apparatus of a type approved by the chief inspector and, further, that—


(a) the provisions of sub regulation (2) (b) are complied with.

(b) any employee or person entering the confined space is using a safety harness or other similar equipment, to which a rope is securely attached which reaches beyond the access to the confined space, and the free end of which is attended to by a person referred to in paragraph (c).

(c) at least one other person trained in resuscitation is and remains in attendance immediately outside the entrance of the confined space to assist or remove any or persons from the confined space, if necessary; and

(d) effective apparatus for breathing and resuscitation of a type approved by the chief inspector is available immediately outside the confined space.

(4) An employer or user of machinery shall take steps to ensure that all persons vacate a confined space on completion of any work therein.

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(5) Where the hazardous gas, vapour, dust or fumes contemplated in sub regulation (2) are of an explosive or flammable nature, an employer or user of machinery shall further take steps to ensure that such a confined space is entered only if –

(a) the concentration of the gas, vapour, dust or fumes does not exceed 25 per cent of the lower explosive limit of the gas, vapour, dust or fumes concerned where the work to be performed is of such a nature that it does not create a source of ignition; or

(b) such concentration does not exceed 10 per cent of the lower explosive limit of the gas, vapour, dust or fumes where other work is performed.

17.2.61 Alcohol and drugs (GSR 2)

1. A contractor shall not permit any person who is or who appears to be under the influence of intoxicating liquor or drugs, to enter or remain at a site.

2. No employee shall be under the influence of or have in his or her possession or partake of or offer any other person intoxicating liquor or drugs.

3. An employer or a user shall, in the case where a person is taking medicines, only allow such person to perform duties at the site if the side effects of such medicine do not constitute a threat to the health or safety of the person concerned or other persons at such site.

17.2.62 General Practices when Working at Heights

- No Homemade structures or ladders will be permitted on the project.
- Trestle tables are not to be fully extended and must be fully boarded, no drums to be used.
- Surroundings to be clear of rubble.
- Fall protection, fall prevention, and fall rescue plans to be in place and communicated to site employees.
- Ladders to be structurally sound and not broken and in accordance with GSR 13A.
- Only competent persons may be allowed to work at heights
- Correct personal protective equipment to be used (safety harness and lanyard) and edge protection / lifelines to be used.
- Anchor points to be in place and determined by an engineer. Anchor points must be pull tested prior to use.
- GSR (6) 6. No employer shall require or permit any person to work in an elevated position and no person shall work in an elevated position, unless such work is performed safely from a ladder or scaffolding, or from a position where such person has been made as safe as if they were working from scaffolding.
- Construction regulation 10 of 2014 to be implemented when working at heights and to prevent any person from falling from heights.

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- Employees required to perform work at heights or from fall risk position must be medically fit to perform such work, such employee's medicals must specify "Fall Risk" or "Working at heights" in the exposure section of the annexure 3 template

17.2.63 Traffic Accommodation

Not thought to be applicable to this project.

17.2.64 Ventilation and Lighting in the Workplace

Every employer shall cause every workplace in his undertaking to be lighted in accordance with the illuminance values specified in the Schedule to the General Safety Regulations:

Provided that where specialized lighting is necessary for the performance of any particular type of work, irrespective of whether that type of work is listed in the Schedule or not, the employer of those employees who perform such work shall ensure that such specialized lighting is available to and is used by such employees.

The Contractor must ensure that:

- the average illuminance at any floor level in a workplace within five meters of a task is not less than one fifth of the average illuminance on that task.
- glare in any workplace is reduced to a level that does not impair vision.
- lighting on rotating machinery in such that the hazard of stroboscopic effects is eliminated; and
- luminaires and lamps are kept clean and, when defective, are replaced or repaired forthwith.

With a view to the emergency evacuation of indoor workplaces without natural lighting or in which persons habitually work at night, every employer shall, in such workplaces, provide emergency sources of lighting which are such that, when activated, an illuminance of not less than 0.3 lux is obtained at floor level to enable employees to evacuate such workplaces: Provided that where it is necessary to stop machinery or shut down plant or processes before evacuating the workplace, or where dangerous materials are present or dangerous processes are carried out, the illuminance shall be not less than 20 lux.

The contractor must ensure that the emergency sources of lighting prescribed above:

- are capable of being activated within 15 seconds of the failure of the lighting prescribed by sub regulation (1).
- will last long enough to ensure the safe evacuation of all indoor workplaces.
- are kept in good working order and tested for efficient operation at intervals of not more than three months; and

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- where directional luminaires are installed, these are mounted at a height of not less than two meters above floor level and are not aimed between 10° above and 45° below the horizontal line on which they are installed.

The contractor must ensure that all rooms, stairways, passageways, gangways, basements, and other places where danger may exist through lack of natural light, to be lighted such that it will be safe.

The contractor must ensure that every workplace in his undertaking is ventilated either by natural or mechanical means in such a way that –

- the air breathed by employees does not endanger their safety.
- the time-weighted average concentration of carbon dioxide therein, taken over an eight-hour period, does not exceed one half per cent by volume of air.
- the carbon dioxide content thereof does not at any time exceed three per cent by volume of air.
- the prescribed exposure limits for airborne substances therein are not exceeded; and
 - the concentration therein of any explosive or flammable gas, vapour or dust does not exceed the lower explosive limit of that gas, vapour, or dust.

17.2.65 Nuclear Density Gauge (Troxler) (IF APPLICABLE)

The use of a Troxler on site must be in line with the SANS 3001 of March 2014. The SANS consists of 5 sections


The in-situ density of road construction materials is only determined in civil engineering using indirect methods such as the nuclear density gauge and sand replacement methods.

This method forms part of a set of methods used to operate nuclear gauges, and includes the following:

- a) administration, handling, and maintenance (see SANS 3001-NG1).
- b) validation of standard calibration blocks (see SANS 3001-NG2).
- c) calibration of a nuclear gauge (see SANS 3001-NG3).
- d) verification of a nuclear gauge (see SANS 3001-NG4):
- e) in situ density determination using a nuclear gauge (see SANS 3001-NG5)

When used Troxlers must be:

- Stored in a dedicated, lockable area and must have a warning signage displayed.
- Must only be transported in a dedicated vehicle with the required signage displayed and by an authorized employee that has been appointed in writing.

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- Must have a Troxler Calibration Certificate in place.
- Must have a Troxler Technician Appointment on file and signed and proof of competency within the safety file.

17.2.66 Ergonomics Regulation of 2019

“competent person” in relation to ergonomics, means a person who– (a) has in respect of the work or task to be performed the required knowledge, training and experience in ergonomics and, where applicable, qualifications specific to ergonomics: provided that where appropriate qualifications and training are registered in terms of the provisions of the National Qualifications Framework Act, 2008 (Act No. 67 of 2008), those qualifications and that training must be regarded as the required qualifications and training; and (b) is familiar with the Act and the applicable regulations made under the Act;

"Ergonomic risk" means a characteristic or action in the workplace, workplace conditions, or a combination thereof that may impair overall system performance and human well-being.

"Ergonomic risk assessment" means a programme, process, or investigation to identify, analyze, value and prioritize any risk from exposure to ergonomic risks associated with the workplace.

"ergonomics" means the scientific discipline concerned with the fundamental understanding of interactions among humans and other elements of a system, and the profession that applies theory, principles, data and methods to design to optimize human well-being and overall system performance.

The ergonomics regulations will apply to any employer or self-employed person who carries out work at the workplace who may expose any person to an ergonomic risk in the workplace and any designer, manufacturer, importer or supplier of machinery, plant, or work systems for the workplace.

An employer must, before the commencement of any work that may expose employees to ergonomic risks, have an ergonomic risk assessment performed by a competent person.

The ergonomic risk assessment must be done at intervals not exceeding two years and must include the following.

- a complete hazard identification and all persons who may be affected by the ergonomic risk.
- how employees may be affected by the ergonomic risks.
- the analysis and evaluation of the ergonomic risks.
- the prioritization of ergonomic risks.

An employer must review the relevant ergonomic risk assessment if:

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- such assessment is no longer valid.
- control measures are no longer effective.
- technological or scientific advances allow for more effective control methods.
- there has been a change in –
- the work methods.
- the type of work carried out; or
- the type of equipment used to control the exposure; and
 - an incident occurs or medical surveillance reveals an adverse health effect, where ergonomic risks are identified as a contributing factor.


An employer must ensure that an employee is placed under medical surveillance, which is overseen by an occupational medicine practitioner, if–

- the ergonomic risk assessment referred to in regulation 6 indicates the need for the employee to be placed under medical surveillance; or
- an occupational health practitioner recommends that relevant employees must be under medical surveillance, in which case the employer may call upon an occupational medicine practitioner to ratify the appropriateness of such recommendation.

An employer must ensure that the medical surveillance consists of–

- in the case of a new employee, an initial health examination before the employee commences employment or within 30 days of commencement of such employment.
- a periodic health examination informed by the ergonomic risk assessment, at intervals specified by an occupational medicine practitioner, but not exceeding two years; and
- an exit health examination informed by the ergonomic risk assessment.


Both the Client and the Contractor have a duty in terms of health and safety legislation to do all that is reasonably practicable to make members of the public and others being affected by the construction processes aware of possible risks and put preventative measures in place to mitigate the risks. The public and/or visitors shall go through a brief health and safety induction detailing hazards and risks they may be exposed to and what measures are in place to control these hazards and risks.

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17.3 OTHER HEALTH AND SAFETY SPECIFICATION REQUIREMENTS

The contractor must be aware of the following additional requirements:


What	When	Output
Awareness training (Toolbox Talks)	At least weekly and before hazardous work is carried out	Attendance Register
Health and Safety Committee Meetings	Monthly	Minutes signed by the employer (Contractor) covering: <ul style="list-style-type: none"> a) Health and Safety Representative Checklist b) Safety report from Safety Officer and Safety Agent
Health and Safety Reports	Monthly	Report covering: <ul style="list-style-type: none"> a) Incidents/Accidents and Investigations b) Non-conformance c) Health and Safety Training d) HIRA Updates e) Internal and External Audits
General Inspections	As per Health and Safety Specification and OHSA	Report on Health and Safety Specification and OHSA compliance: <ul style="list-style-type: none"> a) Scaffolding b) Lifting Machinery c) Excavation
General Inspections	Monthly	Covering:

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What	When	Output
		a) Firefighting Equipment b) Portable Electrical Equipment c) Ladders
Record keeping	Ongoing	Covering: a) General complaints b) Fines c) General incidents d) MSDS e) Surveillance Medicals f) Inspection Register g) Dept of Labour Notices
Permits	Before commencement with certain activities	As stipulated by the Health and Safety Specification and the OHSA / Construction Regulations

Key:

OHSA – Occupational Health and Safety Act, 1993


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17.4 ANNEXURE A – REQUIREMENTS FOR THE SAFETY PLAN ASSESSMENT


The Contractor must note that the information below is pertinent to the compilation of their safety plan response to this site-specific safety specification and it would be preferred if the Safety Plan is

written in the order of the assessment documented below.


No	Item	Notes
1	Project Directory	Please state details of Project Client, Project Manager/Principal Agent, Safety Agent, Consulting Engineer, etc. (Name, address, contact details).
2	Contractors Directory	Please indicate if you will be using Contractors on this project, if yes, include their details, trade, and FEM details.
3	Other Parties Directory	Please indicate contact details for any services applicable (electricity, water, etc.) as well as Department of Labour and Emergency Services.
4	Project Safety Statement	The Project Safety Statement must be included in the Safety Plan.
5	Health and Safety standards for the project (OHS Act, construction regulations, basic conditions of employment, etc.)	Health and Safety standards must be included in the Safety Plan.
6	Project Particulars	Scope of works must be included in the Safety Plan. This is critical.
7	Existing environment – Structures and Surroundings, Services (Electrical, Water, Sewerage, etc.), Traffic Arrangements, Parking, Access to Site, Storage of Plant and Materials	Please include these items in the plan. The items must be Site Specific, the location of services and services that will be affected must be mentioned.
8	Management Structure for safety on the Project	A structured organogram with names of the responsible people must be included.
9	Appointed Persons, Supervision	The required appointments must be identified. A list of the appointed

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No	Item	Notes
		persons must be included in the Safety Plan.
10	Security Procedures	Please indicate if a security company will be appointed and include the contact information in the Safety Plan.
11	Registers list and inspection frequency	A list of the Inspection Registers that will be on file must be included in the Safety Plan.
12	Design Co-ordination	Please indicate your procedure for implementation of design changes by designer on the project, and the procedures for liaison and implementation of temporary works design on the project.
13	Contractor Co-ordination	Mention must be made of how Contractors will be co-ordinated on site to ensure that they work together and not adversely affected health and safety.
14	Housekeeping, stacking and storage	Housekeeping policies and procedures must be included in the Safety Plan.
15	Waste Disposal Arrangements	Waste disposal arrangements procedures must be included in the Safety Plan.
16	Noise and dust control	Please indicate if any noisy operations (more than 85 decibels) will be carried out and what measures will be used to reduce noise exposure to workforce.
17	Training Requirements	Training requirements must be identified and recorded.
18	Plant and Equipment	A list of plant and equipment to be used on site must be included in the Safety Plan.
19	Safety Monitoring Arrangements	The name, contact details and SACPCMP registration status of the Safety Officer must be included in the

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No	Item	Notes
		Safety Plan. State how often the Safety officer will be on site (note safety specification requirement in section 1.7).
20	Information for Contractors	State how information will be given to Contractors on site.
21	Consultation/communication arrangements with Employees	State how information will be given to employees e.g. notice board.
22	Selection of Contractors Procedures	Principal contractor must state what health and safety procedures they will use to assess the competence and resources of their contractors on site.
23	Activities with risk to Health and Safety (Risk Assessment)	A Baseline Risk Assessment must be included in the Safety Plan, it must address the Risks identified in the Safety Specification as well as the risk of any other hazards that the Principal Contractor is aware of that are relevant to the site.
24	Hazardous Substances	Must be listed in the Safety Plan and addressed in the Risk Assessment.
25	First Aid and Medical Procedures	Please indicate name of first aider, position of first aid box, location of nearest medical facility and emergency numbers.
26	Fire and Emergency Procedures	List of emergency telephone numbers must be drawn up and included in the Safety Plan. The position of Fire Extinguishers, Assembly Point location, fire drill frequencies, numbers of fire marshals, etc.
27	Accident and Incident Reporting and investigation	State the Accident and Incident Reporting and investigation procedures of your company.
28	Welfare and Site Facilities	Elaborate on toilets and eating areas, water provision, how will workers be protected during wet weather conditions etc.

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No	Item	Notes
29	Site Rules	The Site Rules must be included in the Safety Plan.
30	Personal Protective Equipment	The necessity must be identified by Risk Assessments, the required PPE for site risks and control measures.
31	Health & Safety File arrangements	Please indicate arrangements for the return of the Health and Safety File to the safety agent at the end of the project.
32	Method Statements/Safe System of Works	A list of Method Statements/Safe System of Works must be included in Safety Plan for all High-risk activities.
33	Permits and wayleaves	List of activities that Principal Contractor anticipates will require permits and wayleaves (including those stated in the safety specification) to be included.
34	Fall Prevention and Protection Plan and Fall Rescue Plan	A copy of the Fall Prevention and Protection Plan, fall rescue plan and fall risk assessment must be included in the Safety Plan.
35	Demolition method statement	A copy of the Demolition Method Statement must be included in the Safety Plan.
36	Confined spaces	The Principal Contractors' procedures for managing access, egress and work in confined spaces must be specified in the Safety Plan. Includes permit procedures, air monitoring, PPE, etc.
37	Safety Representatives and Safety Committees	When a project has more than 20 employees a designated employee must be chosen by the labourers to represent them. A safety committee must be established if 2 or more safety representatives are appointed. Please note Safety Specification requirements regarding this section (section 2.12).
38	Have the significant hazards from the safety specification been addressed?	See section 1.9 of the Specifications and ensure practical measures have been detailed in the safety plan.

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No	Item	Notes
39	Safety File - Safety Policies in File and Signed by 16(1) CEO.	Safety Policies must be signed and explained to employees.
40	Safety File - A copy of the valid Letter of Good standing from FEM / Workman's Compensation must be on file.	A copy of the valid Letter of Good standing from FEM / Workman's Compensation must be on file.
41	Safety File - Signed copy of the 37.2 Mandatary Agreement	A 37.2 Mandatary Agreement needs to be signed between the Client and the Principal Contractor
42	Safety File - Appointment letter from Client (as well as 5.1.K)	The Client must appoint the Principal Contractor in writing.
43	Safety File – Notification / Permit	A copy of the Annexure 2 Notification (and proof of submission) to Department of Labour must be available. This can be in the form of a department stamp, email, or copy of Construction Work Permit.

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The contractor shall make the following appointments, as required:
Chief Executive Officer (OSH Act 16(1))
Contract Director/Manager (OSH Act 16(2))
Construction Manager (CR 8(1))
Construction Supervisor (CR 8(7))
Assistant Construction Supervisor (CR 8(8))
Construction Safety Officer (CR 8(5))
Traffic Safety Officer
Safety Representative (where > 20 employees on site)
Temporary work Designer (CR 12(1))
Temporary work Supervisor (CR12(2))
Construction risk assessor (CR 9(1))
Excavation Supervisor (CR13(1)(a))
Demolition Supervisor (CR14(1))
Scaffold Supervisor (CR16(1))
Suspended Platform Supervisor (CR17(1))
Material Hoist Inspector (CR19(8)(a))
Material Hoist Operator (CR19(6))
Bulk Mixing Plant Supervisor (CR20(1))
Bulk Mixing Plant Operator (CR20(2))
Controller of Explosive Actuated Fastening Devices Nails, Cartridges or Studs Issue and Collection (CR21(2)(g)(1))
Construction Vehicle and Mobile Plant Operator (CR23(1)(d)(i))
Controller of Temporary Electrical Installations (CR24(c))
Stacking Supervisor (CR28(a))

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The contractor shall make the following appointments, as required:

Fire Extinguishing Equipment Inspector (CR29(h))

Fall Protection Plan Developer (CR 10(1)(a))

Incident Investigator (OSH Act 9(2))

Competent Person – Confined Spaces (GAR 5(1))

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17.6 ANNEXURE C – DRAFT BASELINE RISK ASSESSMENT FOR PROJECT

Irrespective of the risk presented on site, it will be ensured that sufficient supervision is in place on site, that personnel are trained in accordance with legislation, including the requirement for site specific inductions on site to inform personnel on site of the risks and hazards applicable to the site. Site supervision is responsible for ensuring that the control measures required below are implemented on site.

	HAZARD	RISK	RISK RATING – HIGH / MEDIUM / LOW	MINIMUM CONTROL MEASURES
1.	Asbestos Containing Products	Release of asbestos fibres	TBA	<ul style="list-style-type: none"> • Consult clients Asbestos Register • Ensure safe access and egress is provided • Erect physical barriers to prevent entry by unauthorised persons, as applicable • damp down exposed area to contain fibre release • Personnel involved to wear asbestos respiratory protection • Exclusion zone may be required • Only Department of Labour registered asbestos contractors may work with asbestos, and strictly in accordance with the requirements of the Asbestos Abatement Regulations.
2.	Compacting and Filling	Contact with tipping materials Contact with moving plant Vehicles/personnel falling into excavations Contact with underground services	M	<ul style="list-style-type: none"> • Trained banksman to control vehicles movement • Only trained personnel use plant • Personal Protective Equipment to be worn • Personnel to stand clear as materials are being tipped

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	HAZARD	RISK	RISK RATING – HIGH / MEDIUM / LOW	MINIMUM CONTROL MEASURES
				<ul style="list-style-type: none"> • Use stop blocks and signs to warn vehicles of excavations, where applicable • Stand clear of plant whilst materials are being compacted • Establish position of underground services and protect services from damage
3.	Compactor Operations	Crushing of feet	M	<ul style="list-style-type: none"> • Only trained and competent personnel to use the machine • Ensure operative wears steel toe cap shoes or boots at all times •
4.	Confined Spaces	Suffocation Fumes	TBA	<ul style="list-style-type: none"> • Ensure that confined space is sufficiently ventilated • Wear personal protective equipment such as proper masks if air supply insufficient or not of sufficient quality • Test oxygen levels in confined space to ensure that is safe for entry • Ensure that emergency procedures in place •
5.	Crime and security	Injury to employees during protest action, criminality, intimidation	M	<ul style="list-style-type: none"> • Workers to be vigilant for signs of security threats • Contractor must have contingency plan in place for emergency evacuation of site • Emergency numbers for police and security to be on hand

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	HAZARD	RISK	RISK RATING – HIGH / MEDIUM / LOW	MINIMUM CONTROL MEASURES
				<ul style="list-style-type: none"> • Report incidents of vandalism, damage and intimidation on site-to-site management immediately •
6.	Cutting Off Disc	Noise Cuts from machine Fire (particularly at refuelling) Flying debris Blade shattering Contamination by fume created or exhaust fume	M	<ul style="list-style-type: none"> • Use competent personnel. • Hot works control- fire extinguisher, fire watchman. (Permit may be required) • PPE to include gloves, eye protection, hearing protection • Solid working position. • Clear working area • Correct grade of blade must be used. • Good ventilation to be provided (forced if necessary). • Changing of wheels to be by competent persons only • Cut off discs must not be used for grinding (grinding disc thicker) • Bystanders to wear hearing protection, as applicable •
7.	Demolition	Falling materials Premature collapse of structure	TBA	<ul style="list-style-type: none"> • Ensure there is a current method statement in place • Ensure all emergency procedures are in place and all details are displayed • Ensure that structural demolition has been approved by the designer and site management • Personnel must be competent • Ensure at all times there is a safe means of access and egress

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	HAZARD	RISK	RISK RATING – HIGH / MEDIUM / LOW	MINIMUM CONTROL MEASURES
				<ul style="list-style-type: none"> All personnel must wear suitable and sufficient Personal Protective Equipment, including head, eye and skin protection
8.	Electrical Commissioning	Electric shock	M	<ul style="list-style-type: none"> Personnel to comply with permits to work issued by Client, as applicable Personal protective equipment to be worn by employees to prevent electric shock First aid treatment to be readily available Only competent and trained persons may decommission or commission electrical equipment
9.	Electric Tools and Electrical Installations	Electric shock Fire	L	<ul style="list-style-type: none"> Electric tools and installations to be in good condition Inspect electric tools before use Do not use electric tools in wet/damp conditions Use personal protective equipment such as insulated gloves Electrical installations register to be maintained, inspected by competent person
10.	Excavations (Working in and around) - (if applicable)	Toxic fumes Collapse of trench walls/trapping Falling into excavation Collapse of adjacent structures	M	<ul style="list-style-type: none"> Deep excavations / monitor air for toxic fumes Prevent collapse by battering back sides to a safe angle or install temporary support

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	HAZARD	RISK	RISK RATING – HIGH / MEDIUM / LOW	MINIMUM CONTROL MEASURES
				<ul style="list-style-type: none"> • Protect vehicles from falling into excavations – provide barriers, signage, etc. as necessary • Beware of undermining of other structures (e.g. buildings, scaffolds) • Record excavation inspections by competent person on daily basis • Provide suitable means of access/egress in case of emergency. • Excavations formed by explosives must be accompanied by method statement approved by Client •
11.	Fire	Injuries to workers, pedestrians, residents, road users, damage to property through fire	L	<ul style="list-style-type: none"> • No littering on site which could become fire hazard, maintain site in clean condition. • No fires to be lit on site. Have a working fire extinguisher at hand at all times. • No smoking or naked flame near flammable substances or in unauthorised areas • Ensure proper storage/use of Petrol/diesel/flammable substances – post warning notices •
12.	Flammable Liquids and Gases (Use of)	Fire Explosion	L	<ul style="list-style-type: none"> • No littering on site which could become fire hazard, maintain site in clean condition. • Have a working fire extinguisher at hand at all times.

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	HAZARD	RISK	RISK RATING – HIGH / MEDIUM / LOW	MINIMUM CONTROL MEASURES
				<ul style="list-style-type: none"> • No smoking or naked flame near flammable substances or in unauthorised areas • Ensure proper storage/use of Petrol/diesel/flammable substances – post warning notices • Equipment must be in good condition, maintained • Personnel using substances must be trained in safe use and risks •
13.	Hand tools	Injuries caused by use of hand tool Impact with the tool Falls due to access problems Contamination with substance being worked	L	<ul style="list-style-type: none"> • Ensure: • Tool is correct for job • Tool is in good order and suitably sharp • Personnel must be competent/instructed in tool usage and tool safely • Lighting is sufficient • Access is safe, working platform is secure, leading edge is guarded • Operative is wearing all necessary PPE
14.	Hazardous Substances	Injuries to workers through use of hazardous substances, e.g. injuries to eyes, skin, etc.	M	<ul style="list-style-type: none"> • Use substances in accordance with data sheet, particularly reference protective clothing required (example: gloves, goggles, etc.) • Know what First Aid measures are • Have welfare facilities available for washing of hands, etc.

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	HAZARD	RISK	RISK RATING – HIGH / MEDIUM / LOW	MINIMUM CONTROL MEASURES
15.	Hot Works	Burns to eyes or other parts of the body	L	<ul style="list-style-type: none"> • Personal Protective Equipment to include eye, skin, and hearing protection • Respirator maybe be required where cutting galvanized steel or anywhere else toxic fumes and gases arise. Dust can also be a problem and forced ventilation may be required.
16.	Lifting Operations	Falling material Crushing by materials Hand injuries to the slinger Toppling crane	M	<ul style="list-style-type: none"> • Check test certificate • Check examination certificate • Check inspection have been carried out • Check certificates for lifting equipment (chains, slings, shackles, etc.) • Ensure lifting gear is rated to carry load (SWL) • Ensure materials being lifted are properly packaged and slung. • Be aware that there should be a minimum clearance of 600mm between any slewing parts of a crane and any fixed installation to prevent being trapped. • Access to the work area during lifting operations is to be restricted to those involved with and trained in the work in hand. Do not allow members of the public to gain access to the area. • Only trained banksmen to be used.

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	HAZARD	RISK	RISK RATING – HIGH / MEDIUM / LOW	MINIMUM CONTROL MEASURES
				<ul style="list-style-type: none"> • The crane driver and the banksman are to ensure that the signals given are clearly understood.
17.	Manual Handling of General Items	Muscular skeletal injuries if the load is too heavy or awkward Operative falling/ tripping Contamination from the substance being carried Fall of material being carried	H	<ul style="list-style-type: none"> • Personnel should be aware of safe manual handling techniques • Personnel to wear Personal Protective Equipment when carrying items, e.g. safety footwear and gloves. • Ensure good housekeeping against tripping/fall hazards. • Operative to get assistance if load too heavy- team lift if necessary. • Utilise mechanical lifting and carrying aids where possible. • Personnel to ensure access equipment, ladders will take weight of operative, and load being carried. • Personnel to ensure item being carried is properly bonded or is not liable to break apart whilst being manually handled. •
18.	Members of Public – Protection of	Injury to member of public and road users from site works	M	<ul style="list-style-type: none"> • Barriers and signage to be in place • Workers must warn away any members of public from the works • Footpaths and bridges which are open to public must be closed off if in area of works or otherwise made safe so that no injury occurs to members of public

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	HAZARD	RISK	RISK RATING – HIGH / MEDIUM / LOW	MINIMUM CONTROL MEASURES
				<ul style="list-style-type: none"> • Signage to be on road at site entrance warning motorists that construction traffic turning into/out of site access. Keep roads free of mud where possible • Refer to plant risk assessment for details on plant safety precautions • NOTE: SIGNAGE TO BE POSTED ON SITE TO WARN OF CONSTRUCTION TRAFFIC MOVEMENTS. SAFE MEANS OF ACCESS FOR BOTH CONSTRUCTION TRAFFIC TO SITE AND PRASA OPERATIONS MUST BE AGREED. •
19.	Night Work	Security Lighting	M	<ul style="list-style-type: none"> • The Contractor shall not undertake any night work without prior arrangement and a written permit from the Client. • The Contractor shall ensure that adequate lighting is provided for all night work and failure to do so shall result in work being stopped. •
20.	Noise and Dust	Breathing in dust can cause long term health problems, noise can damage hearing	M	<ul style="list-style-type: none"> • Wear respiratory and hearing protection • Dampen down and minimise dust where possible. •
21.	Plant or Vehicles and	Workers injured by passing traffic	M	<ul style="list-style-type: none"> • Implement traffic protection measures

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	HAZARD	RISK	RISK RATING – HIGH / MEDIUM / LOW	MINIMUM CONTROL MEASURES
	Equipment Operation	Road users and pedestrians at risk from plant operation Noise		<ul style="list-style-type: none"> • Trained and competent operators must be used • Check plant and vehicles on daily basis before use and record inspections. Maintain vehicles in safe condition. • Medical certificates of fitness required for construction plant. • Crossing of road by construction vehicles or machines must be limited to the practical minimum • Plant and vehicles must be fitted with amber rotating beacons and reverse alarms. • Wear appropriate protective clothing/equipment, e.g. goggles, gloves, ear defenders, etc. as appropriate. •
22.	Rail Precinct – working in or next to tracks	Injury to workers caused by passing trains Injury to railway commuters by works	M	<ul style="list-style-type: none"> • Permits to be obtained for working in rail reserve • Lookouts to be present to warn of oncoming rail traffic • No construction activities to commence until adequate provision made to accommodate safe interface between workers and rail traffic. • Use safety signage to warn rail traffic and pedestrians of construction works • Wear reflective waistcoats as well as any other required personal protective clothing.

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	HAZARD	RISK	RISK RATING – HIGH / MEDIUM / LOW	MINIMUM CONTROL MEASURES
				<ul style="list-style-type: none"> • Crossing of rail tracks by personnel must be limited to the practical minimum • Use of fencing or other barriers as appropriate •
23.	Working at Height	Personnel falling from height Falling debris Those beneath being injured	M	<ul style="list-style-type: none"> • All access equipment is properly constructed (inspections record must be maintained) • Only trained personnel construct, dismantle or control the access equipment • All access equipment must have full toe boards and guardrails - comply with SANS 10085 on erection, use and dismantling of scaffolding • No access equipment may be loaded above the level of the guardrail • No access equipment to be loaded above its safe working load • Where work involves leaning out on an open leading edge, then all personnel are to be fitted with full body harness. The harness must be connected at all times • All fall arrest equipment to be correctly maintained • Ensure if ladders are being used for access, they are either footed or tied. Also, the ladder must be set at the correct level of 1 in 4 or approximately 75°

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	HAZARD	RISK	RISK RATING – HIGH / MEDIUM / LOW	MINIMUM CONTROL MEASURES
				•
24.	Live Services	Striking of live services	M	<ul style="list-style-type: none"> • Make all necessary enquiries to establish what services are in the area. Consult drawings and advice from service provider (e.g. Municipality or ESKOM) when planning work. • Assume all service to be live (Unless confirmation is received to confirm that services are isolated or otherwise made safe). Do not work near live services without authorisation from site management. • Comply with the requirements of the safe system of work for underground services. • Where available, locate services with a locator • Hand dig around services •