PROPOSED NEW POLICE STATION FOR SOUTH AFRICAN POLICE SERVICES (SAPS) - PORTION 4 OF ERF 6934 IKAGENG EXT.4

SUPPLY, DELIVERY, INSTALLATION AND COMMISSIONING OF FIRE PROTECTION INSTALLATION

PROPOSED NEW POLICE STATION FOR SOUTH AFRICAN POLICE SERVICES (SAPS) - PORTION 4 OF ERF 6934 IKAGENG EXT.4

FIRE PROTECTION INSTALLATION

C O N T E N T S

PART 1

PROPOSED NEW POLICE STATION FOR SOUTH AFRICAN POLICE SERVICES (SAPS) - PORTION 4 OF ERF 6934 IKAGENG EXT.4

FIRE PROTECTION SPECIFICATION

TECHNICAL SPECIFICATION

INDEX

PART 1

PROPOSED NEW POLICE STATION FOR SOUTH AFRICAN POLICE SERVICES (SAPS) - PORTION 4 OF ERF 6934 IKAGENG EXT.4

FIRE PROTECTION SPECIFICATION

TECHNICAL SPECIFICATION

1. GENERAL

The work shall be carried out strictly in accordance with:

- The Occupational Health and Safety Act, Act 85/1993
- SANS 10400-T:2020 Fire Protection
- SANS 10139: 2021 Fire detection and alarm systems for buildings - System design, installation and servicing
- SANS 7240-16: Fire detection and alarm systems – Part 16 Sound System Control and Indicating Equipment
- SANS 7240-19: Fire detection and alarm systems – Part 19 Design, Installation, Commissioning and Service of Sound Systems for Emergency Purposes
- SANS 7240-24: Fire detection and alarm systems – Part 24 Sound-system loudspeakers
- SANS10400-A General Principles and Requirements
- SANS 10140-3: 2017 Identification colour markings Part 3: Contents of pipelines
- SANS 543:2019 Fire hose reels (with semi-rigid hose)
- SANS 1086:2015 Flexible poly(vinyl chloride) (PVC) pressure hose
- SANS 10087-1:2013 The handling, storage, distribution and maintenance of liquefied petroleum gas in domestic, commercial, and industrial installations Part 1: Liquefied petroleum gas installations involving gas storage containers of individual water capacity not exceeding 500 L and a combined water capacity not exceeding 3 000 L per installation
- BS EN 12101-Part 5 - Smoke and Heat Control systems
- City of Cape Town Metropolitan Municipality Emergency Services By-Laws

All tests shall be to the satisfaction of the Consulting Engineer or his representative who shall have the right to inspect the installation at all reasonable hours during the progress of the works.

2. THE PROJECT

The project shall consist of the supply installation, testing, commissioning and 12 months guarantee (with free maintenance during the guarantee period) of the proposed new police station for South African Police Services (SAPS) - portion 4 of erf 6934 Ikageng ext.4: fire installation.

The fire design shall include the installation of SABS approved following firefighting equipment;

- 4.5 kg DCP fire extinguishers on backing boards as required in Part TT 37 of SABS 10400
- 4.5kg CO2 fire extinguishers on backing boards as required in Part TT 37 of SABS 10400
- Fire hose reels c/w dragon-seal
- Fire hydrants (tamperproof type)
- Fire storage tank
- Fire pumping system
- Fire Suppression as per SANS 14520 and/or SANS 306 & SANS 10400.
- The installation of SANS approved fire equipment and fire escape signage. Provision must be made for frames for signage for certain areas as directed and such signage frames shall be approved by the architect.

Miscellaneous

The fire subcontractor shall;

Supply 3 sets of as-build drawings and operating and maintenance manuals upon completion of contract, complete with CAD drawings on compact disk

Provide 12 months maintenance with guarantee

Attend site meetings as required

The Contractor is responsible for painting all Fire piping Signal Red A11 as per SANS 10140-3: 2017 and the final coat to be applied one-week handover under this contract.

3. GUARANTEED PERFORMANCE

The system and individual items of the system shall be guaranteed by the Contractor to operate efficiently.

It is the Contractor's responsibility to establish, to the Engineer's satisfaction, that the installation performs as specified.

If at any time during the tender period or course of the contract the Contractor has any doubt about the specified installation he must check and if necessary contact the Engineers in order to satisfy himself.

4. CO-ORDINATION

The Contractor shall be responsible for the co-ordination of his own work, and is to be mindful of co-ordination with all other services as regards both physical clashes and installation programme. Ass potential clashes shall be brought to the Engineers attention for addressing should this have significant design implications.

5. EMPLOYER TRAINING

A representative of the Contractor shall be available to instruct the proprietor's building maintenance staff (or his appointed representative) in the operation of his system, and to ensure that such persons are fully conversant with the control and operation of the system.

This instruction exercise is to take place prior to the system being left operational. The Engineers are to be informed in writing as to when this instruction period is scheduled to commence. On the completion of this exercise the contractor is to obtain the Proprietor's representative's formal acceptance of this hand-over tuition, thus acknowledging his complete understanding of the operation procedure for this installation.

6. AS-BUILT DRAWINGS

The contactor is responsible for the production of as-built drawings, and for the issue of one plastic copy of each drawing to the Proprietor's maintenance engineer. A further 3 paper print copies are required, these forming an integral part of his Maintenance Manuals.

These drawings are to illustrate any changes in the pipe routes and sprinkler heads. The as-built drawings are to include for a process flow diagram, pump/tank room layout and the piping layouts.

7. OPERATING AND MAINTENANCE MANUALS

7.1 General

Operating and Maintenance (O&M) manuals shall be prepared in accordance with the following guidelines. Changes to format may be required but these will be timeously advised by the Engineer.

The Contractor shall prepare a draft copy of the O&M manual and submit to the Engineer at least two month prior to the commencement of dry-commissioning. The Engineer shall solicit comments from Umgeni Water on the draft copy and furnish the Contractor with these comments within 30 days of receipt of the draft. The contractor shall then incorporate all comments and complete the O&M manuals as specified.

Provision of all five (5) sets of O&M manuals as specified is inter alia a pre-requisite for Practical Completion of the Works and Retention Moni
es will not be released until they are in hand.

Preparation Of The Manual

The manuals shall be prepared within the contract, and shall be particular to the project. All charges that may be required by manufacturer's suppliers for the provision of information and literature shall be included in the contract price and the entire cost of producing and providing the O & M manuals shall be to the Contractors' account.

The manual shall be arranged with an index and referencing system. A matching flysheet will give the names and addresses of the principals involved on the project.

The covers shall be hard bound with a four-post loose-leaf system. The contract details shall be embossed on the front cover. Numbered card dividers shall be inserted between the sections.

The completed set of manuals shall be provided to the Engineers at practical completion.

Contents Of Operating And Maintenance Manual

The format of the manual shall be in accordance with the following sections, after a preface and index.

Section 1:

This shall comprise the introduction, abbreviations, and any warnings that may be required by the Machinery and Occupational Safety Act, Local Authorities and other such bodies.

Section 2:
A full description of each system, together with the main plant components and locations, plus the mode of operation of automatic control systems associated with such system shall be reflected in this section.

Section 3
This shall comprise the complete plant technical data of each item of equipment (e.g. manufacturers name and address, type and size of unit, serial number, bearing pulley and belt details, motor details, unit performance and duty details). This information shall be derived from a site inspection of identification plates together with information obtained from manufacturers.

Section 4:
This section shall describe in detail the operating procedures necessary for starting up, running and shutting down each individual system. This shall include the control panel starter and selection facilities together with any alarm and safety interlocks as identified on the control panels.

Section 5:
This shall comprise the maintenance operations on a daily, weekly, monthly etc basis for each item of plant. The preparation of this section shall be carried out by obtaining from the manufacturer his advice and recommendations for lubrication, adjustment and routine maintenance.

Section 6:
This section shall comprise the emergency procedures to be adopted by personnel engaged on the operation and maintenance of the mechanical and electrical services, with respect to fire, first aid, general failures to water and electrical systems, gas lines, chiller refrigerant pipework, and call-out procedures for maintenance personnel in working hours and out of working hours.

Section 7:
A recommended action on plant malfunction shall be detailed in this section. This is to assist both the user and maintenance engineer in the event of a fault developing in a system by indicating the nature of the fault and the recommended action.

Section 8:
This shall comprise a list of recommended spares and lubricants. The preparation of this section shall be carried out by obtaining the manufacturers recommendations and also incorporate the Clients requirements regarding spares.

Section 9:
A schedule of the record or as-built drawings together with reduced copies (A4 size) of the record drawings will be inserted in numerical order in this section.

Section 10:
This section shall comprise test certificates and commissioning reports. It shall also contain copies of fan and pump curves with the duty points clearly indicated.

Section 11:
This shall comprise the manufacturers' literature, arranged in alphabetical order to match the manufacturers list. It shall also give the manufacturers (or their local representatives) names, addresses and telephone numbers

8. MAINTENANCE

The Contractor shall be responsible for maintaining the installation during the initial 12 months of operating of the plant. Unless otherwise specified this shall require service visits not less than 3 months apart. The costs of the initial 12 months maintenance shall be built into the contract price, but will exclude the costs of expendables.

The Contractor is to negotiate and formalise a Maintenance Contract Agreement at least 3 months prior to the expiry of the free maintenance period

Maintenance Contract

Immediately following the service at the middle of the guarantee period, the Contractor is to submit a draft Maintenance Contract Agreement to the client, through the Engineers, in order that a maintenance contract (between Client and Contractor) can be formalised well in advance of the expiry date of the guarantee period. This draft agreement is to fully detail the work intended to be carried out under this contract.

9. TESTING

TESTS TO BE PERFORMED

- All pumping equipment shall be subject to the commissioning tests as described in Additional Specification SC: General Decommissioning, Testing and Commissioning.
- At least one of each type or size of pump supplied shall be subject to a delivery flow rate test. Flow rate or volumetric flow testing facilities will be supplied by others, unless otherwise specified in the detail specification.
- The operating point of each pump shall be determined.
- Efficiency tests will only be performed when specified in the detail specification.
- NPSH tests will only be performed when specified in the detail specification.

PUMP OPERATING POINT

During the day 1 commissioning tests the pump operating point shall be determined by observing the following:

- Pump delivery and suction pressures, and
- Electric motor power consumption.

If no efficiency tests are required in the detail specification then the motor power consumption shall be calculated from the voltage and current measurements obtained during the commissioning test.
The Contractor shall supply the necessary adaptors, fittings and pressure gauges to measure the suction and delivery pressures. If no gauge fittings exist on the suction side, then the suction pressure conditions will be calculated from the system properties.

FLOW RATE (DELIVERY), EFFICIENCY AND NPSH TESTS

- Testing will be done in accordance with BS 5316 Part 1, class C tests.
- Power consumption of electric motors shall be as determined by the three-wattmeter method where efficiency tests are required in the detail specification.

TEST CONDITIONS

- All tests will be performed in situ.
- The pumped medium or liquid specified as the process liquid in the detail specifications shall be utilised during the tests. The Contractor shall obtain from the pump manufacturer the test point for clean water corresponding to the specified duty point for the pumped liquid, in order to relate the measured performance to the pump supplier's curves which are based on water.

ADDITIONAL TESTS

Additional tests may be specified in the detail specification.

10. COMMISIONING PROGRAMME

The fire protection contractor shall adhere to the Principal Contractor's building programme for the installation. He shall be responsible for negotiating with the Principal Contractor for this programme to be drawn up or adjusted to allow for sufficient time for the installation and testing of the fire systems to ensure that his commissioning programme meets the following requirements:

Scheduled Contract Completion Date: To be Confirmed

Beneficial occupation: To be Confirmed

11. NON PRODUCTION OF AUXILIARY ITEMS OF THE INSTALLATION

The specification calls for the Contractor to furnish certain auxiliary items as part of his overall installation. Examples of such items are:

- The Operating and Maintenance Manuals.
- The Production of as-built drawings, including computer discs.
- The Production, framing and fixing of switchboard diagrams, piping schematics, simplified operating instructions etc.
- The instruction of the Employer's staff in the operation and routine maintenance of the works.

Should the Contractor fail to meet these requirements, monies will be withheld against the specific items at a value estimated by the Consulting Engineer. This estimate will be based on what it could cost the Engineer to undertake the task on behalf of the Contractor.

12. PAINTING AND PLANT IDENTIFICATION

The contractor shall be responsible for the painting and colour coding (all the details as specified under Part 5) of:

All brackets and fixings prior to erection

All metalwork which is not otherwise protected against rust

All piping (exposed and concealed within ceiling voids)

All items of equipment shall be identified by labels or painted inscription, and such identification be compatible with the corresponding identification on the mounted zone demarcation diagrams, drawings and labels on the switchboard.

13. STANDARDISATION OF EQUIPMENT

Equipment shall be made by one manufacturer when practicable. The Contractor shall not use items of different manufacture or type to perform the same function in different parts of the installation.

14. VALUE ADDED TAX

Allowance must be made for the Value Added Tax at the rate applicable at the date of tender for all items reflected in the Price Schedule.

15. CONFLICT BETWEEN SPECIFICATIONS AND DRAWINGS

Should the contractor note an inconsistency between the Specification and drawings he shall be responsible for notifying the Engineer and obtaining clarification or instructions prior to ordering or installing equipment.

16. DEFINITIONS

Supply	: To purchase or procure and deliver complete with all necessary and additional specified accessories
Erect	: To place or mount and fix in position
Install	: To erect, connect up and commission, complete with related accessories
Indicated, Shown, Noted	: As indicate or shown on drawings
Or Equal Approved	: Equal or better in efficiency or performance and Compatibility with installation

17. INSPECTION OF THE WORKS

The Tenderer shall take every opportunity to familiarize himself with the existing conditions, tie in points etc, and how they will affect the proposed building works. No extra payment will be allowed for any conditions, which may arise due to the Tenderers lack of knowledge of conditions

18. CO-ORDINATION WITH OTHER SERVICES

Careful co-ordination of the Fixed Fire Systems with other services is required. Tenderers must make allowance for adjustments to be made on site to avoid clashes with other services, as no extra payment will be allowed for this.

19. DESIGN OF LAYOUTS

Tenderers shall submit workshop drawings to the Client or his agent for approval before commencement of the works. No extra payment will be made for any drawing or redrawing by the successful tenderer. Allowance must be made for this in the tender price.

20. PRICING OF THE WORKS

Rates in the Tender Price Schedule shall be fully inclusive of all Preliminary & General items, design work, drawings, fabrication, piping, fittings, hangers, galvanizing, painting and accessories. Adjustments to the Tender Price will only be made for additional elements listed in the Tender Price Schedule at the tendered rates. No re-measurement of piping or fittings will be allowed. No variation orders shall be permitted for changes to piping or fittings due to adjustment of head positions, or co-ordination with structure or other services. Tender rates shall be deemed to include sufficient allowance for this.

Tenderers shall be required to submit the breakdown of the Tender Price Schedule, with their tender. The onus shall be on the Tenderer to ensure that the quantities and calculations provided by him are correct.

21. TIE-IN POINTS

The Tenderer shall use the closest approved tie-in points. No extra payment will be made should alternative tie-in points be used by the successful tenderer. Allowance must be made for this in the tender price.

22. COMPLIANCE WITH REGULATIONS

The entire installation under this contract shall comply in all respects with Regulations set out in the current editions of the publications listed in sub-section 1, together with special requirements as described in these Specification

23. QUALITY OF WORK

The client or his agent shall have the right to visit the site at any reasonable time and inspect the progress of the work and materials used, and shall have the right to reject:

- Any work which in his opinion is not to specification or standard, and which is badly or incorrectly carried out.

- Any materials which are considered not to specification or are of an inferior quality. Only new materials shall be used.

For the full duration of the Contract, the work shall be carried out under the supervision of a skilled representative of the Contractor, who shall be able to receive and carry out instructions on his behalf. A sufficient number of workmen shall be employed at all times to ensure such progress as is commensurate with the progress of the construction work.

24. BUILDERS WORKS

Unless otherwise specified, all builders' work shall be excluded in this Contract.

25. SCAFFOLDING

Scaffolding shall be supplied by the Contractor, and shall in all respects meet the requirements of the Occupational Health and Safety Act.

26. CLEAR AWAY RUBBISH AND MATERIALS

All rubbish accumulated during the works and all superfluous materials not required for the completion of the Contract shall be removed from site by the Contractor on an ongoing basis, as directed by the Client or his Agent.

27. LIAISON WITH OTHER CONTRACTORS

The Contractor shall be required to carry out the works in close collaboration with other contractors. The Contractor shall liase fully with other contractors, and shall co-operate to the fullest extent with all parties involved in the project.

28. PROGRAMME

The successful Tenderer will be required to submit a provisional programme within 2 weeks of being awarded the contract. This programme will show all activities anticipated for the completion of the works, including lead times on any Specialised Equipment.

29. PIPING

MATERIALS

All pipework (including valves and fittings), shall comply with the following requirements with regards to material selection:-

PIPEWORK CONTENTS	MATERIAL OR MANUFACTURE OR TRADE NAME	PRESSURE RATING
Water	UPVC GALVANISED STEEL (Less than 80mm NB)	Pressure as Appropriate Minimum 600 kPa

GENERAL

Flexible couplings shall be provided wherever a pipe section is fixed at both ends, to facilitate removal of the pipework, for maintenance or any other reason.

For steel pipework, these couplings shall comply with the relevant requirements of BS 534.

Flanges shall be provided in all pipework going through walls, within 200mm of the wall surface on both sides. In pipes where flanges are provided, flanges will be installed at regular intervals. Pipework which are joined by means of screwed couplings shall have unions at regular intervals.

Flow direction arrows shall be painted on all pipes. The painting of pipework shall be in accordance with the specification on painting.

All pipes larger than 100mm diameter, connected to equipment or fittings, or where specifically indicated, shall be flanged to SABS 1123 - 1977 as amended. All other piping with a diameter larger than 150mm shall be welded

except where galvanised pipes are used.

Galvanised piping shall be screwed when smaller than 50mm and flanged above 50mm.

Matched flanges shall correspond in construction and dimensions to flanges on equipment. Matched flanges shall be provided with the correct bolts, nuts and packing rings. All piping shall be clean before connections are made.

Buried flanges and flexible couplings (where permitted), shall be wrapped with “Denso” tape.

Bolts and nuts shall be galvanised and shall comply with the relevant requirements of SABS 135 - 1985 and SABS 136 - 1985.

The length of each bolt shall be such that, after the bolt has been tightened, the end of the bolt is flush with the outside of the nut, or projects above the nut by not more than 2 full threads.

Satisfactory temporary end-covers shall be provided for protection of flanges, prepared ends of open-ended pipes and fittings and screwed ends, to prevent damage to internal lining during transportation and during handling on site.

ABS AND PVC PIPE SYSTEMS

ABS and PVC pipework will be in accordance with SABS 1059 - 1985, as amended.

Pipework will only be accepted if supplied by a SABS 0157 - listed company.

The requirements for the material and performance of the pipes shall be in accordance with the specific maximum working pressure requirements of the pipe installation.

Refer to paragraph 30.1 of this specification for material selection.

Only pipes bearing the SABS mark of approval will be accepted.

Provision shall be made in the selection of pipe routes for excessive thermal expansion.

Support centers shall be as specified by the pipe manufacturers, for the specific temperature application. In any event, the support centers shall not be greater than 2,5m apart.

The cold solvent cement welding of joints shall be done according to the manufacturer’s specifications and only the prescribed cements shall be used. No jointing shall be done in rain or wet conditions.

ABS and PVC pipe systems shall be supported in a lateral manner to prevent radial movement of the pipe. At the same time these supports must allow free actual movement due to thermal expansion. Pipe clips recommended by the Pipe Manufacturer will be acceptable.

Adequate provision for expansion loops shall be provided for long pipe lengths where temperature variations occur. All ABS and PVC pipework which is exposed to sun will be painted. Refer to the Standard Specification on Paintwork for further details.

PVC pipe work components shall conform to SABS 966 - 1976, as amended.

PVC piping shall be joined, installed and laid according to the SABS Code of Practice 0112 - 1971.

All bends and fittings shall be molded. Fabricated bends and fittings shall not be permitted. All fittings shall be manufactured in accordance with the stipulations of BS 5750 Part 1.

30. FIRE HOSE REELS

These are to be installed in the locations indicated on the drawings, and are to be conformance with SANS 10400.
Each hose reel is to be of the disc type, complete with:
Stop cock
30 metres of fibre braid reinforced neoprene hose of 20mm internal diameter. Full way nozzle, of the adjustable spray or jet type, not larger than 7,5mm diameter.
The length of the hose must be clearly indicated on the front of the reel.
A pressure gauge graduated I kilopascals, must be fitted to the supply pipe in an easily accessible position.
A connection, not exceeding 50mm dia., with stop valve, for the fire hose reels may be taken off the underside of the sprinkler installation control valves, as permitted under Clause 2014 of the Rules.

31. FIRE EXTINGUISHERS

4.5 kg DCPtype and 5 kg CO2 type fire extinguisher will be installed on hook back plates around the building.Fireextinguishers are to comply with SANS 1910, Portable refillable fire extinguishers.

32. FIRE SIGNAGE

Photo luminescent fire signage will be installed for escape routes, escape direction arrows, hose reels and red directional arrow.
Size of signage to be in line with SANS 1186-1/5 and ensure visibility from 18m.
Support detail of signage from above to be proposed by FC for architectural approval
A3 layout drawings showing escape path and fire information will be framed and placed at escape points.

33. FIRE WATER BOOSTER PUMPS

33.1 Fire water booster pumps shall be located in the Fire water Booster Pump House. 1 Electric run and 1 electrical jockey for system pressure maintenance. Design as specified and manufacturers recommendation.

33.2 Pumps shall be designed and manufactured to DIN specification 24.255.

33.3 The pumps shall be selected to supply the following:

No of pumps required:	-	1 off (Electric Pump)
Water volume to be pumped:	-	2400 litre/min
Required pump duty:	-	17.53 bar
Motor sizing safety margin required:	-	10%
Type seals:	-	Mechanical

No of pumps required:	-	1 off (Electrical Jockey Pump)
Water volume to be pumped:	-	60 litre/min
Required pump duty:	-	17.53 bar
Motor sizing safety margin required:	-	10%
Type seals:	-	Mechanical

33.4 Pumps are to be hydraulically and dynamically balanced.

33.5 All pumps shall incorporate:

(a) Stainless steel shaft.

(b) Shrouded corrosion resistant bronze impellers.

(c) Mechanical seal accommodated with a shaft protecting sleeve.

(d) Pressure ring for easy gland maintenance.

(e) Lantern ring.

(f) Ports on suction and discharge for pressure gauges.

(g) Priming port. These are to be fitted with an air cock.

33.6 Pump casings shall be designed for working pressures of not less than 1000 kPa, or 1, 2 times the actual working pressure of the pump, whichever is the highest.

33.7 Pressure classification of flange connections shall correspond to casing working pressure.

33.8 Low points of casings shall be provided with plugged drains and inlet and outlet connections shall be provided with properly located pressure gauge tapings. These drain points shall be connected to UPVC piping and piped to a drain point just outside the pump room. The piping shall be saddled with metal piping brackets (PVC or Polycop brackets will NOT be acceptable).

33.9 Each pump shall be coupled on both the suction and discharge sides to piping with rubber bellows type

expansion joints with flanged connections.

33.10 Each pump shall be provided with a cast iron or fabricated steel bed-plate of ample size and rigidity to hold and keep both motor and pump in the correct alignment. The pump and motor shall be accurately aligned when running at normal temperature.

33.11 The pump and motor bedplate shall be mounted on a concrete plinth of adequate size and of 100 mm minimum thickness.

33.12 The bedplate shall be supported from the floor on spring type mountings, at 1200 mm centres max.

33.13 Each pump shall be equipped with a condensate drip pan manufactured from 3CR12 sheeting. The pan shall be installed on the bedplate of the pump and shall be big enough to cover the drip area under the pump

All condensate dripping from the pump casing and all leaking water from the pump shaft, etc., shall be collected in this pan.

A drain connection shall be installed at the bottom of the drain pan and a drain pipe shall be run from each drain connection and shall terminate with an air gap over a tundish.

The gland drain pan below the pump shaft shall be separately piped directly in the lowest section of the drain pan, or into the nearest tundish.

33.14 The pumps shall be connected as a set connected to the same inlet and discharge manifold. Each pump shall be equipped with a gate valve, on both the suction and discharge side of the pumps. On the discharge side of the pump and before the gate valve a non-return valve shall be installed. On the suction side of each pump a strainer with a high micron mesh element shall be installed between the valve and the pump. All valves and fitting shall be flanged and shall be easily removable.

33.15 The piping inside the plant room shall be 150mm galvanised steel and all fitting shall be suitable for this. The piping shall be supported on manufactured Unistrut sections (50mm x 50mm) with galvanised U bolt clamps. Nickel plated screws and bolts will not be accepted.

33.16 All fittings and equipment shall be suitable for 1.5 times the working pressure or 1000kPa whichever the larger constraint is.

33.17 Pump protection against no flow or low water level will be will be installed in water supply reservoir as part of this contract.

33.18 The fire booster pump installation will be installed and shall be set up to function as follows:

- Pressure in the fire ring main drops below 350kPa. Fire booster pump duty pump start. If pressure is restored to 400kPa the fire pump switches off.
- Should the duty pump be down and requires servicing or maintenance, the standby pump will operate.

The pump heads given in the schedules are given for tendering purposes only and the contractor shall place an order to the supplier of the pump(s), only after he is in receipt of a written document, which approves the calculated pump head. The contractor shall calculate the pump head and submit the calculations for approval to the Consulting Engineer.

34. ELECTRIC MOTORS

STANDARDS

All electric motors shall comply fully with the relevant standard specifications:

- SANS 60034 – 25 Rotating Electrical Machines Part.25: Guide for the design and performance of cage induction motors specific requirements

- BS 2613: 1970 “The Electrical Performance of Rotating Electrical Machinery”.

- BS 60034-25: “The Electrical Performance of Fractional Horsepower Electric Motors and Generators”.

MOTOR SPECIFICATIONS

Standard Squirrel Cage Motors shall be three phase (or single phase up to 3 kW), continuously rated, screen-protected drip-proof, suitable for direct on line, soft or variable speed drives..

Motors with a speed in excess of 1500 r/min except in the case of submersible motors, will not be accepted

unless agreed to by the Engineer. All motors shall be S1 Duty, IE2 - Premium Efficiency Plus motors with Class H insulation.

MOTOR RATINGS

When determining motor rating, the following shall be taken into account:

(a) All motors shall be rated for continuous full load duty.

(b) The Continuous Maximum Rating (C.M.R.) of the motor shall be 20% in excess of the full load running duty of the load in order to withstand the tolerance of 105% - 120% in the tripping characteristics of over-load protection devices allowed in BS 4941 Part 1.

(c) All starting times, irrespective of the load characteristics or the method of starting shall be limited to 20 seconds unless prior approval to the contrary is obtained from the Engineer. The safe locked rotor time shall be well in excess of the run-up time to allow protection discrimination.

(d) All motors shall be capable of a minimum of three consecutive starts per hour with the load connected and employing the method of starting to be installed without exceeding the allowed temperature limits of the insulation. In addition, the motor shall be capable of the numbers of starts per hour for the particular load as may be specified or as may be experienced under normal operating condition.

(e) Unduly over-rated motors resulting in a low power factor and efficiency are not acceptable.

(f) The motor starting torque and speed/torque characteristics shall be carefully matched to that of the load to ensure that the motor does not stall at a low speed. A safety margin shall be allowed to overcome voltage drops and load fluctuations.

The maximum torque developed by the motor in its final running condition (i.e. when the motor is switched to its final running configuration in the case of pole-changing motors and all starting devices have been switched out of circuit in the case of assisted starting) shall be 1.6 times the rated full load torque to overcome temporary overloads and voltage fluctuations.

(g) The actual ambient temperature in which the motor will be operating (and not the prevailing outside ambient temperature only) shall be taken into account.

It is a requirement that the above information and any other requirements that will affect the type of motor to be used, be submitted to the motor manufacturer when ordering the motor. The Contractor may at the discretion of the Engineer be required to submit written proof that the motor manufacturing will guarantee the performance of the motor for the expected duty and load.

Special attention shall be paid to the starting requirements of motors. It is essential that the starting torque produced by motors under the starting conditions specified, will be sufficient to accelerate the load within the time period allowed by the manufacturer of the motor with a maximum starting time of 20 seconds (refer above). The Contractor may be required to submit calculations showing accelerating torque available, load torque characteristics and run-up time. The following formula may be used to calculate the run-up time:

$$T_e = \frac{\left(\frac{T_1}{T_2} - 1\right) x (T_1 + T_2)}{\left(\frac{T_1}{T_2} + 1\right) x Log_e\left(\frac{T_1}{T_2}\right)} \qquad t = \frac{GD^2 N}{9.55 T_e}$$

Te	=	equivalent accelerating torque in N-m
T1	=	Maximum accelerating torque in N-m
T2	=	Minimum accelerating torque in N-m
GD2	=	Moment of inertia of the rotating parts of the load and motor in kg-m2
N	=	Final speed in r/min.
t	=	Run-up time in seconds

Accelerating torque is the difference between motor torque and load torque at any given speed on the torque/speed characteristic curve.

Where inching operations occur or where motors are controlled by pressure or level switches where frequent cycling duty may occur, motors shall be capable of 40 starts per hour.

MOTOR WINDINGS

All motor windings shall have Class F or better insulation. The following maximum temperatures as determined by the resistance method may not be exceeded:

Class of Insulation	Altitude					
	0 – 1000m	**1200m**	**1400m**	**1600m**	**1800m**	**2000m**
……	150°C	112.6	111.2	109.8	108.4	107
……	120°C	118.4	116.8	115.2	113.6	112
……	140°C	138	136	134	132	130
……	165°C	163.7	162.5	161	160	158.7

The above figures comply with BS 2613 and SABS 948 for a maximum cooling air temperature of 40°C. Where higher ambient temperatures occur (particularly in cases where heaters are installed), the above temperatures shall be reduced in accordance with BS or SANS specifications.

All windings shall be varnished and baked. The insulation shall provide protection against dust, oil and high humidity as well as aggressive vapours and gases where these are specified.

End-windings shall be carefully wrapped and supported to prevent movement and prevent mechanical damage due to vibrational stresses.

MOTOR PROTECTION

Motor protection shall be provided as follows:

Type of Protection	**Application**
Thermal overload	all motors
Magnetic overload	only for short circuit protection When acting on circuit breakers with sufficient rupturing capacity
Thermistor over-temperature	All motors of 25 kW and more.
Single phasing	Al 3-phase motors without thermistor over-temperature protection
Earth fault	Only when condensation in motors can take place,
Phase reversal	All
Under voltage	as specified.
Over-temperature	Auto-transformer starters, liquid starters and resistor starters.

Bearing Temperature Dial-type bearing thermometers with adjustable alarm and cut-out contacts, shall be provided as required. Where such thermometers are also provided on the pump, they shall be of the same type and manufacture.

- All the protection specified in the detailed Technical Specification and the Standard electrical specification shall be supplied.

- Motor overload (O/L) protection shall be provided in accordance with BS 587. O/L protection shall be provided by means of thermal trips or relays actuating contactors, manual motor starters or circuit breakers. HRC fuses are not acceptable for this purpose.

- On motor starters on which the overload protection forms an integral part of the starter the protection shall be by means of temperature compensated bimetal thermal O/L trips indirectly heated by separate heating elements in each phase and connected in series with the load. The O/L trips shall be adjustable within the range of approximately 75% to 120% of the rated current of the motor.

- Where motors are used frequent repetitive cycles or for inching operations, magnetic overload protection with time delays may be used provided the motor is suitably rated for the duty.

- Single phasing protection where provided shall be inherent in the overload protection unit in the case of integral motor starters. Protection schemes depending solely on the excess current drawn by the motor during the single phasing are not acceptable.

- Magnetic over current trips or relays for short circuit protection may never be allowed to actuate contactor starters and may only operated on suitably circuit breakers.

- Short circuit protection shall be provided by means of suitably rated circuit breakers.

- Thermistor over-temperature protection shall be installed. The thermistor control units shall where possible be integrated with the motor starter (VSD). Care shall be taken to select units with sufficient current rating to operate the contactor coil.

- Thermistor protection may not be provided in lieu of over current protection.

- Motor protection shall be “ENGLISH ELECTRIC” type “CMM” OR “P & B GOLDS” type “M”, or other approved, for all motors where preferred. Thermal (or magnetic if required) overload, single phasing (or phase unbalance) and earth fault protection relays as well as auxiliary relays where required, shall be included. The relays shall be housed in a panel mounted unit in a withdrawable case.

- Motor protection relays shall not be allowed to operate on metering current transformers, but shall be connected to separate protection class current transformers matched to the motor full load current and the relay power consumption.

- In all cases where protection relays are used, “CHAMBERLAIN AND HOOKHAM”, or other approved, test blocks type shall be provided to facilitate remote testing or relay operation, current transformers, etc.

- Proven electronic protection relays are acceptable.

- Where motors which are not described in BS specifications, e.g. semi-hermetic compressor motors, etc. are used, protection shall comply with the manufacturer’s requirements.

- Special attention shall be paid to motors driving high inertia loads to ensure that motors are adequately protected against sustained over currents but do not trip unnecessarily during starting.

(a) Shorting of the over current protection during starting is not acceptable.

(b) Increased overload settings on protection units are not acceptable.

(c) Connecting the overload relay in the delta loop in star-delta starting applications thus providing no protection during starting, is not acceptable.

Saturable core current transformers providing a normal over current characteristic up to 120% of full load current may be used provided they are properly matched. Alternatively, separate starting and running over current protection units shall be used. For star-delta starting methods, the latter can be achieved by connecting the starting over current unit in the main supply line to the motor and the running over current unit in the delta loop. For other starting methods, a change-over arrangement is required to switch from the starting to the running after the starting time has lapsed. For motors larger than 50 kW electronic integrating type relays with individually adjustable time/current characteristics shall preferably be used. Whichever protection method is used, a safe discrimination between “safe locked rotor time” and “starting time” shall be maintained.

MOTOR PROTECTION – THERMISTORS

All motors with ratings of 25 kW and higher and all motors with a rating of 15 kW and more that are subjected to run-up times in excess of 15 seconds shall have thermistors for over-temperature protection installed in the stator windings. Three thermistors, one per phase, shall be installed in single wound motors and 6 thermistors shall be installed in double wound motors.

All motors between 50kW and 150kW rating, shall have embedded in their starter-windings, one PTC thermistor per phase, suitable for Class B temperature rise. All motors rated 150kW and larger, shall have embedded in their stator windings and bearings, one platinum RTD of type PT/100 per phase and per bearing. The bearing detectors shall touch the outer bearing race, shall be spring-loaded and shall be of the screw type. The characteristics of these temperature detectors shall match the thermal limitations of the motor electrical installation.

Where thermistors are installed in the end-winding, the “Curie Point” shall be 5°C above the temperature. Where thermistors are installed in the winding “hot spot”, the Curie Point shall be 15°C above the temperature values stated.

The thermistors shall comply with the following:

(a) Only Positive Temperature Co-efficient (PTC) thermistors shall be used.

(b) Thermistors installed in motors connected to supply voltages up to 600 V shall be flash tested at 2 kV r.m.s. Additional insulation shall be provided on higher voltage machines.

(c) A varnished Terylene or glass fiber sleeve shall be fitted around those parts of the thermistor leads, which are embedded in the winding for mechanical protection of the leads. Care shall be taken that the sleeve does not cover the thermistor bead.

(d) The thermistor shall be inserted in the winding in such a way to ensure best thermal contact with the adjacent conductors of the winding.

(e) All leads from thermistors to the protection control units shall be twisted pairs to minimise stray voltage pick-up. Screened cables shall be used where the control units are far from the motor.

(f) All the thermistors acting on one control unit shall be connected in series.

Where thermistors are installed it is essential that relay panels be safeguarded against high voltages in case of a short circuit between sensor and motor windings. Isolation transformers are recommended for this purpose.

MOTOR CONSTRUCTION

The housing, end-shields and feet of totally enclosed surface-cooled motors shall be of cast iron to BS 1452. Standard protected, internally cooled motors may be of welded steel construction. A condensation hole shall be provided at the lowest point in the motor frame.

It is essential that the correct mounting type is selected for each application.

Motor terminals shall be clearly marked, U, V, W or U1, V1, W1 and U2, V2, W2. An earth terminal shall be provided at a convenient position on the motor frame. Vulcanised rubber insulation shall not be used for the connection from windings to the terminals.

When viewed from the drive shaft end, the motor rotor shall rotate in a clockwise direction when the R-W-B supply leads are connected to the U-V-W motor terminals.

All terminals shall be totally enclosed in a waterproof box sealed with gaskets and shall be complete with nuts, locknuts, lugs, etc. Cable boxes for PILCA cables shall be complete with tinned brass wiping gland and armour clamps. PVC cables shall be terminated using compression glands with shroud. Cables shall be provided with a means of support to remove the weight of the cable from the gland. All terminal boxes shall be large enough to ensure proper termination of the cables and connection of cores without exceeding the allowable bending radius. All terminal boxes shall be capable of being rotated through 360°. Where condensation may form on motor terminals, e.g. certain centrifugal refrigeration compressors, terminal boxes shall be hermetically sealed and filled with silica gel.

Motors shall as far as possible have pre-lubricated and sealed ball or roller bearings. Unsealed bearings shall be loaded conservatively in order that the grease need not be renewed at intervals of less than one year. Bearings shall be suitable for flat or V-belts drives where these are indicated without the use of outrider support

bearings. Belt pulleys and couplings shall be balanced.

Bearings shall be protected against possible shaft eddy current and shall be suitable to withstand vibrations caused by reciprocating or unbalanced loads.

Anti-condensation heating elements shall be provided in the motor windings for the following motor applications:

(a) Close-couples motors and pumps in chilled water systems.

(b) Standby motors in refrigeration installations where the ambient air surrounding the motor may drop below the dew point.

(c) Pumps installed in damp areas where the pumps will not run continuously.

The heating elements shall be arranged to prevent terminals and exposed connections becoming damp. As an alternative to heating elements, a low voltage transformer (approx. 50V) can be switched into the circuit when the motor is stationary to provide a continuous circulating current in the motor windings.

Where requested copies of type test certificates for routine and performance tests in accordance with SABS 948, BS 2613 or BS 170 shall be submitted before delivery of the motors. In additions the Manufacturer's guarantee that the motor will comply with the duty as described in this specification, shall be submitted. Curves of Torque/Speed and Current/Speed shall be provided on request.
The client reserves the right to witness all routine or performance tests and shall be notified in writing 14 days before the commencement of such tests.

Motors that have become damp shall be dried out before connection to the supply. Damaged motors resulting from non-compliance with this requirement, shall be rectified by the Contractor at his cost.

35. VALVES

GENERAL

For valve sizes referred to in this specification are nominal bore sizes. The Tenderer should check the requirements of drawings and supporting documentation and specifically in those where with phrases such as "unless otherwise specified" are used in this specification.

"Knife" valves will not be acceptable as either shut-off or modulating valves.

Lifting lugs are to be fitted on all valves which have a mass in excess of 50kg.

Each valve shall have a plate securely fixed to the body on which the following information shall be stamped:-

The Manufacturer's name
Size of valve
Class of valve
Arrow indicating the direction of flow
The contract number

GATE VALVES

Gate valves shall be constructed according to the stipulations of the following Specifications:

SABS 664

For valves operating under working pressures up to 1 MPa and of diameter up to 350mm. These valves shall be constructed of cast iron.

Gate valves subject to working pressures up to 1,6 MPa and of diameter over 350mm, but not exceeding 600mm, shall be of cast iron and shall comply with the relevant requirements of SABS 664.

SABS 191

Valves operating under working pressures over 1 MPa and of diameter exceeding 600mm, shall be of cast steel and shall comply with the material and construction requirements of this specification.

The definitions as contained in SABS 191 and 664 are applicable to this specification.

All valves shall have double flanged ends.

Unless otherwise stated the valves are to be the non-rising spindle type.

The valve shall be provided with a handwheel, unless otherwise specified. Handwheels for Classes 10 and 16 valves, shall be manufactured from cast iron and for Classes 24, 40 and 100, from cast steel.

The direction of closing shall be clockwise.

Channel-guides and shoes shall be fitted to valves falling within the following pressure and size ranges:-

- Class 10 500mm and above
- Class 16 300mm and above
- Class 25 250mm and above
- Class 40 150mm and above
- Class 100 all sizes

The valves shall be capable of being easily operated by one man, against the maximum, unbalanced pressure, and in order to comply with the above requirements, it has been found that the following is normally necessary :-

CLASS	VALVE SIZE	DRIVE
10	250mm and above	Ball thrust
16	200mm and 250mm 300mm and above	Ball thrust or 2,5:1 spur-gear Both ball thrust and 2,5:1 (or greater) spur-gear
25	200mm 250mm and above	Ball thrust or 2,5:1 spur-gear Ball thrust and 3:1 (or greater) spur-gear
40 and 100	All sizes	Ball thrust and spur-gear

The Tenderer shall state the spur-gear ratio offered and whether the valves are fitted with ball thrust bearings, together with a maximum torque required to operate the valves against the working pressure.

Class 10 and Class 16 valves are to be fitted with back sealing rings in order to permit the re-packing of the gland while the valve is under pressure.

Valve-trim shall be either Type B or Type C. Gate seating rings may be deposited.

Unless otherwise specified, position indicators shall be fitted on all valves of size 100mm and larger and shall show clearly the full open, and closed positions and the quarter, half and three-quarter intermediate open positions.

Supporting feet are to be fitted on all valves of sizes 300mm and larger.

In addition to the marking requirements listed in SABS 191 and 664, one flange edge shall have the following number of 3mm wide by 3mm deep grooves cut across it at top, dead-centre :-

- Class 10 1 groove
- Class 16 2 grooves
- Class 25 3 grooves
- Class 40 4 grooves
- Class 100 5 grooves

The design of the valves shall be such that the cast iron/steel sections are not subject to excessive tension, by the tightening of connecting bolts, as can happen when the faces of the bonnet and the stuffing box flanges are not fully machined for a full-faced gasket.

Bolts must be used to fasten the stuffing box to the bonnet and the bonnet to the valve body. The use of studs and Allen-type screws is unacceptable.

Resilient seal gate valves are acceptable for the application where the water contains undissolved solids. These valves shall be covered in bonded nitrile rubber. The gates shall be able to be replaced without removing the valve body from the pipeline.

BUTTERFLY VALVES

Butterfly valves shall be used on water services for positive shut-off only. This type of valve shall not be used for controlling the flow in any way. The valves shall be manufactured in accordance with BS 5155 (cast iron and carbon steel butterfly valves for general purposes), as far as is applicable. Where conflict exists, the requirements in this specification shall take precedence.

The following criteria for construction shall be met:-

Body

These shall be of the wafer-lug type, with drilled/tapped bolt holes, to allow the valve to be used at maximum working pressures of respectively 20 and 16 bars in terminal positions.

This is to allow downstream pipework to be disassembled with the upstream pipework under pressure.

Bodies shall be one piece casting Ductile Iron, UTS 400 MPa, YP 250 MPa, (elongational 12%) GGG 42 or equivalent for sizes up to 1500mm. Sizes above shall be of cast steel. Bodies shall never be in contact with the fluid conveyed and shall be fully protected internally by the resilient seat.

Disc

Shall be cast or stamped, spherically machined and positively splined or keyed internally to the driving shaft. (Use of plinths or bolts is totally prohibited).

Selection of the disc material shall be made taking into account the aggressivity of the fluid. (Cupro-aluminium or stainless steel 316 or equivalent).

Shaft

Butterfly valve technology shall be such that the shaft will never be wetted. (Dry shaft) Stainless Steel, AISI 420 of high mechanical characteristics shall be used.

It shall be positively splined or keyed to the disc. The upper and lower shaft and tie-bolt, when assembled to the disc, shall give in effect a one-piece shaft/disc assembly. At least three bearing assemblies, consisting of steel outer shell, with sintered bronze inner lining, coated with Teflon, facing shall be used.

The upper shaft shall be carried in two bearings, the lower in one.

Liner

The resilient, synthetic rubber seat shall be easily replaceable (bonded liners are prohibited) and shall entirely cover the inside of the body overlapping over the sides to form the seal between the body and matching pipework.

Where necessary, it shall be keyed to the body with annular grooves in the bore of the valve. The design shall be such as to allow the disc to seal drop-tight to the liner so that there is no ingress of fluid to the shaft area.

General

Valves with “0” Ring Shaft Backup Seals shall not be considered. The Manufacturer shall be able to offer alternative grades to cope with various fluids.

Quarter-turn handles shall be supplied for valves up to and including 150mm nominal diameter. The handle shall be lockable in all intermediate positions and be adaptable to the valves.

For valves larger than 150mm a gear shall be used. The gear operator shall be designed with a worm and nut system. The gear operator shall be irreversible in any position. The gear shall have a handwheel and an indicator protected by plexiglass, showing the position of the disc. If specified, limit switches shall be fitted, mounted in a waterproof and dustproof housing.
U-section wafer-type valves, as described in BS 5155, shall be acceptable, provided that:-

- the valve is suitable for individual bolting of each flange

and

- the dimension between the inside faces of the flanges is not less than 3D, where D is the diameter of

the flange bolts as specified in BS 4504: Part 1, or SABS 1123

The use of single flanged and flangeless valves shall be permitted only if provision is made for downstream pipework to be disassembled with upstream pipework under pressure.

The direction of opening of the butterfly blade shall be such that the bottom of the blade moves in a downstream direction.

All handwheels shall be fitted with a suitably sized shear-pin that shall fail before damage can be done to the drive gearing of the valve.

STRAINERS

Strainers shall be provided and installed in all piping installations upstream of water pumps, control valves, etc., where a possibility exists that solid particles of appreciable size will damage the downstream equipment. Strainers shall be of the angle or Y-type. Strainers up to 50mm shall have bronze bodies with screwed ends and bronze screens.

Strainers of 65mm and over shall have cast iron or cast steel bodies, with flanged ends and screens of stainless steel or bronze. Screens shall be perforated as follows:-

STRAINER SIZE	PERFORMATION SIZE
Up to 50mm included	0,8mm
65 to 150mm	1,8mm
200mm and over	3,2mm

Strainers fitted in pipes larger than 150mm diameter shall be provided with a 15mm blow down globe valve fitted with a quick coupler.

36. GAUGES AND FITTINGS

Each pump shall be equipped with a glycerine filled pressure gauge (120mm diameter) on the delivery and suction side of the pump suitable to handle the delivery pressure of the particular pump.

Pressure gauge installation shall comply in all respects to the standard mechanical specification.

37. PRESSURE TRANSMITTER DEVICES

37.1 An electronic pressure transmitter devices shall be installed on the outlet piping of the each Booster pumpset.

37.2 The transmitter shall be sized to for the span limit that shall correspond with the zero to full working pressure of the Booster pumpset.

37.3 The transmitter shall be equipped with both a local pressure display in the pump station and shall interface with each pump VSD PLC. The water pressure will be used to control the speed of the duty pump to ensure a constant pressure as specified is delivered.

37.4 The unit shall be extremely robust and shall have a stainless steel housing.

37.5 The units shall comply too PED Category III standards and shall have a local zero and span button. The units shall be local configurable with keys on the LCD indicator and also remotely configurable with the PC based software in the control room.

37.6 The unit shall have a base accuracy of at least ±0.15% and provide a large turn down ration of up to 20:1. The units shall work on a 4 to 20 mA output signal. The units shall be vibration resistant, shock resistant in accordance with IEC 60068-2-27 standards and shall be able to function in a humid, wet and dust laden atmosphere without malfunctioning.

37.7 Each units shall be complete with all the necessary devices and accessories to comply with the specification and shall be of the 2600T Series Pressure Transmitter as supplied by ABB or other approved.

37.8 All the software, hardware wiring etc. to complete the installation shall be included and allowed for by the contractor

38. MOTOR CONTROL CENTRE (MCC)

SUPPLY

The Contractor shall allow for the supply, installation, testing and commissioning of all a Distribution Board that will act as the MCC and will include all the necessary control equipment to ensure the pumps function as specified in this specification.

The distribution boards shall be made by approved Specialist Manufacturers, who shall also install and fit the switchgear and equipment and carry out all internal wiring.

The Contractor shall install any apparatus, accessories, equipment and systems that may be required by the Supply Authority as part of his electrical contract.

The Contractor shall note the dimensions of the room or openings, in which the panels will be mounted and also the dimensions of the access routes and doors. Panels shall be so constructed that they may be taken through the doors, after doors have been placed in position.

Four copies of working drawings of wiring diagrams, schematic diagrams, general arrangements and construction details of all distribution boards, shall be submitted to the Engineer for approval prior to manufacture. These drawings shall indicate all electrical and mechanical information as well as make and type of equipment, dimensions, ratings and other relevant technical information.

The Contractor shall furnish the Board Manufacturer at the time of tendering and at all other times, with all the necessary information as regards access and the requirements of this standard specification.

The distribution board shall be inspected before delivery to site by the Engineer or his representative and a certificate issued as required by SABS 0142-1, Annexure H or similar.

39. GROUND STORAGE TANK

The contractor shall supply 1x 174.72 kL Cylindrical water storage tank with a sub-division so it is split in 2 for maintenance purposes as detailed on the design. The tank shall be constructed on supports as detailed on the design. The structure and foundations shall form part of a supply and design installation. The completed works shall be supported by a Certificate issued by a Professional Engineer to the effect that the tank, structure and foundations are structurally stable and satisfactory for use under the conditions listed in the Certificate.

Roof trusses

The roof trusses and/or truss sections shall be fabricated from hot rolled first class weld able steel square tube or angle iron. Square hallow sections will be of minimum grade / type S355. All joints shall be welded and the completed truss shall be hot dipped galvanised 150g/m2 to SANS 121 (ISO 1461) after fabrication. Trusses fabricated from sheet metal which is folded and then riveted or screwed or bolted together to form a truss member will not be acceptable.

Where bridges and/or bracing between truss members are used, these items shall be bolted to the main truss members at both ends and at all intersecting points. Truss to wall attachment plates shall be of a fixed mating angle type allowing for correct and accurate alignment of trusses. At point of attachment the truss must be bolted to the tank body with a minimum of four grade 8.8 M10 bolts. The truss attachment should also have a strengthening plate bolted to it externally measuring no less than 200mm x 70mm

Loading of the roof shall be provided for by suitable structural design and shall comply with the relevant requirements of SANS 10160. The roof shall be designed to prevent the accumulation (or ponding) of water on its surface. Steel used in the truss manufacture shall have minimum yield strength of 355MPa. All bolts used in the truss assembly shall be grade 8.8 with nuts and washers to match.

Top and Bottom Hoops

The tank shall be provided with strengthening hoops at the upper outer edge of the top panel and lower outer edge of the bottom panel. These hoops shall be fabricated from steel rectangular tube, pre-curved to suit the tank diameter and hot dipped galvanised 150g/m2 to SANS 121 after fabrication.

The hoop sections shall be joined together with galvanised joiners inserted into the hoop sections. There shall be a minimum of 100mm overlap in two adjacent sections and the joiners shall be securely fixed to the respective hoop sections. These hoops must be securely fixed to the top and bottom of the tank.

Tank Hold-Down Brackets

The tank shall be secured to an engineer designed and approved steel reinforced concrete ring beam or slab base by means of original manufacturers' equipment suitable steel hold down brackets. These brackets shall be

designed taking into account all anticipated loadings on the tank.
The hold down brackets shall be bolted to the tank wall at the panel joins at the base of the tank by no less than 6 x M12, 8.8 grade hot dipped galvanized bolts and nuts, and provision shall be made to allow for fixing to the concrete base by means of suitably approved sleeve anchors / expansion bolts.
For tanks of different sizes there should be a range of different sized brackets used to ensure proportional loading through the brackets in accordance with the tank model. Provision shall be made in the bracket design to allow for expansion and contraction of the tank.

Liner

The liner shall be comprised of multiple layers fabricated from a heavy duty, approved non-toxic food grade material such as PVC, polyethylene, polypropylene or a combination of such.

The liner material must be internationally certified by a recognised authority or testing body for use in contact with drinking water. All liners must be 'supported' by way of an internal central layer / scrim. No unsupported liners will be acceptable. The liners shall be factory fabricated in a controlled environment with all seams homogenously welded by means of an RF or hot air/wedge welding process under controlled conditions to form a watertight seal.
Suitable stiffening shall be provided around the top perimeter of the liner to provide an adequate base for the fastening of the liner to the tank wall. Reinforced attachment straps fabricated from the same material as the liner shall be welded at suitable intervals to the outer face of the liner complete with eye-lets to allow fastening to the panel joint bolts.
If required by the procuring body, the liner material must demonstrate that the seams will not leak or permanently deform by undergoing a flume test using a tube made up of the relevant liner material and with a standard welded seam along its length. The sample must withstand a constant pressure of 3 bar for 30 minutes without evidence of leaks/weeping or permanent deformation.
The completed liner must be provided with a non-leak guarantee backed by the manufacturer for a minimum of ten years. The liner material must be capable of being easily repaired on site in the event of damage.

40. SCHEDULE OF EQUIPMENT OFFERED

Fire Extinguishers

Make ……..

Country of Origin ……..

Date of Manufacture ……

Approved by .....

Fire Hose Reels

Make ……..

Country of Origin ……..

Date of Manufacture ……

Approved by .....

Fire Hydrants

Make ……..

Country of Origin ……..

Date of Manufacture ……

Approved by .....

Fire Storage Tank

Make ……..

Country of Origin ……..

Date of Manufacture ……

Approved by .....

Fire Booster Pumps

Make ……..

Country of Origin ……..

Date of Manufacture ……

Approved by .....

41. SPECIFICATIONS

The specifications to be used in the design of the mechanical service are as follows:

No	Description	Document Number
1	Flange Specification	SANS 1123
2	Identification Colour Markings: Pipe Marking	SANS 10140: Part 3
3	The application of the National Building Regulations: General Principles and requirements	SANS 10400: Part A
4	The application of the National Building Regulations: Lighting and ventilation	SANS 10400: Part O
5	The application of the National Building Regulations: Stairways	SANS 10400: Part S
6	The application of the National Building Regulations: Fire Protection	SANS 10400: Part T
7	The application of the National Building Regulations: Fire installation	SANS 10400: Part W
8	Fire testing of materials	SANS 10177- Part 2-4
9	Fire hose reels (with semi-rigid hose)	SANS 543
10	Components of underground and above-ground hydrant systems	SANS 1128: Part 1
11	Hose couplings, connectors, and branch pipe and nozzle connections	SANS 1128: Part 2
12	Symbolic safety signs: Standard signs and general requirements	SANS 1186: Part 1
13	Symbolic safety signs: Photo luminescent signs	SANS 1186: Part 5
14	Safety of luminaires: Luminaires for emergency lighting	SANS 1464: Part 22
15	Fire detection and alarm systems for buildings — System design and installation.	SANS 10139