

SOUTH AFRICAN BUREAU OF STANDARDS

EAST LONDON BRANCH

MECHANICAL: TECHNICAL SPECIFICATION: STAGE 4

Report Revision:

Rev. 0

Issue Date:

31 January 2024

Prepared for:



Prepared by:



SABS EAST LONDON

HDM ENGINEERING (PTY) LTD

Your Ref.:

Our Ref.:

Address: 1 Dr Lategan Road, Groenkloof
Private Bag X 191
Pretoria
0001

Address: Unit 6 Golf Garden Office
Park
01 Marco Polo Street
Highveld, Centurion,
0157

Contact Person: Cornelis van Hoeve
Project Manager

Contact Person: Setsile Mocumi
Project Engineer

Tel N°: +27 12 428 7708

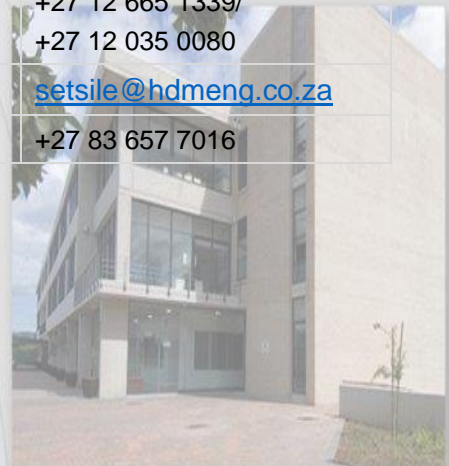
Tel N°: +27 12 665 1339/
+27 12 035 0080

Email Address: cornelis.vanhoeve@sabs.co.za

Email Address: setsile@hdmeng.co.za

Mobile No: +27 84 310 3617

Mobile No: +27 83 657 7016



DOCUMENT CONTROL

Document Information

Description	Information
Document ID:	
Document Name:	Detailed Design Report
Document Revision:	00
Issue Date:	Wednesday, 31 January 2024

Document Revision History

Date	Rev.	Prepared by	Changes
31/01/2024	000	Confidence	

Document Approvals




	Role	Name	Signature	Date
Compiled by:	Mech Tech	C. Makhubele		31/01/2024
Checked by:	Lead Engineer	S. Mocumi, Pr Eng		31/01/2024
Approved by:	Lead Engineer	S. Mocumi, Pr Eng		31/01/2024

TABLE OF CONTENTS

1.	GENERAL.....	4
2.	COMPREHENSIVE CONTRACTS.....	4
3.	FIRST AND FINAL DELIVERY	4
4.	PERIOD OF LIABILITY	4
5.	DRAWINGS.....	5
6.	STANDARD QUALITY SPECIFICATION.....	5
7.	BUILDERS WORK.....	5
8.	PAINTING.....	5
9.	MAINTENANCE AND SERVICING	7
9.1.	GENERAL	7
9.2.	MAINTENANCE INSTRUCTION OF OWNER'S STAFF	7
9.3.	SPARE PARTS AND AGENCIES.....	7
9.4.	TOOLS.....	7
9.5.	OPERATING, MAINTENANCE INSTRUCTION, WIRING AND CONTROL DIAGRAMS	8
10.	COMMISSIONING AND TESTING	9
11.	GENERAL REQUIREMENTS	10
11.1.	Site Supervision by Mechanical Contractor	10
11.2.	Material and Workmanship	10
11.3.	Manufacturers Ratings	10
11.4.	Protection of the Works	11
11.5.	Equipment Installation	11
11.6.	Submission by Mechanical Contractor.....	11
11.6.1.	Submission with regards to Equipment:.....	11
11.6.2.	Marked up drawings and shop drawings.....	12
11.7.	Installation Fit.....	13
11.8.	Supports.....	13
11.9.	Wooden and Steel Frames and Sleeves.....	13
11.10.	Samples to be supplied	13
11.11.	Declaration of Ownership	14
11.12.	Performance of System and Equipment	14
11.13.	Protection, Cleaning, Adjustments, Commissioning, Tests and Operating and Maintenance Manuals	14
11.14.	Approvals	14
11.15.	Language	14
11.16.	Training Program3.....	15

12.	SITE DESCRIPTION	16
12.1.	External Environmental Conditions	16
12.2.	Internal Conditions and Parameters	16
13.	SMOKE MANAGEMENT IN PRE-TEST ROOM AND HVAC PLANT ROOM AND VENTILATION IN THE FLAMMABLE LIQUID STORE	16
13.1.	Scope of work.....	16
13.1.1.	HVAC plant room and Pre-test room systems description	16
13.1.2.	Ventilation of the flammable liquid store room	17
13.1.3.	Fire dampers	17
13.1.4.	Weather louvres	18
13.1.5.	Dampers.....	19
13.1.6.	Smoke ventilators.....	19
13.1.7.	Fans	20
13.1.8.	Ducting.....	21
14.	FIREFIGHTING EQUIPMENT AND SIGNAGE	24
14.1.	General	24
14.2.	Fire extinguishers	24
14.3.	Fire hose reels.....	25
14.4.	Fire Hydrants.....	25
14.4.1.	Fire Hydrants: FH (Ref to GDID std drawing ME-E 01 04 01)	26
14.4.2.	Fire Pump Hydrants: FPH (Ref to GDID std drawing ME-E 01 04 02)	26
14.4.3.	Fire Pump Booster Connection: FPB: (Ref to GDID std drawing ME-E 01 04 03).....	26
14.5.	Piping system.....	27
14.5.1.	Piping above ground	27
14.5.2.	Piping underground for normal soil.....	27
14.5.3.	Pipe supports and sleeves	27
14.5.4.	Pipe fittings.....	28
14.6.	Fire Water Pumps	29
14.6.1.	Pump installation	29
14.6.2.	Pump construction.....	29
14.6.3.	Pressure tank (captive air).....	30
14.6.4.	Pump controls	30
14.7.	Signage.....	30
15.	FIRE DETECTION AND ALARM SYSTEM	31
15.1.	Scope of Work.....	31
15.2.	Control Equipment.....	31

15.3. Control Panel.....	31
15.4. Communications.....	33
15.5. Detectors and detector bases in general	34
15.6. Audible Alarm Units.....	35
15.7. Break-Glass Manual Alarm Units.....	35
15.8. Batteries.....	36
16. ELECTRICAL SYSTEM.....	36
17. FOAM DELUGE FIRE SUPPRESSION SYSTEM.....	37
17.1. General	37
18. GENERAL BUILDING WORK.....	37
18.1. General	37
19. DECOMMISSIONING OF EXISTING UDERGROUND TANKS	38
20. BLOCK PLAN	38

1. GENERAL

This specification is for the supply, delivery and installation of the following mechanical services:

- Firefighting equipment and signage in the entire premises (i.e. hydrants, hose reels, extinguisher and signs),
- Fire detection systems in all the buildings,
- Mechanical Smoke ventilation system in the pre-test room,
- Mechanical ventilation in the flammable liquid store room,
- Deluge automatic fire suppression system in the flammable liquid store room,
- General building work in both buildings.
- Decommissioning of the existing underground fuel tanks.

All equipment and installations detailed in this specification shall comply with the requirements of the Occupational Health and Safety Act 85 of 1993.

Where conditions are at variance, this supplementary specification will have preference over both Standard Specifications and drawings.

2. COMPREHENSIVE CONTRACTS

Only specialist sub-contractors who have previously successfully completed mechanical installations of the extent and nature specified in this document should be considered. This is are unique buildings, and high-quality workmanship is expected of the contractors.

NOTE: *No changes in make, type or capacity of equipment specified in the schedule of particulars shall be allowed after acceptance of the tender without the written approval of the Engineer.*

3. FIRST AND FINAL DELIVERY

The contractor shall deliver to the Engineer the installation, when completed in a clean and perfect state internally and externally, fully operational and complete in every detail.

When the installation is, in the opinion of the Engineer complete and operational, the Engineer will issue a first delivery certificate.

The final delivery certificate shall be issued twelve months after the date of the first delivery certificate provided that all defects referred to in clause 4 hereof are all rectified within this period.

4. PERIOD OF LIABILITY

Any defect or fault which may appear within twelve months from completion of works due to materials or workmanship not being in accordance with the contract shall be made good by the contractor within such period as may be determined by the Engineer or any representative of the client in written instruction to do so.

5. DRAWINGS

The drawings that accompany this specification are schematic and do not necessarily indicate the exact position, size or detail the construction of equipment. The contractor must satisfy him/herself that the equipment offered will fit into the available space and can be positioned so that access for maintenance, repair or removal is not encumbered.

NOTE: *All final dimensions are to be verified on site prior to any equipment or material being ordered or manufactured.*

The following drawings accompany this specification and are to be read as forming part thereof

Fire Protection Drawings

- ME-FP-001 : Fire protection site layout
- ME-FP-002 : Building A – Fire Protection Layout
- ME-FP-003 : Building B - Fire Protection Layout
- ME-SE-001 : Building A – Smoke Extraction Layout
- ME-SE-002 : Building A – Smoke Extraction Section and Elevation
- ME-SD-001 : Building A – Smoke Detection Layout
- ME-SD-002 : Building B – Smoke Detection Layout
- PP1 7/133 : Upgrade of Existing Flammable Liquid Store (JCK FIRE)
- FL9276 : Site Plan - Indication

Appendices: GDID Standard Drawings

- ME-E-01 04 01 : Fire Hydrant – FH - Details
- ME-E-01 04 02 : Fire Pump Hydrant – FPH - Details
- ME-E-01 04 03 : Fire Pump Connection – FPC - Details

6. STANDARD QUALITY SPECIFICATION

This specification is based primarily on the Gauteng Department of Infrastructure Development (GDID) Standard Quality Specifications for “Fire Protection” and “Ventilation, Heating and Air Conditioning” including relevant clauses and other applicable SABS standards.

7. BUILDERS WORK

All building work such as cutting of openings, making good, bases for equipment, etc. shall not be included in this contract but shall form part of the builder’s work.

8. PAINTING

The entire installation, other than aluminium and stainless pipe cladding, shall be painted unless otherwise specified in the supplementary specification.

Painted items shall include plant room areas, equipment plinths and bases.

Before any painting is applied, the surfaces shall be prepared according to SABS 064, code for preparation of steel surfaces for painting. All surfaces shall be moisture free.

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

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

Items which do not require painting such as diffusers and grilles, shall only be installed after the paint work on the plant, ceilings and walls have been completed.

Equipment on which paintwork has been damaged during installation shall be repainted before first delivery of the plant.

Unless otherwise specified in the supplementary specification the installation shall be painted in accordance with SABS colour coding where applicable. Colour code bands and arrow indicators shall be as per SABS 0140 of 1978, and the basic colour shall cover the full length and circumference of pipes and ducts.

Plastered surfaces inside plenums shall be painted with suitable alkali resistant primer to SABS 1414-1987 followed by a universal undercoat with a final coat of high gloss enamel paint to SABS630, Grade I. The colour of the final coat shall be white.

Lagged and plastered duct work and plastered surface s outside plenums shall be painted with a suitable alkali resistant primer to SABS 1414 of 1987 followed by one undercoat to SABS 681, TYPE II and one coat high gloss enamel paint to SABS 630, Grade 1 or PVA exterior type emulsion paint to SABS 634 of 1974 as to coat.

Exposed unlagged galvanized piping shall be painted with one coat wash primer (self-etch primer) to SABS 723 followed by one undercoat to SABS 681, type II and coat gloss enamel paint to SABS 630, grade 1 as top coat.

Unlagged black piping, flat iron, angle iron, rods, etc, for supports, brackets, frames, duct stiffeners, etc, shall be painted on all sides with a zinc chromate primer to SABS 679 type 1, followed by one coat universal undercoat and one finishing coat of enamel paint to SABS 630 Grade 1.

Aluminium shall be painted with wash primer to SABS 723 followed by a zinc chromate primer to SABS 679, type I and one coat universal undercoat to SABS 681-1972 type II and one final coat of enamel paint to SABS 630, Grade 1.

Steel surfaces shall be cleaned and then treated with hot sophisticated process to a minimum weight of 1.6 g/m coating by two coats of backing enamel to SABS 783 type I.

All galvanized surfaces requiring painting other than those covered in the paragraph that follows below, shall be thoroughly degreased. In case a detergent is used, the surface shall be well rinsed and dried. It shall be painted with one coat wash primer (self-etch primer) to SABS 723. When dry, the surface shall be painted with one undercoat to SABS 681 type II and one coat universal under coat, and one coat high gloss enamel paint to SABS 630 Grade 1 as top coat.

9. MAINTENANCE AND SERVICING

9.1. GENERAL

The contractor shall be responsible for all maintenance and servicing of the installation for the full 12-months guarantee period. During this period, the contractor shall make good any defects due to inferior materials or workmanship and maintain all plant and equipment in perfect operating condition.

The contractor shall be entirely responsible for carrying out regular inspections at intervals not greater than 1 month, unless otherwise specified, and for full servicing of all components of the installation in accordance with the manufacturer's instructions. For this purpose, the contractor shall prepare a detailed inspection and service report in a form of a checklist and log sheet showing all functions to be carried out at each inspection and service. Copies of this service reports shall be regularly submitted to the Department after each service.

The contractor shall also maintain a plant log book on site in which he shall record, sign, and date all work carried out at each inspection as well as log all temperatures and pressure readings etc.

The contractor shall allow for all expendable materials necessary for servicing such as lubricating oils, greases, refrigerant and cleaning materials.

9.2. MAINTENANCE INSTRUCTION OF OWNER'S STAFF

The contractor shall make proper allowance in their price for instruction of the client's staff in the maintenance, repair and adjustment of all equipment. Allowance must be made for the proper hands-on tuition of the owner's personnel at the appropriate time to enable them to take over operational duties.

9.3. SPARE PARTS AND AGENCIES

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

The contractor should furnish an undertaking from agents to the effect that they are prepared to carry the necessary stock of spare parts for their particular units.

The contractor is also required to furnish the same undertaking with regard to the spares for units manufactured by their own principals.

9.4. TOOLS

All special tools required, i.e. tools specially designed for the particular equipment offered, must be supplied and listed in the tender offer and be included in the unit price. In the case of a number of identical items of plant being supplied, it will only be necessary to sets of tools covering all units.

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

9.5. OPERATING, MAINTENANCE INSTRUCTION, WIRING AND CONTROL DIAGRAMS

The contractor shall prepare and supply comprehensive manuals for the successful operation and maintenance of the installation. A draft of the manual shall be submitted to the Engineer after commissioning for approval. The draft shall then be corrected, if required, and FOUR sets of the manuals shall be submitted before first acceptance of the plant is considered.

Manuals shall be prepared in the same language as the contract document. Unless otherwise required by the client. These manuals shall be bound in hard file covers with clear titles and indices and shall contain the following information as a minimum, in the sections as indicated:

SECTION 1: System Description

A comprehensive description of the system, including schematic diagrams.

SECTION 2: Commissioning Data

The results of all checks and measurements as recorded during commissioning period shall be compiled in such a manner that every check and measurement is clearly defined.

SECTION 3 Operating Instructions

1. Plant running checklist
2. Safety precautions to be taken
3. Manual and automatic operation
4. Operator's duties
5. Lubricating oil and service instructions
6. Pre-start checklist for each system
7. Starting and stopping procedures

SECTION 4: Mechanical Equipment

1. Description of major items of equipment with the make, model number, names, addresses, and telephone numbers of the supplier, manufacturer or their agents.
2. Design capacities of all equipment including selection parameters, selection curves, capacity table, etc
3. Manufacture's brochures and pamphlets
4. Schedule of spares with part numbers recommended to be held in stock by the client.

SECTION 5: Maintenance Instructions

1. Schedule of maintenance particulars, frequency of service and replacement.
2. Troubleshooting guide
3. Part numbers of all replacement items and spares.
4. Capacity curves of pumps
5. Serial numbers of main items of equipment

SECTION 6: Electrical Equipment

1. Schedule of equipment indicating manufacturer, type, model number, capacity, address, and telephone number of suppliers.
2. Maintenance instructions
3. Manufacturer's brochures and pamphlets
4. Complete "as-built" diagrams and diagrammatic representation of inter-connections of electrical equipment.

SECTION 7: Instrumentation and Control

1. Description of each control system
2. Schedule of control equipment indicating make, type, model number, rating, capacity, name, address and telephone number of supplier.
3. Maintenance instruction
4. Manufacture's brochure and pamphlets

SECTION 8: Drawings

1. Paper print (reduced if so desired) of all "as-built" mechanical and electrical contractor's drawings
2. Wiring diagrams, framed behind glass shall be mounted adjacent to each relevant control panel

10. COMMISSIONING AND TESTING

The contractor shall carry out all tests and commissioning of the systems installed by him in a coordinated and properly organized manner. Ventilation installations shall be commissioned in accordance with the following codes or such other recognized commissioning procedures or code approved by the Engineer:

a) Air Distribution Systems:

SABS 0173: Code of practice for the installation, testing and balancing of air conditioning ductwork.

b) Control Systems:

CIBS: Commissioning code: Series C: Automatic control

Should the test be carried out over an area outside the range of normal speech, it is required that the contractor makes available four battery powered, two-way radio sets, to facilitate communications.

The testing procedures shall be sufficiently comprehensive to prove the correct functioning of each and every piece of equipment, and its suitability for the application.

After all systems and equipment have been tested and commissioned to the satisfaction of the Engineer, a detailed demonstration of all functions of the system shall be carried out in the presence of the client representatives, so as to allow them to become fully acquainted with the operation of the system.

The commissioning tests shall include the tests laid down under specific sections hereafter, and a full operational test of all pumps, compressors, fans and control gear in all modes of operation.

The contractor shall allow for the replacement and cost of any materials and fuel used for testing purpose as part of the contract.

The demonstration to the users shall include a repeat to the operational tests above.

The planning of this demonstration shall take place in collaboration with the client.

A certification of completion will not be issued until all tests have been satisfactorily completed, and the plant has operated successfully, to the complete satisfaction of the Engineer.

11. GENERAL REQUIREMENTS

11.1. Site Supervision by Mechanical Contractor

The mechanical contractor is responsible for supervision on this contract. A complete CV of the person responsible for the site supervision shall be submitted to the Engineer. The Engineer may require an interview with the proposed supervisor. The final choice of the supervisor shall not in any way alter the final tender price on this contract. The mechanical contractor shall replace the supervisor at his own cost if the aforementioned supervisor is unable to perform his duties satisfactorily. The submission of the supervisor's CV is required only after the contractor has been appointed.

11.2. Material and Workmanship

All materials and equipment used shall be new, free from rust, defects, undamaged and be suitable for the purpose for which it will be used. Materials shall comply with the latest issue of the relevant SANS or BS specification where applicable. If any material or workmanship is not to the satisfaction of the Engineer, it shall be rectified and/or replaced at the mechanical contractor's cost and all rejected material shall immediately be removed from site.

The mechanical contractor is responsible for the correct and complete erection of the installation and inspections executed by the Engineer do not exempt the mechanical contractor of this obligation.

11.3. Manufacturers Ratings

All equipment shall be able to work within the rated capacity, as determined by the manufacturer. Any equipment offered for use out of these limits will not be considered. Sub-contractor shall hand in the rated capacities of all equipment as well as descriptive literature with the tender documents.

11.4. Protection of the Works

The mechanical contractor will be responsible for taking all necessary precautions for the protection of lives, equipment and materials, installations or structures in the vicinity of the works during installation and commissioning. Any damage caused by the mechanical contractor, his agents or workman to the building, structure or any other installation will be made good by the mechanical contractor at his own expense and to the entire satisfaction of the representative of the Client.

11.5. Equipment Installation

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

As the final selection of equipment is, however, in the hands of the mechanical contractor and the contract for the supply of equipment is between the mechanical contractor and the supplier, it shall be the mechanical contractor's responsibility to ensure that the equipment procured will be suitable for the spaces in which it will be installed and that other influences shall not interfere with the safe and optimum operation of such equipment. Particular attention must be given to the aspects of accessibility for maintenance and adjustment, and specific safety requirements of particular suppliers.

11.6. Submission by Mechanical Contractor

This clause shall not supersede but shall complement any clauses stated in the preambles of this document.

11.6.1. Submission with regards to Equipment:

The Mechanical Contractor should take note that all equipment selections approved (or not rejected) by the Engineer shall not free the contractor to comply with the specification.

The following information with regard to equipment selections shall be submitted to the Engineer at tendering stage:

- Manufacture, name and model,
- Motor capacity,
- Power consumption,
- Diagrams, tables and graphs to explain the functioning of equipment where applicable,
- Applicable pamphlets or catalogue information,
- Name and address of manufacturer and /or distributor,
- Number of years that equipment is available in RSA,
- Any other relevant information required by the Engineer

The following submissions are required:

- Fans
- Booster connection and hydrants
- Pumps
- Hose reels and extinguishers
- Signage
- Control panels
- Detector
- Fire dampers, roof ventilators and dampers
- Automatic fire suppression equipment

11.6.2. Marked up drawings and shop drawings.

The mechanical contractor shall be responsible for any discrepancies, errors or omissions in the drawings and information supplied by him, whether they have been approved by the Engineer or not, provided that such discrepancies, errors and omissions are not due to incorrect drawings or inaccurate information furnished to the contractor in writing by the Employer or Engineer.

The mechanical contractor shall, at his own expense carry out alterations or remedial work necessitated by reason of such discrepancies, errors or omissions for which he is responsible and modifies the drawings and information accordingly, or, if the same be done by or on behalf of the Employer because of the mechanical contractor's failure to undertake the same, the mechanical contractor shall bear all costs reasonably incurred therein.

Marked-up Structural and Other Drawings.

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

- All dimensions and positions of openings and sleeves through both brick and concrete building structures required to fit the specified services.
- Dimensions and positions of concrete plinths (machine bases) required to locate the equipment. The point loading and any forces generated by equipment shall also be shown on these drawings.
- Installation positions of wooden, glass fibre or steel frames or sleeves to be built in by the contractor.
- Any other requirements in respect of water supply points, drain points, power supplies, etc. that may be required and do not form part of this contract.

Shop Drawings and As-Built Drawings

Where equipment is indicated on the shop drawings, then the shop drawings must also be signed by the supplier of such equipment, approving the application, positioning and installation details of his equipment (i.e. pumps, etc):

- All shop drawings shall be approved and signed by the professional mechanical engineer. All electrical diagrams shall be approved and signed by the electrical professional registered engineer and by the specialist controls supplier.
- Required service space around equipment shall be marked-up on shop drawings.
- Operating mass of equipment must be indicated on shop drawings.
- Calculated point loads at all hangers, support, brackets, etc. used to suspend the installation from, or supporting the installation must be indicated on shop drawings.
- Electrical operating and motor loads in amperes, single phase or three phase must also be indicated.

The successful mechanical contractor shall verify that provisions have been made for all openings, wooden frames, sleeves, plinths, electrical distribution boards, conduits, etc. as described above and that such openings, frames, etc., are in the correct position before any concrete casting or building work is done.

11.7. Installation Fit

Installation fit is an engineering function, and not a system design function. Tenderers shall price in their contract for the required engineering undertaken during the preparation of shop drawings in coordinating services to suit service space provided. Such engineering to include co-ordination with other Contractors and shall take into account the principal contractor's preferred services installation sequence program.

11.8. Supports

Unless otherwise specified in the Technical Specification or indicated on the drawings, all wooden and steel frames and sleeves in walls and slabs required for services to be installed after such walls and slabs have been completed, shall be supplied under this sub contract. The Mechanical Contractor shall ensure that frames and sleeves are of the correct size to suit the services.

11.9. Wooden and Steel Frames and Sleeves

All sleeves and frames to be provided under this contract.

11.10. Samples to be supplied

The Mechanical sub-contractor shall supply samples as listed in clause 11.6.1 above, to the Engineer for approval. Approval of samples to be obtained in advance of mass manufacturing of such items, allowing for sufficient time for approval and to meet the principal contractor's installation programme.

Samples will only be approved with regard to physical and aesthetical aspects and will not relieve the contractor from his obligation under the contract to meet the specified performance requirements.

Once an item has been approved for manufacture, the approved sample shall be kept on site or at the Engineer's office for future reference. The Engineer shall have the right to reject materials and equipment on site not conforming to the approved sample.

11.11. Declaration of Ownership

Before any progress payments are made to the Contractor, a prescribed form of “Statement of Ownership” shall be signed and submitted to the Engineer.

11.12. Performance of System and Equipment

The system equipment and layout designed by the Engineer shall conform to his requirements with regard to installation and performance and in accordance with the Specification. This suggests that the performance of the equipment in the system supplied and installed by the contractor, shall be in accordance with the design and performance figures as published by the manufacturers and / or suppliers.

The efficiency of the design of the specified system is not the responsibility of the contractor. It is, however, the responsibility of the contractor to see to it that the quality of the workmanship and the installation of the equipment shall conform to the requirements of the Engineer and to the satisfaction of the supplier/manufacturer.

It is furthermore accepted that the contractor has assured him/herself that all equipment supplied and installed under this contract shall perform within the given limits, as stated by the supplier/manufacturer, to conform to the specification.

11.13. Protection, Cleaning, Adjustments, Commissioning, Tests and Operating and Maintenance Manuals

The mechanical contractor shall be responsible for the running of the installation, including the maintenance and replacement of worn parts, from the start-up date until it is handed to the Owner.

The mechanical contractor shall allow for 12 months of complete maintenance and guarantee on the installation after the installation has been handed over to the Owner.

The mechanical contractor shall explain fully, in the presence of the Engineer, the working of the system to the Owner or his representative.

11.14. Approvals

All equipment offered shall have the full approval of either one or more of the following organisations:

- South African National Standard (SANS),
- British Standard (BS).

All equipment offered shall be compatible with all other equipment fitted into the same system. Approval of compatibility by one of the above organisations shall be provided.

Approval by other organisations may be granted by the Engineer, on application.

11.15. Language

All notations on control equipment, panels, air conditioning plants, etc. shall be in English.

11.16. Training Program3

The contractor shall make proper allowance in their price for instruction of the client's staff in the maintenance, repair and adjustment of all equipment. Allowance must be made for the proper hands-on tuition of the owner's personnel at the appropriate time to enable them to take over operational duties.

12. SITE DESCRIPTION

The site consists multiple buildings of single storey with exception of building A or testing centre, which is a single storey building with a partial second floor serving as the HVAC plant room. The site is located on 1a Teichmann PI, Sunnyridge, East London, 5201.

Locational coordinates of the facility are 33°02'11"S, 27°50'40"E, at an elevation of about 122 m above sea Level.

12.1. External Environmental Conditions

All systems and equipment must be designed to provide specified performance under the following environmental conditions:

- Summer outside conditions (Approximately) : 30°C DB, 20°C WB
- Winter outside conditions (Approximately) : 2°C DB, 0°C WB
- Prevailing winds : Refer to local authorities (for information)
- Sound level at site boundaries : to comply with municipal requirements.
- Power supply : 220-240 V/ 1 Ph/ 50 Hz
380-420 V/ 3 Ph/ 50 Hz

12.2. Internal Conditions and Parameters

Equipment and systems must be designed to provide the following internal conditions:

- Sound levels in service areas : To comply with "SANS 10103"

13. SMOKE MANAGEMENT IN PRE-TEST ROOM AND HVAC PLANT ROOM AND VENTILATION IN THE FLAMMABLE LIQUID STORE

13.1. Scope of work

- The supply and install a smoke ventilation system in the HVAC plant room and pre-test room as indicated on the drawing no's ME-SE-001 and ME0SE-002. The system must be approved by the fire engineer.
- Ventilation of the flammable liquid store room

13.1.1. HVAC plant room and Pre-test room systems description

Smoke ventilation in the plant room will be achieved by means of ten roof mounted smoke ventilators fitted with a fusible link. The total aerodynamic free area of the ventilators will be at least three (3) % of the plant room floor area.

NB: A fire rated dry wall partition dividing the HVAC plant room into sections is to be installed. Fire dampers are also to be installed in the supply and return ducting crossing this new dry wall partition.

The pre-test room system will consist of six mechanical extraction systems. Each system will in turn consist of the following (installed in a sequence from the ceiling to the discharge side of the extraction ducting):

- a) 800 x 800 mm fire damper with fusible link installed on the ceiling panel.
- b) 800 x 800 mm Vertical duct installed from the damper mentioned above, rising through the ceiling void and roof, then bend horizontally along the roof.
- c) Inline extraction fan installed in the horizontal ducting.
- d) A smoke ventilator with a fusible link installed on the discharge side of the ducting system.
- e) The ceiling mounted fire damper, the fan and the smoke ventilator will all be activated simultaneously by the same signal. The mid wall units shall be complete with suitable filters, multi-speed recirculation fans, adjustable directional air discharge grilles and direct expansion cooling coils fitted into appropriate cabinets.

13.1.2. Ventilation of the flammable liquid store room

Ventilation of the flammable liquid store shall be achieved by means of ducted ventilation system, with inline fans and sound attenuators. The system shall be fitted with an inline fire damper to isolate the flammable liquid store in the event of the fire outbreak. A relay switch will also be provided in the to switch of the ventilation system in the event of the fire outbreak.

13.1.3. Fire dampers

Combination fire/smoke control dampers complying with SANS 193 and NFPA 90A are required in the positions indicated on the main drawings.

The dampers must be UL or SABS marked with proven low leakage in the closed position.

Dampers must be actuated by fusible link, electrical solenoid or pneumatic means as specified in the Project Specification.

Fire dampers must be flanged both sides and access panels must be provided in the ducting at each fire damper on the upstream side.

Each fire damper must be clearly marked as per clause 4 of SANS 193.

Fire dampers must have at least a 2-hour resistance rating when tested in accordance with SANS 193.

The open or closed status of the damper must be clearly indicated outside the casing for inspection purposes.

Dampers must be sized so that the nominal free air area when in the open position is not less than the connected duct free air area.

Install dampers so as to form part of a continuous barrier to passage of fire when in a closed position. Where a fire damper cannot be fitted immediately adjacent to the fire wall, the section of ducting between damper and wall must be of at least the same metal thickness and fire rating as the damper casing.

Dampers must be self-supporting in case of duct destruction due to heat. Care must be exercised that the frame be set so that the closing device is accessible.

Provide suitable hand openings with tightly fitted covers to make dampers accessible for inspection and maintenance.

Provide sheet metal sleeves for housing the fire dampers where a fire damper is mounted in a wall. These sleeves must be built into the walls by the Main Contractor. Install retaining angles on four sides of the fire damper sleeve and on each side of the wall. Fasten angles to the sleeves only, and not to the wall. Retaining angles must lap the masonry by a minimum of 25mm around the entire opening.

Recommended minimum angle sizes are as follows:

Largest Dimension of Fire Damper	Angles
0 mm to 1 200mm	38 x 38 x 3,2mm
1 200 mm to 1 800mm	44 x 44 x 3,2mm
Over 1 800mm	51 x 51 x 4,8mm

Provide clearance between the sleeve and the masonry opening on the top and at the sides of the fire damper to allow for expansion. Allow a gap of 1mm for each 100mm of sleeve width or depth, but the gap must not exceed 15mm.

13.1.4. Weather louvres

Weather louvers must be manufactured of extruded aluminium sections or ferrous metal hot dip galvanised after manufacture, as specified.

Weather louvres must be constructed with drip edges to blades and rigid frame to enable building in.

Weather louvres must be finished in natural anodised aluminium, powder coated or painted as specified.

Weather louvres must be watertight even with nominal air velocity up to 3,0m/s.

Weather louvres must be fitted with 12mm opening size galvanised expanded metal or wire mesh screen.

Top and bottom blades must be fitted flush with the frame and smooth without grooves, channels or recess where dirt or water can collect.

13.1.5. Dampers

Dampers for positive volume control purposes must be manual or electric actuator driven as specified and provided where indicated on the drawings.

Damper blades, links and damper frames must be of rigid construction galvanised steel generally as per SANS 1238, and of the opposed blade type.

Manually adjusted dampers must be provided with adjusting levers in accessible positions with provision for positive locking in any position from fully open to fully closed.

Dampers must be of the link or gear type as specified.

13.1.6. Smoke ventilators

Ten (10) Curvent (or similar) fire rated type 1620K-EN, EN12102-2:2003-09 certified slope mounted louvred smoke ventilators in colorplus material, with 93°C fusible links will be supplied and installed in the plant room.

Six (6) Curvent (or similar) fire X 1620C-EN electromechanical ventilators will be installed on the roof of the pre-test room to discharge hot smoke extracted from the pre-test room.

The ventilators will be fitted with SELA N 24 R BS7346: Part 1: 1990, Appendix C certified, 24V DC electromechanical linear actuators controlled by two (2) SE Controls EN12101-10 certified 220V AC control panel, housing a 72-hour battery back-up. A SE Controls EN12101 Part 9 certified, Manual Control Point with selector switches, indication lights and audible sounder will be installed at the designated system control point at low level.

The electrical wiring will consist of 150m (estimate) of PH30 cable reticulated in galvanised conduit piping from the Curvent (or similar) control panel to the roof where the rest of the wiring will be fixed into purlins and other structures without conduit to the actuators.

Smoke ventilators material, galvanised Z275 corrosion resistance

13.1.7. Fans

A system for the pretest area will consist of six (6) AMS type (or similar) LCS1004BA7/5.5 smoke extractor fans, EN12101-3 certified with 1.000 diameter casing housing a 5,5kW (380/3/50) axial motor rated at 300°C for 60 minutes with a duty of 11,5m³/second at 200Pa.

The system for ventilation of the flammable store room will consist one axial fan, 1 m³/s at 200 Pa complete with mountings and sound attenuator.

13.1.7.1. General

The total fan system's design resistance, as specified in the Project Specification, must be finally checked when all information on selected system elements is available. Fans must be selected to operate at or as near to maximum efficiency as possible.

Flexible connections must be fitted between fan inlet/discharge and ducting or equipment as appropriate. Flanges are required with flexible connections.

Fit fans with manufacturer's nameplates permanently fixed to the casing in a prominent position clearly indicating manufacturer, model number, maximum operating speed, maximum power absorbed, size and serial number for larger fans.

Protect air in/outlets not connected to ducting or equipment with removable screens.

Provide indicating arrows for both direction of rotation and direction of air flow on fan casings.

Mount all fans on anti-vibration mountings or support from anti-vibration hangers. All anti-vibration mountings must be to the approval of the Department.

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

Fans must be painted in the factory with one primer coat and two coats of high gloss corrosion resistant paint.

13.1.7.2. Axial flow fans

Axial flow fans must be of the aerofoil type with non-overloading characteristic with peak power requirements occurring in normal operating pressure range and motor rating exceeding this requirement.

Axial fans must be selected for the highest possible efficiency with the lowest possible blade tip speed. All fans must be of the adjustable pitch impeller type.

The complete fan unit must be statically and dynamically balanced in accordance with ISO 1940 within Grade G6,3.

Fan performance must be based on tests carried out in accordance with BS 848: Part 1.

Fan casings must be manufactured from reinforced mild steel with pre-drilled flanges at both ends. Casing access panels must be provided where specified in the Project Specification.

Fan motors must be totally enclosed squirrel cage induction type with protection to IP55 unless for a special application as set out in the Project Specification.

Motor connections must be in an external weatherproof terminal box forming part of the casing except for flameproof and special applications which are specified in the Project Specification.

Lubrication points must be extended to the outside of the casing and inspection doors of ample size must be provided in the casing.

13.1.8. Ducting

Construct air ducts according to “Low Velocity Duct Construction Standards” and “High Velocity Duct Construction Standards” (SMACNA), as applicable.

Install ductwork as indicated on the project drawings.

Where changes in duct sizes indicated are necessitated on site, duct sizes must be determined using equivalent diameters (hydraulic diameter) and not cross-sectional area.

Ducts must be airtight, must not drum or vibrate when the internal static pressure varies and must be so constructed that airflow is even without excessive static pressure drop. Construction must be sturdy.

Avoid aspect ratios in excess of 4:1 in rectangular ductwork. Internal duct dimensions of less than 200mm in rectangular ducting are not acceptable in low and medium velocity ductwork.

Provide adjustable opposed blade dampers, sound attenuators, duct splitters and turning vanes where shown on the drawings.

Unless otherwise specified ductwork must be manufactured of galvanised sheet steel using thicknesses as recommended by SMACNA.

Isolate all ducts passing through concrete or brick walls from the walls by means of a high-density glass fibre collar to prevent transmission of vibration to the building structure. Seal all openings where ducts pass through plant room walls by means of polysulphide mastic.

Flexible joints exposed to weather must be provided with protecting galvanised sheet steel cover strips.

Flexible connections must be made of fireproof fabric reinforced air-tight material attached both sides with approved galvanised steel collars or frames.

Overhead hangers for horizontal ducts must be of the “Trapeze” type (SMACNA page 45). Support vertical ducts in accordance with SMACNA page 43, Fig B.

13.1.8.1. Low velocity duct (Flammable liquid store room)

This refers to ducts with velocity up to and including 10 m/s and static pressure up to and including 500 Pa.

Refer to “Low Velocity Duct Construction Standards” (SMACNA) for all constructional requirements. Alternative methods applicable are specified hereafter.

Galvanised sheet steel must be used with thickness as recommended in SMACNA (Table 1, page 11). Either cross-breaking or beading is acceptable. Longitudinal seams must be of the “Pittsburgh Lock” or “Acme Lock” type. Transverse joints must be as follows (SMACNA – Table 1, page 11):

Dimensions of longest side of duct	Traverse joints		Reinforcing angle
	Long Side	Short Side	
Up to 450mm	B	A	SMACNA – p 11
475 – 750mm	E	A	SMACNA – p 11
775 – 1 500mm	L	L	SMACNA – p 11
1 525 and larger	M	M	SMACNA – p 11

Reinforcing angle irons must be galvanised. rivets, screws, bolts and other fastening equipment must be completely corrosion proof.

Elbows must be in accordance with SMACNA page 61. Use standard radius elbows generally. Install short radius elbow pieces as shown on the project drawings.

Provide square elbows with galvanised turning vanes, SMACNA Fig A, page 53.

13.1.8.2. High velocity, medium pressure duct (Pre-test room)

Refer to “High Velocity Duct Construction Standards” (SMACNA) for all constructional requirements. Ducts with velocities higher than 10 m/s and a static pressure between 500 Pa and 1 500 Pa apply.

Galvanised sheet metal must be used with thickness as recommended in SMACNA Fig 3 –1, pages 14 and 15. Construction must be in accordance with (1), (2), (4) and (12) of Fig 3-1.

Use standard radius elbows generally. Install short radius square elbows as shown on the project drawings. Provide short radius elbows with splitters and square elbows with double thickness type turning vanes. (SMACNA pages 42, 43 and 44).

Flexible ducts must be of the spiral wire reinforced glass fabric type (SMACNA page 63).

Overhead hangers for horizontal ducts must be of the “Trapeze” type (SMACNA page 56). Support vertical ducts as indicated in SMACNA page 57.

The system consists of about thirty meters (30m, 6m per fan system) ducting to suit that that satisfy the guidelines and recommendation laid down in the Warrington Fire Agent Test Report Ref N° 12650A. The ducting material is Z275 galvanised sheet metal with material thickness of 1.2mm. Duct flanges are roll formed and material thickness 1.2mm. Flanges will be bolted together with high temperature silicone gasket duct sealant.

14. FIREFIGHTING EQUIPMENT AND SIGNAGE

14.1. General

All work to comply with the SANS 10400-T, The application of the National Building Regulations Part T: Fire Protection and SANS 10400-W, The application of the National Building Regulations – Part W: Fire Installation. The installation shall comprise the following:

- Fire extinguishers;
- Fire hose reels
- Fire hydrants
- Fire signage
- Above ground piping and fittings
- Below ground piping and fittings

The scope for new works includes the complete manufacture, supply, delivery, rigging, installation, testing, commissioning and handing-over in working order of the installation as described in the Project Specification.

All labour, scaffolding, material and apparatus required for the completion of the works, whether specified, indicated on drawings or obviously required to be included in the contracts must be allowed for.

The scope for maintenance work relates to services may include all of the above and the removal, repair, servicing, restoration and refitting of existing equipment with the purpose of attaining the original functionality and appeal of these.

14.2. Fire extinguishers

Portable fire extinguishers with steel bases shall be installed in the positions indicated on the drawings.

Portable fire extinguishers must be in accordance with the following:

- Dry Chemical Powder (DCP) Type : SANS 1910
- CO2 Type : SANS 1567

Fire extinguishers shall be mounted with the handle 1,2m from finished floor level. For installations combined with hose reels install at a minimum of 1000mm.

fire extinguisher must be provided with a suitable sized Meranti backing board, complete with mounting bracket and suitable wall anchors as support. Backing boards must be painted "Signal Red".

Where necessary, existing fire extinguishers shall be serviced in accordance with SANS 1475-1.

14.3. Fire hose reels

Fire hose reels shall be installed in the positions indicated on the drawings.

Branches to individual hose reels shall be 25mm nominal bore with key operated lock shield type isolating valve. The valve shall be of gunmetal construction. Fire hose reel systems pipework shall be installed in medium weight galvanised mild steel pipe to SABS 62 with screwed fittings to SABS 509-1975.

Hoses shall be controlled by means of a lever operated jet/spray nozzle assembly of chromium plated gunmetal construction. The fire hose reels must be complete with 30 m long, 20 mm diameter hose, hose run-out guide, clamps, nozzle bracket, fixing brackets and bolts, nozzle-cock and 25 mm stop valve all to conform to SANS 543. Fit rotary type cocks to the hose reels.

Provide hose reel bases with four bolt holes spaced and orientated as per SANS 543. Use bolts of at least 10 mm diameter and of a suitable length to fix the hose reel to the wall.

Hose reel components must be manufactured from the following components

- Stop valves : In accordance with SANS 543
- Water seal housing and spindle : In accordance with SANS 543
- Reel discs : Cold rolled mild steel
- Fire hose : In accordance with SANS 543
- Nozzle cock : Aluminium
- Hose run out guide : Chromium plated steel
- Nozzle bracket : Mild steel
- Base : Mild steel

Install hose reels with centre line at 1600 mm from finished floor level. Use bolts of at least 10 mm diameter and of a length and design suitable for the material of the wall to fix the hose reel to the wall.

Where necessary, existing fire extinguishers shall be serviced in accordance with SANS 1475-2.

14.4. Fire Hydrants

Install fire hydrants on permanently charged fire mains in position as indicated on project drawing.

- All fire hydrants must conform to SANS 1128 – Part I.
- Hydrant hose couplings, connectors and branch pipe and nozzle connections must conform to SANS 1128 – Part II.

Hydrants valves must be cast iron, right angled, single lug tamper proof valves with non-protruding sheathed spindles suitable for tamper proof keys.

No brass hydrants valves are allowed.

Provide all hydrants with purpose made vandal proof covers, caps or plugs complete with chains to secure to valves.

Install hydrants valves, fire pump connections and booster points at approximately 1200 mm above natural ground level. The fire hydrants installation shall consist of the following equipment:

Install hydrant valves on mild steel metal riser with 1-meter mild steel offset and 90° long radius bend. Refer to GDID standard drawing ME-E 01 04 01 for typical detail.

Provide 15MPa concrete anchors as detailed on GDID standard drawings ME-E 01 04 01, ME-E 01 04 02 and ME-E 01 04 03 to each hydrant.

Provide Type B anchors for hydrants exposed to damage by vehicles.

14.4.1. Fire Hydrants: FH (Ref to GDID std drawing ME-E 01 04 01)

Provide each hydrant with an 80mm riser pipe complete with an 80mm x 65mm hydrant valve.

In general, all hydrants must be installed at ground level no less than 3 meters from any building.

Refer to GDID standard drawing ME-E 01 04 01 for typical installation detail.

14.4.2. Fire Pump Hydrants: FPH (Ref to GDID std drawing ME-E 01 04 02)

Provide a fire pump hydrant on the premises, as indicated on the main drawing, in close proximity to the main entrance of the facility. Care should be given to the placement of unit and direction of valve to facilitate accessibility.

Provide a 100 mm riser pipe pedestal complete with a 100mm hydrant valve.

Provide a 100 mm pressure gauge, range 0 -2500kPa. Provide a 3mm steel protection strip around the gauge for protection providing sufficient space for removal.

As determined by the relevant local authority, provide either a 110 mm “Stortz” adaptor or a 65mm double lug instantaneous adaptor.

Refer to GDID standard drawing ME-E 01 04 02 for typical installation detail.

14.4.3. Fire Pump Booster Connection: FPB: (Ref to GDID std drawing ME-E 01 04 03)

Provide a twin fire pump connection (booster points) on the premises, as indicated on the main drawing, in close proximity to the main entrance of the facility. It is preferred that the fire pump connection is installed right next to the fire pump hydrant facing the same direction.

Provide an 80mm riser pipe pedestal and header with two (2) of 65mm one-way male instantaneous adaptor units.

Provide a 100 mm pressure gauge, range 0 -2500kPa. Provide a 3mm steel protection strip around the gauge for protection providing sufficient space for removal.

Refer to standard drawing ME-E 01 04 03 for typical installation detail.

14.5. Piping system

Install fire protection piping in accordance with the routes and sizes indicated on the project drawings. Provide for a 100mm council connection (communication line) as supply for both fire and domestic requirements. All piping and equipment related to the fire-fighting system must be rated at a minimum of 1200 kPa.

14.5.1. Piping above ground

Above ground piping must be galvanized steel and must be at least of medium wall thickness in accordance with SANS 62 Part I.

Long pipe runs can be screwed, flanged or joined with pipe couplings. Pipe couplings must be in accordance with SANS 815. No welded joints on galvanized pipes will be allowed.

All galvanizing must be in accordance with SABS 121 and SANS 10214.

Make all threaded pipe joints with approved cold water pipe jointing compound or Teflon tape. Provide flanged joints with gaskets. Flanges must be in accordance with BS10, Table F. Ream ends of pipes before fitting. Install pipework at a slight slope to avoid air entrapment. Install pipes in a neat and symmetrical manner.

14.5.2. Piping underground for normal soil

Underground piping must preferably be plastic piping although galvanized mild steel is allowed.

Wrap underground galvanized piping with a bitumen tape. Long pipe lengths must be factory protected with bitumen with only the joints and fittings wrapped on site.

Ring main lines may not be less than 1 meter deep and not be less than 1.5m away from any building foundation.

Prepare trenches and do backfilling and compacting in accordance with SANS 2001 – DP6.

The Engineer must carry out the following inspections:

- Completed trenches and trench work.
- Completed pipe installations before backfilling takes place.
- Samples of back filling and compacting.

14.5.3. Pipe supports and sleeves

Although supports are not indicated on the drawings, the contractor must allow for all pipe supports and sleeves. Submit samples of supports for approval.

Support piping from the building structure at the following maximum spacing:

Nominal Pipe Size (mm)	Span (m)
15 – 32	2,50
40 – 65	3,00
80 – 90	3,50
100 – 150	4,00

Support vertical pipes at intervals not greater than 2m.

Provide metal sleeves where fire protection piping passes through building structure components and position the sleeves for building in by the builder. In existing buildings, the breaking, core drilling (where required) and making good forms part of this contract.

Seal all openings between pipes and sleeves and sleeves and walls where pipes pass through fire walls or fire partitions. Use only non-combustible sealing material.

Where installations must have FM approval, use only FM approved pipe supports.

14.5.4. Pipe fittings

Provide and install isolating valves, check valves, strainers, pressure reducing valves, pressure relieve valves and pressure gauges in accordance with the project and relevant standard drawings. Fittings must be in accordance with the following SANS Specifications.

Pipe fittings i.e. elbows, T's, valves etc. must be in accordance with SANS 62 – Part 2, SANS 815 and SANS 14.

Fitting type	Applicable standard
Isolating Valves	SANS 509, SANS 191, SANS 1056-1. SANS 776, SANS 665, SANS 664
Check Valves	SANS 1551-1 and 2, SANS 1808-10
Float operated valves	SANS 752
Pressure switches	: F.O.C approval
Strainers	: SANS 1808-58
Gauges	: SANS 1062

In general use pressure gauges of the "Bourdon Type". Unless specified otherwise use 100 mm diameter dial pressure gauges. Install gauges as required or in positions indicated on the project and relevant standard drawings complete with syphon tubes.

14.6. Fire Water Pumps

Two pumps operating on duty/standby configuration shall be provided in the pumpstation for fire water. The pumps shall have the flow rate of 1 l/s and at head of 400 kPa.

14.6.1. Pump installation

Install booster pumps and pumping equipment inside plant room provided.

Mount pumps on angle iron or channel framed base 150mm in height.

Provide suitable covered protection to the satisfaction of the Department for pump installations where no plant room is available.

14.6.2. Pump construction

- Provide pumps with electric motors.
- Provide pumps of the non-overloading, centrifugal, volute type.
- Pumps may be of the vertically split, single suction type and may be of the close coupled type in which the impeller is overhung on the motor shaft or of the bracket mounted type in which the casing is overhung from the bearing bracket.
- Pumps must operate at speeds not exceeding 3 000 rpm.
- High points of pump casings must be provided with air vent cocks. Low points of casings shall be provided with valve drains and inlet and outlet connections shall be provided with properly located gauge tapping's.
- Provide pumps with balanced bronze impellers, stainless steel shafts and mechanical seals.
- Bearings for all pumps shall be either ball or roller bearings.

Thrust bearings shall be of the ball type. Bearings shall be effectively sealed to prevent loss of oil and entrance of dirt or water.

- Provide all pumps other than close-coupled pumps with suitable flexible couplings. Couplings shall impose no restriction on normal end play or expansion.
- Each flexible coupled pump shall be provided with a cast iron or fabricated steel bedplate of ample size to hold both pump and motor in correct alignment.
- Pump and motor must be accurately aligned when running at normal temperature. Bedplates of horizontally split pumps must have raised lips and drain connections. Install a drain pipe from each drain connection and terminate with an approved air gap over the nearest drip funnel or floor drain.

14.6.3. Pressure tank (captive air)

Fit a sufficiently sized self-supporting bottom outlet hydro pneumatic pressure tank connected to pump header with a 32mm Line. Fit a 32mm ball type bleed-off/test valve complete with threaded end drain piping to outside.

Tank preset pressure to be as per manufacturers detail or 15kPa lower than the cut in pressure of the pump.

Tank must be of the replaceable bladder type and must be fitted with an air charge valve "Schrader Valve".

Note: Tank to be sized to ensure a minimum drawdown time of 1 minute for pump motors 1.5kW and smaller and 2 minutes for larger motors at maximum design flow rate.

With a draw down factor of 0.2 a 300l tank is estimated per 1 minute of draw down time.

14.6.4. Pump controls

Fit a suitable pressure operated micro switches with a range of 2 to 6 bar for each pump to the delivery header of the booster pumps to initiate and control the operation of the pumps.

Pump control boards to be fitted with on/off/auto selector switches for each pump.

Provide an alternating control configuration, or flip flop relay, to ensure equal run time on pumps.

Provide a lead and lag configuration for demand support.

Provide phase failure, over and under voltage, phase rotation and run dry protection for pumps and pump motors. Provide a 0 to 10 minute timer on the shut off control.

14.7. Signage

The signs shall be SABS approved and compliant to the requirements of SANS 1186,

The signs have the following dimensions:

190 x 190, 190 x 384, 190 x 578.

The signs shall be photoluminescent.

15. FIRE DETECTION AND ALARM SYSTEM

15.1. Scope of Work

The fire detection system shall be installed in all the areas as indicated on the drawings.

The design is based on the analogue addressable system, which shall include all fire detections and break-glass units.

The PC will also indicate the fire condition of each protected area.

Cabling will form part of this contract.

The fire detection installation is based on the Department on the National Department of Public Works Standard Specification FPO/82/5E, revision June 1994 and on the BS 5839: Part 1: 1988.....Fire Detection and Alarm System for Buildings.

A 20% spare capacity shall be allowed in the design of the control panels, loops, zones etc.

15.2. Control Equipment.

All control equipment shall comply with Standard Specifications FPO/82/5E.

15.3. Control Panel

Standard Specification FPO/82/5E, Clause 3.2 and 3.4 shall apply. The following clauses highlight the Engineer's additional requirements.

The main control panel shall be a sturdy wall mounted metal construction. The unit shall be durable and shall be powder coated, colour: FIRE RED.

The control panel shall be installed in the reception office. The control panel must have a hinged, key lockable front panel with LED's, a keyboard for control and system configuration, as well as an alphanumeric liquid crystal display unit (LCD).

The LED's shall indicate the following conditions:

- Fire (per zone)
- Fault (per zone)
- System Normal
- Zone/System Isolated
- Main or Standby Power Supply Active.

Different conditions shall be displayed by different signalling, e.g. different colours, flashing displays, etc.

- The LCD display unit shall supply more detailed information pertaining to alarms, faults, etc. Example: It shall give in plain language alphanumeric text more detail about an alarm situation (right down to detector level). It shall also serve as an aid during commissioning, to display configuration information and to supply servicing information for the maintenance of the system.
- Alarm messages shall be displayed in order of priority with an indication of further messages waiting for acceptance/acknowledgement. A scroll facility shall be available to the operator.
- An audible alarm with different tones or modulations for different functions shall be built into the panel to accentuate visually indicated alarms and fault messages.
- Facilities for operator control of the system, shall comprise at least the following:
 - Alarm accepts pushbutton switch (silences buzzer per particular alarm)
 - Alarm activation pushbutton switch (evacuation signaling)
 - System reset pushbutton switch, which will be functional only after certain action routines.
 - Function keys if such are necessary for maintenance and commissioning.
- Relay outputs shall be supplied on the main control panel for the following functions:
 - A latching fire alarm output.
 - A latching fault signal output.
 - Two monitored fire alarm outputs.
 - The design and system infrastructure shall also make provision that at least the following signals can be relayed to a secondary panel(s):
 - Fire Alarm
 - Fault Alarm
 - Buzzer
 - Alarm Accept Switch
- All LED signals on the panel shall be repeated through voltage free relay contacts shall be available.
 - Alarms.
 - Fault Conditions.
 - Maintenance Requirements.
- An industry standard communication port (e.g. RS232) is a requirement. The complete communication protocol shall be included which protocol conversions they have already successfully implemented.

- A “watchdog” circuit shall be included in the design of the central processor to generate reset pulses if the processor should fail, as well as to generate alarm signals in the event of a permanent fault condition(s).
- The configuration/grouping of detectors shall be a software function without any special requirements (e.g. cabling, etc.).
- The zoning of each detector, the activation and detection thereof, etc., shall be possible through a keyboard which shall be an integrated part of the system.
- The panel shall be able to provide the operator with full details about any peripheral unit on an alphanumerical LCD display.
- 220V AC will be supplied for the panel. The complete fire detection system shall, however, operate at less than 50V DC.
- The system power supply shall have a capacity to power the central panel and all field units in the passive mode for at least 48 hours if the mains supply should fail. In an alarm situation where every detector in the largest zone and all alarming and controlling peripherals in the system are active, this supply shall be able to power the whole system for at least one hour. It is noted that all power supplies will be linked to the stand-by generator.
- The normal audio and visual local alarms with relay telemetering such as telephone auto-dialling, RF signalling, etc., which may be required (refer to the Project Specification) and their power requirements shall be included in the design of the power supply. These facilities shall be available as optional functions.

15.4. Communications.

- Communication between the control panel and all field units shall be on a wire pair. The wire pair shall also serve as power supply line for field sensors.
- Each field unit shall have a unique binary address. The main control panel shall be able to address and interrogate/control each field device individually.
- The control panel shall interrogate each detector on a regular basis.
- The control panel shall interpret the response from different field devices to an interrogate cycle according to the type of device. With regards to binary type devices (break glass units, door monitors, etc.) the alarm condition fault signal, etc., shall be generated immediately. In the case of analogue type devices, abnormal feedback signals shall be confirmed through at least three consecutive responses to interrogations from the control panel before the necessary indications and/or alarms are generated. Analogue alarm signals will typically be generated after a few seconds, whereas binary type input signals shall be generated in a fraction of a second.
- Communication between the control panel and field devices shall be through digitally coded modulation of the two-wire power supply line. The response of the field unit shall be through

a simple negative configuration pulse – or the absence thereof – per binary coded interrogation signal.

- The communication protocol must be sophisticated enough to fully identify each field device (address, type, status), as well as to gather digital and analogue information about each detector. The calibration values (high and low set points) and the actual signal generated by the sensor shall be transmitted to the control panel typically with 1% resolution.
- As a safeguard against electro-magnetic interference and the corruption of signals, communication shall be at a relatively low frequency (circa 1 Hz).
- Communication lines shall be monitored for open circuit and short circuit condition and the appropriate alarms shall be generated.

15.5. Detectors and detector bases in general

All detectors shall comply with Clause 3.8 of FPO/82/5E, and the following clauses:

- Detectors: General Aspects.

All detectors i.e. Ionization smoke detectors, optical smoke detectors, and heat detectors are covered under this heading.

- The detector base shall be such that the detector head is held firmly in the base by means of an insert and twist (bayonet) action).
- Reverse polarity or faulty circuit wiring shall not cause damage to the detector head or base.
- Detector base shall be suitable for surface mounting on a ceiling and shall fit on a 65 mm standard C-type electrical outlet box with fixing holes 50 mm centres. Fixing lugs or holes in the base shall be substantial and shall withstand repeated insertion and removal of the head without damage.
- The base shall be provided with wire terminals suitable for wires up to 1.5 mm²
- The wiring terminals of the unit shall be able to accept wiring lugs and shall be of the screw and clamp plate type to hold a lug firmly pressed against its contact surface. Spring loaded push-in contacts will not be acceptable.
- Terminals for circuit wiring shall be clearly marked.
- The base shall be suitable for connection of a remote indicator LED.
- The detector or base shall be fitted with a local indicating LED, which shall flash/illuminate under an alarm condition.
- A metallic Sprague will connect all detectors installed in ceiling panels to the conduit box.
- An alarm signal shall be generated whenever a detector is removed from its base.
- Each detector shall have an LED indicator which can be switched on and off from the control panel.

- The sensitivity of each analogue sensor shall be individually programmable from the main control panel.
 - The control panel will be able to identify each field unit, even when, e.g., it is positionally swapped. An appropriated alarm shall be generated centrally.
 - Each detector shall have a built-in self-checking facility. On instruction from the control panel the sensor shall locally simulate an alarm condition and raise the appropriate alarm, which shall be detected by the control panel.
- Ionisation Optical Smoke Detectors.
 - These smoke detectors shall be able to detect visible and invisible combustion products.
 - The ionisation smoke detector shall be of the dual chamber type construction for the radioactive source.
 - The sensitivity of the ionisation detector shall at least cover the particle range of 0,01 to 1 micrometer.
 - A typical alarm level shall be at 1% shading of the sensing element.
 - The unit shall be built into a white polycarbonate moulding which shall conform to all the mechanical and environmental requirements of the European EN 54 specifications.
 - Device Addresses
 - Refer to Clause 3.4.9 of FPO/82/5E.
 - With reference to 3.4.9(b), the following will also be acceptable to the Department: "If a detector head is moved from its base, and this results in the address being moved to another zone, then an alarm shall be generated in the control panel. This alarm can only be cancelled by replacing the head in its original zone."

15.6. Audible Alarm Units.

The audible sounders shall comply with clause 3.10 of FPO/82/5E.

The sounders shall be silenced without affecting the light signaling facilities.

15.7. Break-Glass Manual Alarm Units.

- The break-glass units shall be of an approved type in accordance with Clause 3.9 of FPO/82/5E.

- Manual activation of a break-glass unit shall raise the alarm through the evacuation system/public address. It shall also signal a fire condition at the fire control panel indicating the fire zone affected.
- Each break-glass unit shall incorporate the necessary communication modules with priority interrupt facility.
- A test feature must be provided whereby the interrupted and analogue value changes can be remotely tested.
- All break-glass units shall be surface mounted.

15.8. Batteries.

The battery must be a PWD accepted totally sealed lead cell type operating on a float charge from the main control unit. Tenderers must furnish the Department with a certificate from the battery supplier, stating that the requirements of the battery are known to him and that he is satisfied with the charging equipment incorporated in the offer.

The battery must be of sufficient capacity to maintain the alarm system fully operational for a period of 24 hours for all applications and be able to operate the total alarm load for a further period of 1 hour. The charging rate shall be such that 80% of the battery capacity is reached within 10 hours. Clause 3.5 of FPO/82/5E shall apply.

16. ELECTRICAL SYSTEM.

- The electrical system shall comply with FPO/82/5E clauses 4.2 and 4.4. The following equipment, including all electrical wiring and conduits as specified below shall form part of this contract.
 - Detection control panel positioned in the reception office.
 - Wiring of all smoke detectors to the main control panel to be fire proof cables.
 - Interconnecting wiring and conduiting between the air conditioning DB's and the ventilation fans DB's and the fire control panels.
 - 24V Signals shall be taken to the air conditioning and ventilation fan MCC, to manually shut down any of the systems by the Fire Department.
 - The contractor shall incorporate in his costing any additional costs that may be necessary to render the designed fire protection installation fully operational. It is the responsibility of the Tenderer to ensure that the system installed will comply with this technical specification in its entirety.
 - Control circuit power supplies shall be a maximum of 220V AC or 24V DC and shall be derived from a separate suitable double wound air-cooled transformers within the enclosure of each controller, monitoring panel or power supply unit. Refer FPO/82/5E Clause 3.5.

- Protection of main and control circuit power supplies shall be by means of high rupturing capacity (HRC) fuses of suitable rating and rupturing capacity.
- Fault current levels will be as follows:
 - Incoming supply to fire protection detection board 40kA.
 - Incoming supply to fire detection alarm/control panel 40kA.
- Electrical supply elements installed under this contract shall be designed for the above fault level on 380/220V circuits.
- The fire detection sub-contractor to note that Bosal Conduits may be used instead of threaded conduits.

17. FOAM DELUGE FIRE SUPPRESSION SYSTEM

17.1. General

This is a design and supply system to be designed and installed by an accredited specialist sub-contractor in accordance with SANS 10263 requirements including all other relevant statutory requirements for a fully functional system.

18. GENERAL BUILDING WORK

18.1. General

Building work includes the following among others:

The replacement of some of the existing doors with approximately 820 mm W x 2040 mm H with self-closing 2 hours fire rated door with a push button.

The replacement of some of the existing double doors with approximately 1620 mm W x 2045 mm H self-closing 2 hours fire rated door with a push button.

The replacement of the existing roller shutter door with approximately 2465 mm W x 2465 mm H self-closing 2 hours fire rated roller shutter door.

Detection of all leaks in the roof and the sealing thereof.

General building work like sealing of openings in slabs and walls and other unforeseeable circumstances; 2 x (1300 mm x 1300 mm 30 MPa slab) + (1.5 x 1.5 210) brick wall.

19. DECOMMISSIONING OF EXISTING UDERGROUND TANKS

Permanent decommissioning or abandonment of existing underground tanks and pipework shall be carried out:

a) in accordance with

- 1) API RP 1604; or SANS 10089-3:2010 Edition 4
- 2) APEA/IP: Design, construction modification, and decommissioning of filling stations ("Blue Book"), chapter 15; and

b) subject to the approval of the relevant authority.

An environmental assessment should be made and an Environmental Impact Assessment (EIA) may be required. Special disposal of decommissioned equipment and hazardous and contaminated materials will be required.

20. BLOCK PLAN

Adjacent to the control panel, a block plan of the area shall be wall mounted. Clause 6.1 of FPO/82/5E shall apply.

A block plan shall indicate:

- a. The outer building line of the area protected.
- b. All partitions and internal walls.
- c. All escape corridors and staircases.
- d. The position of all addresses.