SPECIFICATION FOR THE CONSTRUCTION OF A NEW UNDERFLOOR WHEEL LATHE WORKSHOP AT TRANSNET ENGINEERING LOCOMOTIVE DEPOT, INSEZI IN RICHARDS BAY, KWAZULU-NATAL PROVINCE

INSEZI LOCOMOTIVE DEPOT, RICHARDS BAY.

REFERENCE No.: LOC_RBA_SPEC_000

Revision 0

Date of release: 28 May 2019
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Scope of Work

1. WORKS INFORMATION

1.1 Description of the works
Construction of a New Underfloor Wheel Lathe Workshop at Transnet Engineering Locomotive Depot, Insezi in Richards Bay, KwaZulu-Natal Province.

1.2 Employer's objective
The objective of the Employer is to construct a New Underfloor Wheel Lathe (UFL) Workshop for the Locomotives Business at Insezi Locomotives Depot in Richards Bay. In order for the Locomotives Business to be able to perform the wheel cutting and machining of wheels back to specification. The Supply and Installation of the UFL Equipment will be undertaken by other Suppliers/Contractors that are appointed separately by the Employer.

The detailed design drawings of the workshop and the site layout plans are attached to the specification. The design reports and geotechnical investigation report will be shared with the successful contractor at the award stage for the verification and development of the construction drawings by their own Design Team.

1.3 Extent of works
The works include:

- Professional fees for the verification of designs issued by the employer, development of the construction drawings and construction monitoring (Inspections and Stage Sign offs)
- Geotechnical Investigations and foundation confirmation for the underfloor wheel lathe machine at a depth ±5m below natural ground level.
- Client approvals before commencement of any construction works on site. Including providing any additional information that may be required by Authorities for their approvals (Municipality and Rail Safety Regulator).
- Setting-out of the works on site.
- Compliance with the Occupational Health and Safety requirements (In accordance to OHSA 85 of 1993) and Transnet Engineering specific SHE specification requirements.
- Overall responsibility for the Environmental Management during execution.
- All As-built drawings and quality records to be submitted at completion of the project.

In summary the works will focus mainly on construction of:

- Demolishing of the existing structures and site clearance in the area of the workshop.
- Construction of the UFL workshop of a total area of 975.95m² (Lower ground floor of 250.56m² and ground floor of 725.39m²) as per the architectural and structural design drawings and specifications.
- Civil and perway engineering services required for the new workshop as per the drawings and specification.
- Electrical and OHTS engineering services required for the new workshop as per the drawings and specification.
- Mechanical engineering services required for the new workshop as per the drawings and specification.

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- Furniture requirements for the new workshop as per the drawings and specification.
- ICT will be done by others. The contractor will be required to provide sleeves as per the ICT and civil drawings.

**Employer’s Specification**

2. **GENERAL**
- All material used to be SABS approved and must be installed as per SANS requirements.
- All rubble to be removed from site on a daily basis and dumped at the designated area.
- Before work commences, a Health and Safety File (SHE File) completed with project specific risk assessment must be handed to the Project Manager/Health and Safety Officer for approval.
- When a contractor intends to carry-out construction, excavation or demolition work, he/she shall before carrying out such work, notify the Department of Labour Provincial Director in writing
  - The demolition of a structure exceeding a heights of 3 meters
  - The use of explosives to perform construction work
  - The dismantling of fixed plant at a height greater than 3 meters
  - Exceeding 30 days or will involve more than 300 person days of construction work, and
  - This includes excavation work deeper than 1 meter; or
  - Includes working at a height greater than 3 meters above ground level.

The principal contractor shall ensure that a copy of notification is kept in the SHE file on site for inspection by Department of Labour inspector or TE representative (Project leader/Manager)

- The contractors to do induction for Health and Safety on site before commencement of the works, the induction will be conducted by Transnet Engineering, and they must have valid permits when entering Transnet Engineering Depots.
- The contractor to have a Safety File, Triplicate Site Instruction Book on site at all times
- Contractor to comply with TE safety regulations and OHS Act
- All measurements to be confirmed and discussed on site.
- All drains to be free from any materials.
- This specification should be regarded as the minimum requirements.
- **Attending the site inspection meeting is compulsory and any alterations made on site to this specification will take preference to this specification.**
- No deviation from this specification will be accepted unless approved by the Project Manager. Only the Project Manager will approve or not approve the workmanship.

3. **SITE ESTABLISHMENT**

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• At the site handover meeting Transnet Engineering will identified areas where the site camp can be established by the contractor.

• Contractor’s name board must be erected on site and must be visible at all times on site during the execution of the project.

• It is important that activities are conducted within a limited area to facilitate control and to minimize the impact on the existing natural environment and the surroundings landowners.

• Contractor shall demarcate the boundaries of the site in order to restrict construction activities to the site. The method of demarcation and the location of the demarcated area shall be determined by the Contractor and approved by TE prior to any work being undertaken.

• The Contractor shall ensure that all his plant, labour and materials remain within the fenced off boundaries of the site.

• The contractor is responsible for the safeguarding of his/her own equipment and material while on site.

4. DETAILED SPECIFICATION

4.1 ARCHITECTURAL SERVICES

The architectural works include the following:

• The construction of a stand-alone single storey facebrick workshop that will allow for rail locomotive access and egress from the facility as per the drawings.

• The offices, kitchen and ablutions are accommodated in a facebrick single storey annexure to the main workshop structure as per the drawings.

• Timber roof trusses, plastering, ceiling and fittings.

South African National Standards

The application of the National Building Regulations and Standards Act 103 of 1977 and the standards and codes of practice contained in SANS 10400 shall be strictly adhered to.

Manufacturer’s instructions and specifications

All materials and products shall be stored, used and installed in strict accordance with the manufacturer’s instructions and specifications. This shall include all materials, finishes, flooring, tiling, adhesives, aluminium cladding, brickwork, ceilings, sheeting, paint, partitions, shopfronts, window systems, waterproofing and sanitary fittings.

Use of locally manufactured materials and products

Materials and products manufactured in South Africa shall be used in carrying out the work to which this specification refers, unless an imported product is prescribed specifically, or when no suitable locally manufactured product for the specific use is available.

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Samples

The Contractor shall furnish samples and/or certificates as called for or may be called for by the Supervisor / Project manager. Materials and/or workmanship not corresponding with approved samples may be rejected. Samples for approval shall be required for paint colours, joinery with associated finishes, furniture, wall finishes, ceiling finishes, floor finishes, windows, shopfronts, wallpaper, artwork and facebrick sample wall of 2m². These approved samples shall remain on site for the duration of the Works.

Mortar Joints

Mortar joints to facebrick-work generally shall be 10mm in thickness with level bedding joints, and vertical perpends. Joints shall be half round recessed and shall be well rubbed with a standard jointing tool of suitable size to ensure that the entire exposed surface on the joint presents a smooth and polished appearance.

Waterproofing

The Contractor shall furnish the Employer with a written guarantee covering materials and workmanship for all waterproofing specified or offered. This guarantee shall be signed by the Contractor and countersigned by the supplier of the materials used, and underwritten by a recognised insurance company. The guarantee shall be valid for a 10 year period.

Should any maintenance be required during the guarantee period the Contractor must allow for the cost of such in his tender price as the Contractor will be held solely responsible for any leaks that occur during the guarantee period.

Glazing, Shopfronts, cladding and Windows

All glazing and safety glazing shall comply with SANS 613 and the SANS Codes of practise. All safety glass shall carry the Manufacturer’s warranty against any manufacturing defects and discoloration for a minimum period of 5 years.

As per SANS 10400-N, an approved permanent safety stencil mark shall appear on each pane on all safety glass.

Glazing and shopfront installations shall comply with SANS 10400-XA. All tinted glazing must have the required thermal protection (U-factor rating) to ensure compliance to SANS 10400-XA.

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Installation certificate by an Association of Architectural Aluminum Manufactures of South Africa (AAAMSA) approved contractor is required for all shopfront and glazing installations.

All shop fronts and window sections shall be water tight and able to withstand coastal winds of up to 60m/sec.

All glazing, shopfronts and windows shall be designed, stored, installed as per manufacturer's specification.

Aluminium Cladding shall be inspected by the PM prior to installation. Cladding shall be uniform in colour, smooth and with no visual imperfections.

**Roof Structure**

The Contractor shall provide Engineer's certificate confirming the design, structural stability and installation of the roof structure on completion of the roof structure.

Shop drawings shall be required for Engineers approval for steel roof structures.

**Protection of works**

The Contractor shall provide all necessary dust sheets, hoarding, etc. and shall exercise all necessary care to prevent marking surfaces, walls, floors, glass, electrical fittings, etc. and shall keep all parts of the works perfectly clean and free at all times from spotting, accumulation of rubbish, debris of dirt arising from the operations. Any surface disfigured or otherwise damaged shall be completely renovated or replaced as necessary by the Contractor at his own expense to the Supervisor's approval. The premises shall be left clean and fit for occupation at completion of the work.

4.2 **STRUCTURAL ENGINEERING WORK**

The structural works for the building is a combination of structural steelwork, reinforced concrete and masonry brickwork.

The structural works include the following:

- Reinforced concrete foundations i.e. pit foundations and walls, pad footings, track slab and surface beds.
- Concrete columns and beams.
- Manhole bases etc.
- Structural Steel Work (Steel columns, beams and roof)

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4.2.1 Concrete, Formwork and Reinforcement

This section covers the construction of all new reinforced concrete and associated concrete works requirements for the Under Floor Lathe Workshop.

All in situ concrete work (mass) shall comply with SANS Specification 1200G. Where SANS 1200G and the clauses in this section are in conflict the clauses in this section shall take precedence.

- **Cement**

  Common cements, complying with SANS 50197-1 shall be used for all concrete work. On no account shall masonry cements be used for concrete work, even if the strength designations are the same as for common cements.

  The Engineer for test purposes may require samples of cement from any one, or from every consignment. Cement in any consignment from which a sample may have been taken for testing shall not be used until it has been approved. Allowance must be made for possible delay in that tests may take 10 days to carry out.

- **Alkali reactive concrete**

  Alkali Reactive Aggregates shall not be used in this project. The equivalent Na2O content of the concrete shall not exceed 2,0 kg/m³ where % Na2O equivalent = % Na2O + (0,658 x %K2O)

- **Aggregates**

  Fine and coarse aggregate shall comply with the relevant clauses of SANS 1083.

  Where aggregates have constituents, which in the opinion of the Engineer, may give rise to damage due to alkali-aggregate reactions, the provisions of 6.3.3.3 shall be applicable.

  Evidence of compliance of the aggregates with the requirements of 6.3.3.1 & 6.3.3.2 shall be furnished as early as practical. No aggregate shall be delivered for use in the works until approval is given.

  Sand (fine aggregate):

  The sand shall comply with the requirements of SANS Specification 1083 and shall not contain more than 3% silt and clay by mass. Other aggregates may be approved if they have a satisfactory history and / or test results.

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No aggregate may be used until it has been approved. Samples having a mass of 25kg (16.5 litres) of the proposed aggregate to be used may be required by the Engineer for test purposes. Allowance must be made for possible delay in that the tests may take 14 days to carry out.

- **Admixtures**
  Admixtures containing chlorides may be used in the concrete mix to achieve workability.

- **Cover blocks**
  Cover blocks used to ensure the cover to reinforcement shall be made of cement mortar.

  Cover blocks shall be dense and have a minimum 28 day crushing strength of 30 MPa and shall be cured in water for at least 14 days before being used.

  Cover/spacer blocks made of plastic will not be permitted.

- **Concrete quality**
  Prior to the start of any concrete work on site, the Contractor shall submit a quality assurance plan which will ensure compliance with specification and provide acceptable documentary evidence that all specified operations have been carried out satisfactorily. Mix design to be submitted for filling, comments and approval.

  Where the minimum dimension to be placed during a single pour is larger than 600mm, and the cement content of the reinforced concrete exceeds the following:

  - Cement Types I and II/ * S : 400 kg/m3
  - Cement Types II/B-V and II/B-W : 450 kg/m3

  Assessment of workability must be measured by the slump test. The slump of about 75 mm must be achieved.

  The Project Manager may require that measures be instituted to reduce heat development in the concrete.

- **Unreinforced concrete**
  Class A Concrete:
  Filling to cavity of hollow walls.

- **Unreinforced concrete cast against excavated surfaces**
  15 Mpa/19mm Concrete

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Surface blinding under footings and bases.

- **Reinforced concrete**
  
  30 MPa/19mm Concrete:
  Bases.
  Foundation beams (Provisional).
  Surface beds cast in panels on waterproofing.
  Walls in foundations.
  Columns in foundations.
  Columns and ring beams etc.

- **Batching**
  
  All cementitious binders shall be batched by full sack or by mass batching with approved precision weighing equipment.

  All aggregates shall be precisely measured by mass using approved precision batching equipment, unless otherwise permitted by the Project Manager.

  Should any variation in the composition of the aggregate become apparent, the Project Manager shall be notified and a further sample of aggregate submitted immediately for his approval.

- **Concrete placing**
  
  The size, shape and depth of any excavation shall be approved by the Project Manager before concrete is placed.

  Unless otherwise permitted by the Project Manager, no concrete shall be placed until the fixed reinforcement has been accepted by him and confirmed in writing by way of a release certificate.

- **Construction joints**
  
  Unless otherwise shown on the drawings, the exact position of horizontal construction joints shall be marked on the formwork by means of grout checks in order to obtain truly horizontal joints.

  Stub columns, stub walls and stays on footings shall be cast integrally with the footing and not afterwards, even where another class of concrete is being used.

  Joint lines shall be so arranged that they coincide with features of the finished work.

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Where new concrete is to be cast against a hardened concrete surface, neat cement slurry mixed to a creamy consistency shall be brushed onto the cleaned concrete surface.

Contraction joints shall be smooth and shall have one coat of lime wash or PVA applied to the older surface prior to casting the fresher concrete.

- **Slip Joints between Concrete and Brickwork**
  Slip joints shall be provided between brickwork and concrete slabs and beams by levelling up and towelling smooth the bearing surfaces of brickwork with 3:1 cement mortar and covering the bearings before the concrete is placed, with two layers of one side smooth tempered hardboard, with the smooth sides in contact.

  The ends and sides of beams and edges of concrete slabs shall be separated from the brickwork with 13mm thick bitumen impregnated soft board or expanded polyethylene strips placed vertically against the brickwork before the concrete is cast.

  Similar slip joints shall be provided between brickwork and concrete lintels cast In situ, but without soft board or expanded polyethylene strips at ends.

- **Movement/Construction Joints**
  All movement joints are to be filled in with approved bitumen impregnated soft board or expanded polyethylene strip unless otherwise specified or detailed on drawings. Descriptions (prices) of movement joints shall be deemed to include formwork.

- **Grouting**
  25 MPa non-shrink cementitious grout:

  Bedding approximately 25mm thick under base plate including chamfered edges all round.

- **Curing compound**
  Unless otherwise directed by the Project Manager, the curing compound shall be:

  An approved trafficable, resin-based, white pigmented, membrane forming for slopes flatter than 1:1.

  An approved clear, aesthetically acceptable, membrane forming for all other concrete surfaces, including beam and slab soffits.

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The curing compound shall comply with specification ASTM C309, except that the maximum permissible water loss in the test shall be 0, 40 kg/m².

Alternatively, the curing compound shall be acceptable if the treated concrete retains 90% or more of its mixing water when subject to the test set out in BS 8110 Part 1 – Chapter 6.6.

- **Curing compound application**

  The total application rate of the curing compound shall be the greater of the supplier’s specification or 0.90 l/m². On textured concrete surfaces, the total application rate shall be 0.90 l/m².

  In cases of concrete surfaces with run-off problems, it may be necessary to apply more than one coat of membrane forming curing compound to obtain the specified total or cumulative application rate.

  Curing in accordance with SANS 1200G shall commence on all concrete surfaces as soon as it is practical in the opinion of the Technical Officer.

  On unformed surfaces the curing compound shall be applied after finishing and as soon as the free water on the surface has disappeared and no water sheen is visible, but no so late that the liquid curing compound will be absorbed into the concrete.

  On formed surfaces, the exposed concrete shall be wet with water immediately after the forms are removed and kept moist until the curing compound is applied.

  Application of the curing compound shall begin once the concrete has reached a uniformly damp appearance with no free water on the surface.

  Application of the compound may be done by hand or power spray.

  The compound shall be applied at a uniform rate with two applications at right angles to each other to ensure complete coverage.

  Pigmented compounds, without a thixotropic agent, shall be adequately stirred to assure even distribution of the pigment during application.

  Unless otherwise directed by the Project Manager, the initial 24 hour curing of concrete surfaces not covered by formwork shall be carried out by ponding, covering with
constantly wetted sand or mats, or continuous spraying in accordance with SANS 1200G
when the following climatic conditions occur:

Wind velocity greater than 5 m/s

and/or

Ambient temperature is above 25 °C

and/or

The relative humidity is below 60 %

If plastic shrinkage occurs, the concrete, while still plastic, shall be re-vibrated, floated
and re-coated with curing compound as if no curing has previously taken place.

- **Curing period**

  The curing period for concrete containing only CEM 1 shall be 7 days.

  The curing period for concrete containing CEM 1 plus cement extenders (MGBS, FA) shall
  be 10 days.

  The curing period will start on completion of the concrete pour and for formed surfaces
  shall included the time for which forms are still in place after the pour.

- **Concrete records**

  The Contractor shall maintain the following daily records for every part of the concrete
  structure and shall make these available at all times during the progress of the work for
  inspection by the Engineer. Frequency of sampling and testing shall be as specified in
  SANS 1200G minimum of 2 sets of samples per day from each grade of concrete placed
  in each independent structure.

  - The date and time during which concrete was placed
  - Identification of the part of the structure in which the concrete was placed
  - The mixed proportions and specified strength
  - The type and brand of cement
  - The slump of the concrete
  - The identifying marks of test cubes made
  - Curing procedure applied to concrete placed

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• The times when shuttering was stripped and props removed
• The date of despatch of the cubes to the testing laboratory
• The test results

The records shall be delivered to the Engineer at the completion of the project.

• **Tolerances**
  
  Deviations shall be within the limits listed in SANS 1200G for degree of accuracy II unless otherwise specified.

• **Testing and monitoring**
  
  Frequency of sampling and testing shall be as specified in SANS 1200G

• **Formwork**
  
  Descriptions of formwork shall be deemed to include use and waste only (except where described as left in or permanent), for fitting together in the required forms, wedging, plumbing and fixing to true angles and surfaces as necessary to ensure easy release during stripping and for reconditioning as necessary before re-use.

**Rough formwork (degree of accuracy ii)**

Rough Formwork to Sides:
Strip footings.
Edges not exceeding 300mm high

**Smooth formwork (degree of accuracy ii)**

Smooth Formwork to sides:
Inner face of shaft walls.
Edges not exceeding 300mm high

**Movement joints etc.**

Expansion joints with soft board between vertical concrete surfaces:
12mm Joints not exceeding 300mm high.

**Saw cut joints:**

3.2 x 50mm And 6.4 x 20mm saw cut joints in two operations in top of concrete.
Seal SikaFlex-11FC on backing chord to manufacturer's specification

Horizontal toggle construction joints through concrete including thick cement slurry to one face.
Surface beds not exceeding 300mm thick.

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Reinforcement (provisional)

**High tensile steel reinforcement to structural concrete work:**
In various diameters and lengths

**Mild steel reinforcement to structural concrete work:**
In various diameters and lengths

**Fabric reinforcement:**
Fabric reinforcement type as specified on structural drawings.

- **Forming key to concrete for plaster, mosaic tiles and other finishes**
  Where rough formwork has been used, surfaces of concrete to receive plaster, mosaic tiles and other finishes, shall, immediately after the formwork has been removed, be well wetted and wire brushed whilst the concrete is still green and then shushed over with 2:1 cement grout to form a key for the finish, all to the approval of the Supervisor. The shushing is to be allowed to set hard before the finish is applied.

  Where smooth formwork is used, surfaces of the concrete to receive plaster, mosaic tiles and other finishes shall be hacked, on the distinct understanding that hacking of concrete shall be at no extra cost to the employer.

  Surfaces of concrete receiving plaster or other finishes shall not be plastered or finished until the Supervisor has signified his opinion in writing that the surfaces are suitable to receive plaster or other finishes.

- **Sleeve Pieces and Ties**
  Where it is necessary to leave plugs or holes in beams, slabs or any other reinforced concrete, all such plugs or holes must be situated in positions approved by the Supervisor before concreting. Where it is necessary to carry pipes, bolts, wires or any other fittings through reinforced concrete members, approved pipe sleeves must be provided and placed in position before concreting.

  Where waste, ventilation water, heating or other pipes under 100mm diameter pass through concrete slabs and beams, galvanised mild steel sleeve pieces or diameters shown or required shall be cast into such concrete slabs and beams.

  Chases shall be formed in edges of slabs or slots shall be formed in the slabs, or sizes required, where two or more pipes pass through together.

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All necessary bolts, plugs, brackets, cramps, etc. shall be cast into the concrete as the work proceeds.

Where brickwork abuts against concrete, the brickwork is to be tied to the concrete with galvanized hoop iron ties 1.6m thick by 32mm wide and approximately 600mm long to every third course of brickwork with one end of each tie cast approximately 150mm deep into the concrete. Where such fixing is impossible, i.e. where steel formwork is used, the ties are to be gun-nailed against concrete with steel nails to less than 38mm long.

- **Bagged Finish to Concrete**
  Concrete surfaces to receive bagged finish shall be prepared by removing sharp projections and making good defects with 3:1 cement mortar. Finish by rubbing over the whole area with wet rough sacking and cement grout to obtain an even surface.

- **Power Floated Finish**
  Power floated finish to floors etc. means that surfaces shall be floated mechanically to a smooth and even finish before the concrete has set. Small areas inaccessible to the machine are to be floated by hand.

  Under no circumstances is cement mortar to be added while floating the concrete.

- **Precast Concrete (provisional)**
  **Materials**
  Cement, water, aggregates and reinforcement shall be as described under: CONCRETE, FORMWORK AND REINFORCEMENT above.

  **Concrete**
  Concrete shall be as described under: CONCRETE, FORMWORK AND REINFORCEMENT and, unless otherwise specified. Class E concrete shall be used but with coarse aggregate of an appropriate size.

  **Smooth Finish**
  Where described as “finished smooth from the mould” such surfaces shall have a layer of fine stuff composed of 1:4 (1 part cement and 4 parts clean fine sand by volume) packed against the faces of the mould before placing the concrete backing. The concrete backing

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shall be disposed into the moulds in a wet state (not dry pressed) whiles the facing is still wet.

Projections shall be rubbed off the faces shall be of even colour and free from blemishes, cracks and other imperfections. Salient angles shall be arras rounded.

4.2.2 Piling (provisional)

This part covers the design, fabrication, provision and installation of piling for the workshop.

- **Design and Materials**
  
  **Design**
  A layout drawing has to be produced, showing the proposed position of the piles and its loads.

  For each pile the contractor is to indicate the following.

  - Pile type and diameter (if applicable)
  - Founding depth of piles
  - Pile reinforcement

  The design and construction of the pile caps may be required if the proposed foundation design is not adequate after the verification of founding conditions at the Underfloor Wheel Lathe Machine.

  **Materials**
  The strength of the piles shall be provided solely by the concrete and rebar in the pile and not a steel casing (if used). The concrete and rebar is to comply with the requirements of SANS 1200G.

  **Plant**
  Tenderers shall submit with their tenders a schedule of plant, which they intend to use on this project.

4.2.3 Steel Work

All steel plates and rolled steel sections used in the construction of the structure shall be of steel made by the open hearth process (acid or basic) and shall comply in every respect with BS 4360, "A" quality Structural Steel for Bridges and General Building

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Construction, Grade 43A or Grade 50B or SANS 50025 grade S355JR, where sections sizes allow. That is, the percentage of phosphorous and Sulphur shall not exceed 0.06.

The above is laid down as a standard, but tenders will also be considered for rolled steel not conforming strictly to the above standard. Full particulars of the guaranteed properties of the steel tendered for should in this case be furnished, i.e. chemical composition, tensile strength, yield point, reduction in area, bend tests, etc.

- **Welding**
  All the provisions of BS 5135 shall be complied with as far as applicable.

  All welds on the load bearing frame structure, containers, piping, pipe line flanges, etc., shall be continuous and shall be visually inspected for cracks and other discontinuities.

  Welds on the main chords must be tested ultrasonically in accordance with BS 3923 or X-rayed in accordance with BS 2600 and those on minor joints by the dye-penetrant method. The equipment required for these tests must be supplied by the Contractor and the testing done at his cost.

  The welding of all rails shall be done by an approved method.

  Welding shall only be carried out by a coded welder according to SANS 10044, BS-EN 287 Part 1 and BSEN 288 Par: 3 or ANSI/AWS D1.1.

  All parts to be welded shall be thoroughly cleaned and dried before welding. The welding will only be done in dry surroundings and all steps taken to prevent hydrogen embrittlement.

  Where materials of different compositions are joined by welding, especially carbon steel to chrome steel, the filler welding method and post welding treatment shall be such that embrittlement and other degradation of both steel and filler is prevented.

  It must be ensured that welded joints are ductile.

- **Fasteners**
  All bolts, nuts and rivets shall be manufactured in accordance with the following standards:-

    - Commercial bolts and nuts Grade 4.6: SANS 135

**Signature of Bidder/s:** _____________________________  **Date:** ______________
- Precision bolts and nuts Grade 8.8: SANS 136
- Friction Grip Bolts and nuts Grade General: SANS 10094
- Rivets: SANS 435

All friction grip fasteners shall be hot dip galvanised, including high tensile bolts (and their nuts and washers), structural rivets and Huck bolts.

All holding down bolts and nuts and brackets, as well as all fixing bolts, studs, nuts and washers shall be of stainless steel. Fixing rivets shall be of either stainless steel or brass.

Bolts and set screws shall be locked in an approved manner and shall not be stressed in tightening to beyond the recommended loads.

The quality of friction grip bolts, nuts and washers, bolt lengths, sizes of holes, tightening standards, surface condition of clamped components, shop and site assembling and acceptance inspection of friction grip joints shall comply with the latest edition of SANS 10094. Certificates shall be supplied for all bolts of grade 8.8 and 10.9.

All bolt and rivet holes must be accurate to size and location, the centres of holes shall not be placed nearer the edge of a plate than 1,5 diameters with an extra allowance of 3mm for sheared edges. All holes in the structural work shall be drilled or otherwise punched to a diameter not exceeding 1,5mm less than the diameter of the finished hole on the die side, and afterward reamed out to the exact size.

Where possible the adjoining parts forming a connection shall be drilled or reamed together, with holes not exceeding 1,5 mm diameter the rivet or bolt for which it is made. No rough or broken edge shall be left around any of the holes.

For turned and fitted bolts, the holes shall be accurately drilled or reamed; the diameter of the hole shall not exceed the finished diameter of the bolt by more than 0,25mm.

Where bolt heads or nuts are seated on bevelled surfaces of beams or channel flanges, bevelled washers must be inserted.

- **Joints and Mating Surfaces of Members**

Mating surfaces of members to be joined by high tensile steel bolts in friction grip shall be cleaned and primed as specified for the rest of the steelwork. Mating surfaces shall lay flat against each other to eliminate gaps which may allow ingress of water. After joining,
the edges shall be sealed with an approved brand of Butyl/Rubber sealing compound by means of a suitable caulking gun, or shall be seal welded.

Other joints shall be formed by one of the following methods:

The mating surfaces of members shall be blast cleaned, primed and protected prior to sub-assembly by the liberal application of caulking compound. While the compound is still wet, the members shall be bolted together and caulking compound which is squeezed out shall be completely removed.

The mating surfaces shall be protected with the full corrosion protection system as specified, the surfaces joined together and the joint so formed shall be sealed with butyl rubber sealer.

After being cleaned and primed the surface shall be joined together and the joint so formed shall be seal welded.

The primer coating on mating surfaces must be applied not more than 4 hours after cleaning and the edges must be sealed within 3 weeks of assembly of the part.

4.2.4 Corrosion Protection

- Scope

Structural steeework in coastal area (within 10km from coast):

Structural steeework is to be protected against corrosion as follows:

This specification covers requirements for protective coating of steel structure against corrosion and must be read in conjunction with the main specification as well as the following (latest editions):-

- SANS 10064 "Preparation of steel surfaces for coating"
- SANS 121 "Hot-dip (galvanized) zinc coatings"
- SANS 1091 "National colour standards for paint"
- SANS 1200 HC "Corrosion protection of Structural Steel Work"

Types of Corrosion Protection to BE USED

- Main steel structure must be hot-dipped galvanized.
• Galvanizing shall be done to SANS 121 heavy duty hot dip galvanizing to a thickness of at least 85mm. Electroplated components in zinc or cadmium are not acceptable.

• All galvanized components including bolts and nuts but excluding walkway gratings, must be painted with the specified system, unless otherwise approved.

• Corrosion protection shall be applied to the structural steel under workshop conditions, the only structural corrosion protection work allowed on site will be touching up of minor damage.

• The paint manufacturer shall guarantee the paint for at least 10 years.

• Paint contractors must have a quality management system which must be submitted to the Engineer for approval before commencement of the work.

• All mounting bolts, nuts, washers and brackets as well as all fixing bolts, studs nuts and washers shall be of stainless steel. Fixing rivets shall be of either stainless steel or brass.

• High tensile bolts for friction grip joints must be hot dip galvanized and painted. High tensile bolts must be certificated after galvanizing.

• The full paint system shall be applied to all surfaces which are to be covered with wear pads, linings etc.

4.3 CIVIL AND PERWAY ENGINEERING SERVICES

4.3.1 Existing Services and Demolishing of Existing Structures

This part covers the demolition of the existing structures and dealing with existing services.

Existing Services

Existing underground services to be identified before any earthworks and foundations work took place, all known services are provided on the drawing. However, due to the lack of adequate As-built records, the contractor will be required to prove services prior to removal. The contractor shall take the necessary precautions to ensure that the services are not damaged. The existing water supply to the building must be shut off at the nearest valve to be determined on site, prior to the removal of plumbing fittings and demolishing.

Signature of Bidder/s: ___________________________ Date: __________
As soon as any underground service not shown on the drawings is discovered, it shall be brought to the attention of the Project Manager. The contractor must in collaboration with the Depot Engineer, ascertain whether or not the service is live. The contractor shall not uplift any such services unless he is instructed to do so.

The contractor shall be held responsible for any damage to known services (i.e. services that are within the site of the works and are shown on the drawing) and he shall take all necessary measures to protect them. In the event of a service being damaged, the contractor shall immediately notify the Plant Engineer. The contractor shall not repair any such service unless he is instructed to do so.

Any damage to the adjacent areas not designated for demolition shall be repaired by the contractor to the satisfaction of the Project Manager.

**Demolishing of existing structures**

The contractor shall demolish and spoil the buildings/structures to the underside of foundation. A set of As-Built drawings of the existing buildings shall be issued to the contractor to assist with the demolition works.

To prevent the undermining of the adjacent premix pavement, the Contractor shall notify the Project Manager prior to the exposure or demolition of the foundations of the structures.

**Demolishing of existing storm water pipes**

The Contractor shall dismantle and remove all pipe work and place in storage for handover to client at a later date.

**Demolishing of existing Perway and OHTE**

There is currently an OHTE mast which is in the way of the new rail line which will be built, therefore it must be relocated to the new position as detailed under OHTE scope of work. The old breakdown shed access rail to be uplifted.

**Excavation**

For the purposes of uplifting of underground pipes, a trench width of 1m shall be used and existing material to be excavated according to (SANS 1200DA Clause 3.1.2)

**Compaction of in-situ material**
The in-situ material shall be trimmed, levelled out and compacted to 93% MOD AASHTO density on alluvial sands at average depth of 0.5m.

4.3.2 Site Clearance, Earthworks & Layer works
The works for the site clearance, earthworks and layer works include the following:

- Clearing of site.
- Bulk excavation and treatment of in-situ material.
- Construction of sub grade layers from commercial sources.
- Construct of sub-base layers from commercial source.
- Construct of base course layers from commercial source.

And any other work arising out of or incidental to the above, or required of the Contractor for the proper completion of the works.

Site Clearance
Digging up and removal of rubbish, debris, vegetation, hedges, shrubs and trees. All vegetation, trees, etc, resulting from site clearance shall be removed off site to a disposal site to be selected by the contractor.

Construction of Earthworks and Layer works
Layer works
The backfilled layer works shall comply with the specifications as detailed in the discipline specific requirements for the area.

Imported Backfill material
Backfill material shall be selected in accordance with the stipulated layer works design from commercial sources and placed in 150mm layers compacted to 95% and 93% MOD AASHTO density as stipulated in the discipline specific requirements. No clay shall be used as backfill.

4.3.3 Pavement Construction
The pavement construction consist of the following layer works and surfacing:

- 150mm In-situ material compacted to 95% MOD AASHTO density (on alluvial sands an average depth of 0.5m)
- 200mm G7 sub-grade layer compacted to 93% MOD AASHTO density.
- 150mm G5 sub-base layer compacted to 95% MOD AASHTO density.
- 150mm G5 base layer compacted to 95% MOD AASHTO density.
- 30mm asphalt surface.
- Construction of kerbs and channels.

Signature of Bidder/s: __________________________ Date: _______________
Sub-grade Layer

Preparation of the in-situ subgrade will be by means of ripping and compaction. Compaction of the in-situ subgrade will be done to a minimum of 95% of MOD AASHTO maximum density for all materials, to a minimum depth of 150mm and at between -2% and +2% of the optimum moisture content. Followed by a layer of 200mm G7 material imported from commercial source and compacted to 93% MOD AASHTO density to accommodate any deficiencies in the in-situ material.

Sub-base Layer

150mm G5 sub-base layer conforming to the requirements of SANS 1200 ME shall be imported from commercial sources. The layer shall be compacted to 95% MOD AASHTO density respectively.

Base Layer

150mm G5 sub-base layer conforming to the requirements of SANS 1200 MF shall be imported from commercial sources. The layer shall be compacted to 95% MOD AASHTO density and tolerance on the base levels will be -10mm to 0mm.

Asphalt Surfacing

30mm thick continuously graded, medium grade (60/70 penetration grade bitumen) conforming to the requirements of SANS MH.

Kerbing and channels

Kerbs and channels shall be as shown on the drawings and shall comply with the relevant requirements of SANS 927, when applicable SANS 1200 MK.

4.3.4 Perway Construction

The work for the perway construction consist of following:

- Supply and deliver: 2 x New 1:9 LH tangential set: Build two 1:9 x 60kg tangential LHTO adjacent to location of the new track– the turnouts will be built next to the track where it will be installed, so that it will be ready when the occupation is required and no unnecessary time will be wasted during the occupation,
- The installation of turnout works on this site requires occupation (Track and Terminal OPS),

Signature of Bidder/s: ____________________________ Date: ___________
• Uplift existing track at sets/points position as indicated in a drawing and remove track components to stockpile at client’s (Transnet Engineering) allocated storage and re-use ballast, and install new track on these turnout positions.
• Build two 1:9 x 60kg tangential LHTO each adjacent to the location of installation to minimise installation time during occupation.
• Supply and deliver rail, ballast, sleepers, fasteners, layer works material and Bulk fill to stockpile for construction purposes.
• Excavate to full width for formation as per the typical profiles to spoil.
• Import and place bulk earthworks and layer works as per the drawings.
• All subsurface works originating from or for the Works.
• Thermit welds and fishplate rail joints where applicable.
• A 57kg junction rail is to be installed where existing rail profile is 48kg/m.
• De-stress new track, within the correct specified temperature ranges.
• Commissioning of tack after completion of construction.
• Reinstatement of any disturbed infrastructure during the time of this works.
• As-built survey to be submitted to the employer.
• Install the new 60kg/m rails (240m lengths) from the stockpile area to construct the new lines.
• Supply and install clearance markers in accordance with E10/13 specification clause 5.4.2.
• Construction of Subsurface drains, discharging to existing storm-water manholes.

The construction of a new access rail line approximately 240 m. The design is for a 26t/axle load (Class S). The existing ground level is above in-situ subgrade level and therefore excavation to spoil is required. There’s poor drainage system in these construction sites.

The work will be undertaken in accordance with the latest Transnet
• Specification for Railway Earthworks (S410).
• Geosynthetics Specification for Railway Earthworks Construction & Subsurface.
• Drainage (Supersedes S412).
• Specification for the Supply of Ballast Stone (S406).
• Specification for Railway Trackwork (E10) and the SANS 1200 Standardized Specification for Civil Engineering Construction series.
• Manual for Track maintenance (2012) BBB0481
• Track welding Manual (2007)
• SARTSM (South African Road Traffic Signs Manual)

4.3.5 Storm water Drainage Construction

The works for the storm water drainage include the following:

• Excavate, supply, bed and lay concrete, uPVC and HDPE storm water pipes as shown on the drawings.
• Construction of storm water grids inlets and connection chambers.
• Construction of storm water channels.

And any other work arising out of or incidental to the above, or required of the Contractor for the proper completion of the works.

Pipes

Signature of Bidder/s: ___________________________ Date: _______________
The storm water pipes shall be precast reinforced concrete pipes conforming to SANS 677/69 with “Spigot and socket” joints and rubber collars throughout, with the class of the pipe as stated on the drawings.

The uPVC class 34 shall conform to SANS 966-1 class pipes with integral rubber ring type pipe end socket, except were otherwise stated. The HDPE class PE 100/PN 8 double walled slotted pipe (with smooth internal surface) shall be used in the connection points.

**Brickwork manholes**

All brickwork shall be built in manhole bond i.e. stretchers only on the inside face, using cement mortar as specified. Bricks shall be well soaked before use and the previous course shall be wetted before bricks are laid thereon. All joints on the internal face (and the external face above ground) shall be half round recessed and shall be well rubbed with a standard jointing tool of suitable size to ensure that the entire exposed surface on the joint presents a smooth and polished appearance. Intersecting walls shall be properly toothed with each other and all angles levelled and plumbed. Should cement bricks be utilized, then all internal surface shall be plastered with a 12mm thick 3:1 cement sand mortar mix.

When brick built’ manholes are constructed in wet ground, the external surfaces shall be rendered with 12mm thick 3:1 cement sand mortar mix.

**Storm water Inlets**

The inlets shall be constructed in 225mm common brickwork in manhole bond in accordance with the details shown on the drawings. The workmanship will be as specified under Brickwork Manholes. The reinforced precast concrete cover slabs shall be bedded in 8mm mortar joints and levelled. Heavy duty cast iron grated inlets of size 450mm x 600mm as per Besaans du Plessis shall be used where indicated on the drawings.

**Pipe crossings**

Where pipes cross one another with a vertical height difference of less than 150mm, a polystyrene block must be placed between them, and the fill material around the pipes thoroughly moistened and compacted. The contractor will be held responsible for any damage to pipes resulting from the construction of a pipe crossing.

**Cut pipe ends**
All ends may be cut on site. Reinforcement exposed by such cutting is to be protected with 20mm thick cement mortar.

4.3.6 Water Reticulation Construction

The works for the water reticulation include the following:

- Provision and installation of a 54mm diameter connection onto the existing main.
- Provision of a 75mm diameter HDPE fire ring main and 54mm diameter HDPE portable water.
- Provision and installation of isolation, scour and air valves on the new ring main.
- Provision and installation of fire hydrants on the new fire main.
- Connection to the existing portable water main reticulation, including provision and installation of isolation valves on the existing water main.
- Provision for interim inspections and testing to final inspection and testing for acceptance.

And any other work arising out of or incidental to the above, or required of the Contractor for the proper completion of the works.

**Pipes**

All pipes will be HDPE class PE 100/PN8 as stated on the drawings.

**Hydrant Connections**

All hydrant tees shall be 75mm diameter x 75mm flanged cast iron conforming to latest edition of SANS 1476.

All flange adaptors shall be cast iron conforming to SANS 1123.

**Corrosion Protection**

All exposed (i.e. not buried) valves, pipes and specials shall be prepared and protected as follows:

The surface shall be prepared by abrasive blasting to SIS Sa 2.5.

A twin pack ethyl base inorganic zinc silicate primer shall be applied within 24 hours of the abrasive blasting, to a minimum dry film thickness of 75 microns.

A polymide cured high build epoxy undercoat shall be applied to a minimum of 60 microns dry film thickness.

These steps must be carried out after erection; any damage to the primed surface shall be touched up with the zinc rich primer. The above shall be read in conjunction with the paint manufacturers specifications for that particular paint.

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For all buried steel and cast iron fittings clause 3.9.1 and clause 3.9.6 of SANS 1200L shall apply. All buried steel pipes shall be protected against corrosion in accordance to SANS 10129 by treatment with a compatible primer, packed with a bitumen or tar based mastic and wrapped with an approved plastic tape to the requirements of SANS 1117.

Valves

Isolation Valves

All isolation valves shall be as specified on the drawings, class 16 double-flanged cast iron gate valves for mains sizes, wedge gate with non-rising spindle, conforming to SANS 664. Gate valves shall be flanged to SANS 1123 Table 15 and shall be fitted with valve caps as per SANS 664.

The direction of closing shall be anti-clockwise and clearly indicated on the valve body. The 50mm and 25mm isolation valves shall be female/male ball valves. Taps shall comply with SANS 226 and be suitable for working pressure of up to 12 Bars.

Landing Valves

All hydrant valves shall be upward oblique flanged inlet, 65mm instantaneous outlet, complete with hand wheel and conforming to the latest edition of SANS 1128.

All hydrant risers shall be 75mm nominal diameter double-flanged cast steel pipe, galvanized to 100 microns in accordance with SANS 32.

Air Valves

All air valves shall be Vent-O-Mat double acting RBX series or similar approved to the specified pressure rating as shown on the drawings.

Flanges, Bolts and Nuts

Pipe flanges shall comply with SANS 1123 Table 1600/3, drilled to suit mating flanges and shall be installed square to the axis of the pipeline. Reaming of bolts holes to oversize dimensions in order to make a particular piece fit will not be permitted. Flanges shall be hot-dip galvanized to 100 microns in accordance with SANS 10214.

Bolts, nuts and washers shall comply with ANSI B16.5 or the relevant sections of SANS 1700 as applicable, in sizes appropriate to the class of pipe or special and of grade 316 stainless steel. The length of the bolt shall be such that, after the bolt has been tightened, the end of the bolt projects a minimum of one thread above the nut and to a maximum of three full threads.

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4.3.7 Sewer and Effluent Construction

The works for the sewer and effluent include the following:

- The construction of sewer and effluent pump stations as per the drawings.
- Excavate, supply, bed and lay 110 mm class 34 uPVC pipes.
- Excavate, supply, bed and lay 63 mm HDPE pipes rinsing mains (PE 100/PN 8).
- Connection to the existing sewer and effluent reticulation manholes. New manholes to be constructed as per the drawings.
- Minimum gradient of all the pipes to be 1:80.
- Vents to be provided at all high points and critical sections.

And any other work arising out of or incidental to the above, or required of the Contractor for the proper completion of the works.

Construction of Sewer and Effluent Substations and Manholes

- Channels and specials shall be of the same material as the pipes used.
- The initial chamber section used in the construction of the manhole chamber shall be at least 1500mm in height and this ring shall be bedded 100mm into the concrete base. The height of sections above this shall be arranged to ensure that a minimum number of joints occur.
- Joints between precast concrete manhole chamber sections shall be effectively caulked from the inside with 3:1 sand cement mortar or other sealing method as shown on the drawings.
- Step-irons are to be installed in manholes deeper than 800mm.
- The concrete bases shall be cast as per the details shown on the drawings.
- For angles of intersection exceeding 10°, standard channel bends, cut to suit where necessary, shall be used. Below 10° two straight sections shall be used, cut and mitred to suit.
- Pipes of 100-150mm diameter protruding from manholes:-
  - The maximum length of pipe protruding from the base shall not exceed 150mm at the nearest point.
- A prototype manhole must be constructed and when approved will be used as a standard to be maintained for all manholes for the project.
- Joining a sewer to a manhole:-
  - The sewer must be jointed to a 0.5m length of pipe built into the manhole by means of a flexible joint. The flexible joint must consist of a 1.0m length of sewer pipe with two triplex couplings on either side of it.

4.3.8 Cable Ducts

The works for the cable ducts include the following:

- Excavation, bedding and backfilling for cable ducts.
- Supply and lay heavy duty PVC pipes.
- Construction of electrical and communication manholes.

And any other work arising out of or incidental to the above, or required of the Contractor for the proper completion of the works.

Signature of Bidder/s: ___________________________ Date: _____________
Depth, position and marking of ducts

All electrical/communication cable ducts are to be laid approximately 800mm below finished road level and the pipes must protrude 500mm beyond the edge of the hardened roadway or storm water drain. Both ends of each duct must be sealed with an end cap. The position of each duct crossing shall be indicated on site using suitable markers.

Draw wires must be provided in each duct and duct ends must be sealed with suitable stoppers. A double strand copper wire of at least 2.8 mm² cross section that will serve as a screen and is to be installed approximately 200mm above all ducts over its entire length.

Electrical / communication manholes

All brickwork shall be built in manhole bond i.e. stretchers only on the inside face, using cement mortar as specified. Bricks shall be well soaked before use and the previous course shall be wetted before bricks are laid thereon. All joints on the internal face (and the external face above ground) shall be half round recessed and shall be well rubbed with a standard jointing tool of suitable size to ensure that the entire exposed surface on the joint presents a smooth and polished appearance. Intersecting walls shall be properly toothed with each other and all angles levelled and plumbed. Should cement bricks be utilized, then all internal surfaces shall be plastered with a 12mm thick 3:1 cement sand mortar mix.

When brick built' manholes are constructed in wet ground, the external surfaces shall be rendered with 12mm thick 3:1 cement sand mortar mix.

4.3.9 Landscaping

- The site shall be cleared of all loose debris, rubbish and foreign matter of any kind.
- Supply and plant instant grass/lawn and outdoor plants suitable for the area. Preparation and the works shall be carried out in accordance with the requirements of general landscape operations.
- Minimum depth of topsoil required for grass seeding areas is 150mm.
- The topsoil in areas to be seeded shall be ploughed or disc harrowed to a depth not exceeding 150mm, care to be taken not to bring the sub-soil to the surface.
- The area shall be cultivated to produce a fine tilth suitable for seeding and firmed by lightly rolling.
- Fertiliser shall be granular fertilizer, obtained from the approved reputable horticultural supplier, stored in approved dry building until required for use.
- Finished grass levels are to be same height as existing. The addition of imported topsoil shall be undertaken where required.
- Turfs shall be clean meadow.

Signature of Bidder/s: ___________________________ Date: ________________
4.4 ELECTRICAL ENGINEERING AND OHTE WORK

The electrical and OHTE works for the building include the following:

- Supply, delivery and installation of 11kV Ring Main Unit.
- Supply, delivery and installation of Medium Voltage (MV) cables.
- Supply, delivery and installation of 11kV/400V Mini – Substations.
- Supply, delivery and installation of Low Voltage (LV) cables.
- Supply, delivery and installation of Interior/Exterior Luminaires.
- Supply, delivery and installation of wiring.
- Supply, delivery and installation of low voltage distribution board.
- Design, supply and installation of earthing and lightning protection.
- Supply, delivery and installation of the electrification of the railway line on the south west side at 25kV AC up to the entrance of the workshop.
- Commissioning and testing of the entire installation and hand it over to the Employer.

The Contractor may be required to undertake designs and submit them to the Employer’s engineer’s responsible personnel for acceptance. The high level designs by the Employer which illustrates the overall design methodology is detailed and shown in the drawings accompanying this document. The Contractor shall read this document in conjunction with all the drawings and the specifications mentioned herein this document.

4.4.1 Electrical Conditions

Medium Voltage System

The Medium Voltage system of supply will be one phase, 3 – wire system, 50Hz alternating current (AC) at a nominal voltage of 11kV.

The voltage may vary within the range of 95% to 105% of the nominal and all equipment installed shall be suitably rated.

Low Voltage System

The Low Voltage system of supply will be three phase, 4 – wire system, 50Hz alternating current (AC) at a nominal voltage of 400V.

The voltage may vary within the range of 95% to 105% of the nominal and all equipment installed shall be suitably rated.

4.4.2 Contractor’s design

The contractor shall design the following:

Signature of Bidder/s: ________________________ Date: ____________
• All supporting infrastructure required to implement all of the Employers' high level designs. These may include, but is not necessarily limited to, cableways, cable support systems, conduit systems, and arrangement, piped systems and pipe support systems, and the selection of fasteners and fastening systems for these items, where not specified, referenced or detailed by the Employer.

• All detailed designs of all LV distribution panels.

• The Contractor shall design, supply and install an Earthing and Lightning protection system for the mini substation and underfloor wheel lathe workshop.

• The Contractor shall submit detailed drawings and Workshop details for all designs, both Contractor's designs and Employer's designs, to the Project Manager for acceptance by the Employer's Engineer's.

• The Contractor is responsible in his design for the overall integration of the design of the Works with the design of the Employer.

4.4.3 Construction of the Work

Excavations and Backfilling

• All trenching, excavations and backfilling required for the electrical installation shall be carried out by the Electrical Contractor. Backfilling shall be executed as detailed in cable trench to avoid subsequent settling of soil and damage to structures and services.

• Cognisance will be taken of the fact that other services might be installed along the same routes as the cables.

• The Contractor will be required, before starting any excavation, to peg out and verify the proposed cable route.

• Appropriate safety measures will be taken to prevent damage to other services.

• The contractor will be held liable for any damage to other services, including all resultant repair costs.

• The excavated ground in front of the mini substation should be left open until all the main cables have been pulled in and connected to the mini substation.

11kV Ring Main Unit

• The Contractor shall examine the scope of works in this section in close connection with the drawings and other documents.

• Should the Contractor find discrepancies in or omissions from these specification or from other documents, or should be in doubt as to their meaning, the contractor shall immediately contact the Project Manager for interpretation, clarification or correction.

• The Contractor shall supply, install and commissioning 11kV 3CR12 outdoor ring main unit (RMU) with 1 x incomer panels and 2 x out going feeders in the containerized substation as detailed on drawing 3526783-5-201-E-LA-0001-01-OA-YL, as well as having full responsibility for civil works including RMU platform.

• The RMU position shall be inspected and signed off by the Engineer and the Contractor prior to any construction taking place on the prepared platform.

Medium Voltage (MV) cables

Signature of Bidder/s: ___________________________ Date: ______________

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• The Contractor shall supply, deliver, install, and terminate medium voltage 70mm² three core XLPE insulated PVC bedded, SWA, 11kV copper cable from the existing Diesel Depot Mini substation to the new Outdoor Ring Main Unit, and from the new Ring Main Unit to the new UFL Mini substation as per drawing 3526783-5-201-E-LA-0001-01-OA-YL.

• The Contractor shall take note of the requirements stipulated in the SANS 10198-8: The selection, handling and installation of electric power cables of rating not exceeding 33 kV Part 8: Cable laying and installation. The Contractor shall install the medium voltage cable in the trench as per drawing 3526783-5-201-E-LA-0001-01-OA-YL.

• No deviations shall be allowed without the written consent of the Engineer.

• All cables and wiring shall be clearly labelled by using an approved wiring labelling system from Transnet.

• All cables shall terminate onto panels by the use of compression type glands. These glands shall be fitted with neoprene shrouds. All cables shall be terminated and connected to a terminal strip inside all panels.

• The radius of each bend or change in direction in the route of a cable shall not be less than the calculated value or as technically recommended by the cable manufacturer whichever is more stringent.

11kV/415V Mini – Substation
• The Contractor shall supply, deliver, offload and install 1x 500kVA 11000/415V low maintenance VCB type RMU with internal arc outdoor type B Mini substation, consisting of 3CR12 steel enclosure; MV ring main switch and LV compartment complete with switchgear as specified on drawings 3526783-5-201-E-SL-0001-01-OA-YL and 3526783-5-201-E-LA-0001-01-OA-YL.

• The Contractor shall design, supply and install earthing including earth-mats and earth spikes as per the specification. Transnet Technical specification and drawings for the design, supply and installation of lightning protection and earthing for buildings and structures are provided. Earth electrodes and couplers shall be manufactured from stainless steel in accordance to SANS 1063. The earth electrode resistance at each spike shall not be more than 2 ohms.

• The Contractor shall submit mini substation layout drawings from the board manufacturer to the Employer’s Electrical Engineer for acceptance, showing the actual size and the equipment layout before ordering the material.

• A certified commissioning Engineer shall be appointed by the Contractor to test and commission the mini substation.

• All protection relays shall be suitably graded by the commissioning Engineer prior to the energisation of the mini substations.

• The Contractor shall then test and energise all the MV cables once the mini substations have been complete installed.

• The MV cables shall be VLF tested by a certified commissioning engineer prior to the energisation of the mini substation.

• All test results shall be submitted to the project manager for record purposes.

• The mini substation support structure shall be designed, supply and install by the civil engineer.

Low Voltage (LV) cables
• The Contractor shall be responsible for the supply, delivery and installation of all low voltage cables to and between all equipment as per the Employers design drawings.

Signature of Bidder/s: ________________________________ Date: ________________
• This shall typically include but shall not be limited to the following:
  • From the secondary side of the new UFL mini substation to the new UFL distribution
    board in the workshop.
  • From the new UFL distribution board to the UFL control panel and crane.

**Low Voltage Distribution Board**
• The Contractor shall Design, supply, deliver and install floor standing distribution
  board A. The distribution board shall be complete with circuit breakers, switch
  disconnectors, bus bars, fuse disconnectors, surge arrestor, earth leakages as
  specified in drawing number 3526783-5-201-E-SL-0002-01-OA-YL. The earth bars
  and neutral bars of the distribution board shall be appropriately sized to suite the
  loads specified in the distribution board and suitably supported. The distribution
  board shall be fitted with door(s), gland plate, din rail and any other mechanical
  support accessories.
• Distribution boards shall comply with SANS 60439 part 1 to part 6.
• All distribution boards shall be supplied with 30% spare ways for future expansion.
• The power supply cable to the distribution boards will be supplied and terminated as
  indicated on the drawing by the Contractor. The cable size is shown on drawing
  3526783-5-201-E-SL-0002-01-OA-YL.
• The main distribution board shall be installed and feed electrical lighting and power
  circuits, air conditioning and ventilation circuits, and sub distribution boards as shown
  on drawing 3526783-5-201-E-SL-0002-01-OA-YL.
• The distribution board shall be earthed as per earthing details shown on drawing
  3526783-5-201-E-SL-0002-01-OA-YL.
• All distribution boards should have the following signage:
  • Name
  • Fed From...With ecc, pvc, copper cable (cable size to be indicated and
    length)
  • Voltage
  • Danger Sign (lightning Bolt)
• The Contractor shall submit distribution board layout drawings from the board
  manufacturer to the Employer's Electrical Engineer for approval, showing the actual
  size of the distribution board and the equipment layout before ordering the material.
• The new distribution boards shall be supplied complete with cover plates and suitable
  doors.
• Equipment shall be fully enclosed within the distribution board with only the
  operating toggles protruding through the cover plate.
• All circuits shall be labelled and clearly designated.
• Embossed tape is not acceptable. The labels shall be of the engraved type and shall
  be permanently secured to the faceplate.

**Interior Luminaires**

**Lighting**
• All luminaires shall be installed according SANS 10142-1 and the specification for
  electrical installations to buildings other than dwelling houses.
• The Contractor shall supply and install luminaries as shown on drawings 3526783-5-
  201-E-LA-0002-01-OA-YL and 3526783-5-201-E-LA-0003-01-OA-YL.
• The Contractor shall supply and install a unistrut system for the workshop as shown
  in drawing number 3526783-5-201-E-LA-0002-01-OA-YL. The unistrut system shall

**Signature of Bidder/s:** ___________________________ **Date:** ________________

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suitably house all wiring used to connect up light fittings and switches from the associated DB. The unistrut system shall also be used to safely and neatly mount light fittings in the workshop area.

- The power supply to interior luminaries shall be installed in conduits. All conduit terminations to light switch boxes shall be done using a PVC male adaptors and suitable PVC washers and shall be fully water proof. All PVC conduits, couplers, male adaptors, boxes and PVC adhesives used for lighting circuits shall be SABS approved.
- The light switch boxes and the conduit droppers if required shall be surface mounted.
- All electrical works pertaining to the electrical lighting should be done in accordance with the referenced drawing, if clarity is needed in any regard the electrical engineer should be contacted prior to any commencement of work.

**Light Switches**

- The Contractor shall supply, delivery and install photocell device, the device shall comply with BS 667:2005 and shall have good tolerances in physical dimensions and with no moving parts. An additional circuitry shall be provided to achieve a delay of at least 30 seconds so as to eliminate switching due to lightning or other short period changes in illumination.
- The Contractor shall supply, delivery and install occupancy sensors as indicated on drawings 3526783-5-201-E-LA-0002-01-OA-YL and 3526783-5-201-E-LA-0003-01-OA-YL.
- The Contractor shall supply, delivery and install light switches as indicated on drawings 3526783-5-201-E-LA-0002-01-OA-YL and 3526783-5-201-E-LA-0003-01-OA-YL.

**Sockets outlet**

- All socket outlets shall be installed according SANS 10142-1.
- The exact positions of switched socket is shown on drawings 3526783-5-201-E-LA-0002-01-OA-YL and 3526783-5-201-E-LA-0003-01-OA-YL.
- The power supply to the socket outlet shall be installed in conduits recessed into the wall or slabs. The mounting height for the power points is as specified in the drawings 3526783-5-201-E-LA-0002-01-OA-YL and 3526783-5-201-E-LA-0003-01-OA-YL.
- Wall outlet boxes for switched socket outlets and isolators shall be mounted above floor level as indicated on drawings 3526783-5-201-E-LA-0002-01-OA-YL and 3526783-5-201-E-LA-0003-01-OA-YL.

**Wiring**

- All wiring shall be installed in wire ways and/or conduit as specified.
- Open wiring is not acceptable.
- Only the loop-in system of wiring shall be acceptable.
- Joints in the wiring shall not be permitted.
- No surfix or twin and earth wiring will be accepted.
- AC and DC wiring shall be installed in separate conduit.

**4.4.4 Earthing and Lightning Protection**

- A Lightning protection system for the mini substation and building shall be designed by the Contractor.

Signature of Bidder/s: ___________________________ Date: ____________
• Lightning protection measures will be designed in compliance with SANS Codes of practice 10313 (2012), 10199 (2010) and 1063 (2014 Edition 4) in conjunction with SANS 62305-1-4 (2011) and IEC 62305-1-4: 2010 by an experienced, competent and accredited lightning specialist that will be appointed by the Contractor.

• Typical earthing and lightning protection drawing will be given to the contractor as a basics development of the detailed design.

• It shall be necessary for the Contractor to conduct earth resistivity tests and to make calculations in accordance with the Code of Practice to determine what the requirements should be for the new earthing system to comply with the Code of Practice.

• The Contractor shall design the earth mat for mini substation to meet the safety potentials for both personnel and equipment. The Contractor shall submit his design to the Engineer for acceptance.

• The earthing design shall incorporate all conductor sizes for the earth mat and all equipment and structures.

• All earth mat joints shall be brazed or exothermically welded to SANS specifications.

• The earth resistance of the earth mat shall be less than 1 ohm.

4.4.5 Testing and Commissioning

Type and Routine Test Requirements
• Type and routine tests shall be conducted on all equipment to be supplied. These tests shall be carried out at the Contractor expense.

• Test certificates in respect of type tests conducted on identical equipment may be accepted in lieu of type tests at the discretion of the Employer’s Engineer.

• Delivery of equipment shall not commence before acceptance of type test certificates by the Employer’s Engineer.

• All equipment and material shall be jointly inspected by the Contractor and the Employer’s Engineer, at the place of manufacture prior to delivery to the Contractors works or to site.

Factory Functional Tests (Factory Acceptance Tests) (FAT)
• The Contractor shall be responsible to facilitate all factory functional tests to be conducted by the manufacturers of equipment at their premises before such equipment may leave their premises.

• At the completion of the factory functional tests, Employer’s Engineer shall either sign the test sheets (supplied by the Contractor) as having witnessed the satisfactory completion thereof, or hand to the Contractor a list of defects requiring rectification.

• Upon rectification of defects, the Contractor shall arrange for the QA Inspector to certify satisfactory completion of factory functional tests for the switchgear and control equipment.

• Acceptance by the Employer’s Engineer of satisfactory completion of factory functional tests in no way relieves the Contractor of his obligation to rectify defects, which may have been overlooked or become evident at a later stage.

Site Acceptance Tests (SAT)
• The Contractor’s Test Engineer shall be responsible for the calculation of all relay settings as well as all other protection settings.

• On-site tests and subsequent commissioning shall not commence until all construction work has been completed. Construction staff, material and equipment

Signature of Bidder/s: ________________________________ Date: ____________
shall be removed from site prior to the commencement of testing. Testing and commissioning of the substation equipment will not be allowed to take place in a construction site environment.

- The Contractor shall be responsible to conduct functional test on all equipment and circuitry to prove the proper functioning and installation thereof. Proper operation of the protection system including the tripping and lockout functions as well as interlocking required shall be checked and ensured.
- The Engineer shall arrange for the Employer's Electrical Engineer and the TFR Test Department Engineer to be present to witness the on-site tests.

4.4.6 Labelling

- All nameplate and warning boards shall be in English.
- All lettering shall be white on a black background. Lettering shall be a minimum of 5mm in height unless otherwise approved by the Engineer.
- All labels shall be neatly secured by rivets or screws.
- Danger warning notices shall be supplied and fitted to the substation buildings access doors.
- All signs shall be supplied complete with supporting brackets, bolts and nuts.

4.4.7 Overhead Track Equipment (OHTE)

The OHTE works for the building include the following:

- Relocate the existing OHTE mast which is in the way of the new rail line to be built, to a new position indicated in OHTE drawings.
- The supply and installation of fixed terminated tubular cantilever 25kV AC overhead track equipment, concrete masts 84kN and small part stainless steelwork (3CR12) on the south west side to the entrance of the workshop as per the design drawings.
- Commissioning and testing of the systems.

Wiring

- All catenary wire, contact wire and earth wires are to be fixed terminated at anchors.
  Wire sizes: 161mm² contact wire – Cu
  160mm² catenary wire – Cu
  50mm² earth wire – AAL
- Contact wire height shall match with the existing. Except at bridges where profiling of the conductors will be required.
- Only cross-contact wire method of anchoring shall be used. Fixed type cantilevers shall be installed with a system separation of 2m between the contact and catenary wires.

Masts and cantilevers

- Galvanised universal column mast shall be installed on a bolt group foundation where indicated on the design layout. Otherwise pre-stressed 85kN 13m concrete masts shall be installed to match the existing OHTE installation as indicated on the OHTE layout designs. Maximum span lengths for the fixed termination in yards will be 60m. Cantilevers shall be of the tubular type with a tie bar.

Small part steelwork

- All small part steelwork shall be 3CR12 stainless steel and painted.
Insulation
- All insulators shall be of the silicone high pollution vandal proof type.

Bonding and earthing
- All mast to rail bonds are to be 97mm² galvanised stranded steel wire with a PVC covering.
- All structures are required to be connected via an earth wire. Where not possible such structures shall be double bonded. No steelwork shall be left floating during construction as well as on completion of the final works. All switch structures shall be provided with a grading ring in 25kV AC sections.

Painting
- All small part steelwork shall be painted in accordance with the TFR’s paint specifications.
- Masts to be numbered as per TFR standards. Masts shall have an appropriate approved primer applied for good paint adhesion before the first white background top coat is applied.

As-built Documentation
The Contractor provides the following:
- The Contractor shall mark-up the construction drawings with as-built information.
- The Contractor shall submit all as-built quality measurements.

As-Built/Final Documentation
- In undertaking the 'Works' (including all incidental services required), the Supplier shall conform and adhere to the requirements.

Installation, Maintenance and Operating Manuals and Data Books
- In undertaking the 'Works' (including all incidental services required), the Supplier shall conform and adhere to the requirements.

4.5 MECHANICAL ENGINEERING WORK

The mechanical works for the building include the supply, delivery, installation, testing, commissioning and handover of the following:

- HVAC (Heating, Ventilation, And Air Conditioning) systems and all associated components.
- 5 ton overhead travelling workshop gantry crane.
- Cold water reticulation systems including pipes, pipe fittings, pipe supports, valves and all associated components.
- Geyser to be fitted 200l high pressure with all accessories outside building.
- Cold water connection to water mains pipeline including all check valves, isolating valves, strainer, water flow meter and all associated valves and pipe fittings.
- Fire Protection system and all associated firefighting equipment including all fire water pipework reticulation, fittings, valves, fire hydrant standpipes, fire hydrants and all associated components.
- A mobile compressed air compressor unit.
- Painting and corrosion protection of equipment.
- Commissioning and testing of the installations.

Signature of Bidder/s: ___________________________ Date: ________________
And any other work arising out of or incidental to the above, or required of the Contractor for the proper completion of the works.

4.5.1 Design And Drawings

**Contractor’s Responsibilities:**
- Plant is positioned and installed in such a way as to ensure proper access for service and maintenance.
- All control panels, wiring and components of the electrical installation forming part of this contract shall comply with all application safety codes standards and regulations.
- In addition to abovementioned, the Contractor may comment on aspects of the design with a view to realise improvement or cost saving, but must draw to the attention of the Project Manager any aspect of the design which in his view not appropriate. The final decision and responsibility rests with the Project Manager.
- The Contractor shall comply with all regulations and by-laws of local or other authorities having jurisdiction regarding the execution of the works. The Contractor shall not be responsible for non-compliance where this results from the system design.
- Specific aspects of equipment selection which must be carried out by the Contractor together with the Suppliers of such equipment in order to achieve the design system performance are listed below.

**Equipment Supports**
- The Contractor shall be responsible for the design of supports, stands, hangers suspended platforms for machinery or other equipment. Where such elements involve major structural design which is beyond the capability of the Contractor then these shall be referred to a suitably qualified person for design.

**Workshop Drawings**
- Preparation of complete shop drawings is the responsibility of the Contractor. The shop drawings must be prepared on the basis of:
  - The latest Architect’s, Structural Engineer’s and Electrical Engineer’s drawings regarding co-ordination and layout.
  - Actual equipment offered in the Tender and accepted by the Employer. No work may be put in hand before the relevant shop drawings have been reviewed by the Engineer.

**Builders Work Drawings**

**Openings**

The Contractor shall show all openings and other finishes on layout drawings in such a way as to constitute a clear instruction to others.

**Plant Submittals**

Before ordering, the following list of equipment offered by the Contractor it shall be submitted to the Project Manager for acceptance:

**Signature of Bidder/s:** ___________________________  **Date:** ____________
• Air Conditioning Equipment
• Ventilation Equipment/Parts/Fixtures
• Pumps
• Fans
• Air and water equipment

**Noise and Attenuation**

- In respect of noise control and attenuation the Contractor shall be responsible for the supply and installation of all plant as per the relevant standards and specifications, including sound attenuators, spring mounts, mass bases, flexible connections etc., to limit undesirable noise generation and transmission. Correct selection of the items listed below shall be the responsibility of the Contractor together with the Specialist Supplier:
  - Spring Mounts
  - Vibration Isolating pads
  - Spring Hangers and Supports for Pipes
  - Vibration Isolating Hangers and Supports for Pipes
  - Flexible connections

- The Contractor shall also be responsible to ensure that where ducts and pipes pass through concrete, brick or other structural members and finishes. This is achieved without transmission of noise and vibration

**4.5.2 Technical Requirements**

**Erection of Equipment**

- The Contractor shall allow for a complete installation, including the provision of mobile cranes, air compressors, lifting tackle, measuring equipment, precision levels, and all other special or regular tools and equipment that may be needed to complete the entire installation in accordance with the specification.
- The Contractor will be responsible for the rectification of any damage caused to buildings, equipment, plant etc. during the course of the erection of the equipment.

**Plant Plinths**

- Plinths as specified hereunder shall not be confused with any form of inertia or anti-vibration base.
- Plinths shall be provided for all floor standing mechanical plant. Plinths cast on concrete surfaces shall protrude at least 100mm above floor levels and depending on the position of the vibration mountings.
- Plinths for plant which do not need inertia bases or plinths for inertia bases with recessed vibration mountings shall be of the same size as the plant or bases mounted on top.
- The Plinths shall be designed to be able to support the weight of the plant being fixed on them and the surface shall be completely horizontal and even.

**Holding Down Bolts and Bolts for Plant**

Signature of Bidder/s: ________________________________ Date: ____________
• The Contractor shall be responsible for the supply of all necessary holding down bolts for the plant supplied by him. He shall also supply all bolts necessary for assembling all the supplied equipment by him.

• Holding down bolts shall preferably be cast into concrete bases when the bases are being cast. All bolts shall, in this instance, be provided with hot dip zinc galvanised sheet metal sleeves approximately three times the diameter of the bolt, and projecting a minimum of four-bolt diameters below the surface of the concrete. This sleeve must be kept free of concrete until the final grouting takes place.

• Where galvanised bolts are called for, it shall be fully galvanised all over. No recutting of threads will be permitted after galvanising. All nuts must run freely on the threads.

**Bed Plates**

• All bedplates shall be of fabricated hot dip zinc galvanised mild steel with surfaces on which the pumps, motors, heat exchangers etc. are mounted.

• All bedplates shall be stress relieved after welding but before machining. Each bedplate shall be provided with approximately eight horizontal jacking screws with locknuts for each unit mounted thereon to assist in aligning the pumps and motors, etc.

• It will not be necessary to dowel equipment in place, provided the jacking screws specified above are fixed and locked.

**Packing of Equipment**

• All base plates and steel work shall be suitably packed with steel packs to ensure that they are true to level, line and grade. The thickness of packing shall be such as to allow for not less than 25mm, and not more than 50mm of grout under all base plates or steel work. Packings shall be of suitable size to support the base plates and one pack must be situated immediately on each side of each holding down bolt as well as in any position as may be required in order to adequately support the base plates and its superimposed load.

• All packs shall be as near as possible to the exact height in one thick piece. Thinner shims may be used for final adjustments, but large piles of thin shims will not be accepted. All packs must be of parallel shims. Taper packs or wedges will not be accepted. Packs must be bedded on a flat and smooth area on the surface of the concrete foundation. Packs resting on rough concrete will be rejected.

• After final levelling and lining up, it is essential that all packs are tight. Loose packs will be rejected.

• No shims will be permitted between a machine base and plate and the machine’s feet except as mentioned hereinafter.

**Alignment of Equipment**

**Bedplates**

• Where plant is delivered completely assembled on a bedplate, these items of plant shall be removed from the bedplate prior to installation. The bedplates shall first be installed, levelled, lined up and packed to ensure that there is no twist or distortion therein. The machines shall then be installed on their bedplates and the final alignment carefully checked and adjusted until it is completely level.
• Minor corrections to the alignment of machines may be carried out using thin shims between the machinery feet and the machined surface of the bedplate. This applies particularly to electric motors.

**Couplings**
• The alignment of all couplings must be carefully checked for both the parallelism and eccentricity of their shafts. Alignment must be carried out to the manufacturer’s tolerances.
• In any event, a misalignment of more than 0.05mm will not be permitted for either parallel or eccentric misalignment as measured at the periphery of the couplings. It is essential that a dial micrometer is used to set the final alignment, which must be witnessed by the Project Manager’s Representative.

**Assembly of Components**
• It is essential that all mating components such as couplings, taper lock bushes, machined faces, etc., be thoroughly cleaned with a suitable solvent before assembly. All surfaces must be free from burrs or irregularities, which may prevent the correct mating of the surfaces.
• A molybdenum-disulphide lubricant similar or equivalent to Mobil-grease Super shall be used on the threads of all bolts and between the mating surfaces of all parts closely fitted together, such as shafts and couplings, keys and base plates. PTFE tape shall be used in all screwed pipe connections.

**Welding**
• Welding shall be carried out in accordance with the current edition of SANS 10044 where applicable.
• All welded filler or butt joints shall be free from porosity, cavities and entrapped slag.
• The joints in the weld run, where welding has been recommended, shall be as smooth as possible and shall show no pronounced hump or crater in the weld surface.
• The profile of the weld shall be uniform, of approximately equal leg length and free from overlap at the toe of the weld. Unless otherwise specified the surface shall be either flat or slightly convex in the case of fillet welds and with reinforcement of not more than 3mm in the case of butt welds. The weld face shall be uniform in appearance throughout its length.
• Filler metal electrodes shall be of an approved type for the material being used and shall be kept in a dry condition. All electrodes shall conform to the latest edition of SANS 2560.
• Only welders in possession of a valid approved competence certificate shall be employed.
• All welds must show proper fusion.

**Galvanising**
• All fabricated mild steel sections, pipework, fixtures and fittings shall be hot dip zinc galvanised to comply with SANS 62 and SANS 1182:2013 and shall be of minimum mean coating thickness 170µm.
• Items to be galvanised shall be entirely pre-fabricated and then dismantled in sections for galvanising. No cutting of threads or welding will be accepted after galvanising.

Signature of Bidder/s: ___________________________ Date: ___________
• Mild steel plate and sections shall be of good commercial quality, or higher grades, best suited for galvanising. The materials shall be free from slag or coarse laminations, fine fissures and rolled-in impurities.
• Welding flux shall be chipped away and all welds wire brushed before galvanising.
• The surface to be galvanised shall be free from paint, oil, grease and similar impurities.
• All exposed surfaces including welds shall be thoroughly sand blasted prior to galvanising.
• The Project Manager reserves the right to inspect all steel components before galvanising, and shall have the right to reject or ask for remedial treatment of any material which is considered to be unsuitable. This applies particularly to welds.
• The hot dip galvanizing bath shall primarily contain molten zinc. The total of the other elements (as identified in ISO 752, EN 1179 or EN 13283, excluding tin and iron) in the molten zinc shall not exceed 1.5 % by mass.
• The significant surface(s) of all the hot dip galvanized article(s), when first examined by normal or corrected vision from a distance of not less than 1 m, shall be free from nodules, blisters (i.e. raised areas without solid metal beneath), roughness and sharp points (if either can cause injury) and uncoated areas. Flux residues shall not be permitted. Lumps and zinc ash shall not be permitted where they might affect the intended use of the hot dip galvanized article or its corrosion resistance requirement.
• Articles that fail visual inspection of the galvanising shall be renovated according to the criteria mentioned in clause 6.3 of SANS 121: 2011.

Vibration Control

Vibration Isolation

• Proper provisions shall be made in the foundations and mountings of all plant capable of transmitting vibration forces to its environment, whether local or remote, (as is the case with pipes) for vibration isolation.
• Selection of vibration isolation equipment and in particular, mountings for plant and machines, shall be done with due regard to the forcing frequency of the driven machinery and the mounted natural resonant frequency of the machine.
• In the case of installation of equipment on upper floors, suspended floors, roofs etc. it is of prime importance that floor stiffness, floor deflection and natural frequency of the floor be taken in to consideration to ensure that resonant conditions cannot occur.
• Driven machinery and isolator deflections shall be carefully selected in these applications.
• Should added mass inertia blocks be required to comply with these vibration isolation requirements, proper provision shall be made at tender stage for the provision of such.

Damping

• Where static deflections in excess of 8mm are indicated, steel springs shall be employed incorporating acoustic sound pads in series with the spring.
• The horizontal stiffness of the springs shall not exceed that in the vertical, in particular for systems mounted at vertical frequencies below 5Hz.
• Low frequency mounts shall incorporate rubber snubbers to accommodate extreme horizontal or vertical motions such as can occur near resonance during start up.

Signature of Bidder/s: ___________________________ Date: ____________
• The snubbers shall however not be relied upon to provide the necessary horizontal stability of the machine in normal operational conditions. Spring layouts and inertia blocks shall be employed to avoid this situation.
• For static deflections below 8mm, rubber in shear mounts may be used provided the frequency is above 6Hz.
• For small static deflections less than 4mm and particularly for high-speed machines and general acoustic isolation, ribbed rubber neoprene composite pads may be employed subject to the specified requirements.
• Sufficient stability and damping shall be incorporated in the mountings to minimise the movement of the machine during start up or changes in the operating conditions.
• The selection of mounts shall take proper cognisance of unequal distribution of the mounting weight of equipment and rotational and/or pressure forces acting thereon.

Painting
• The paint color scheme shall comply fully with the SANS 10140 requirements.
• All steel surfaces that need to be painted shall be prepared as per SANS 8501-3 and SANS 10322.
• All exposed portions of hot water tanks, heat exchangers, cylinders, etc. shall be properly cleaned, primed and painted two coats of heat resistant paint.
• All other exposed metal parts such as pumps, belt guards, all piping, pipe lagging, fittings, dampers, fans, coils, motors
• Packaged units, control panels, steelwork, exposed ducts and lagging, expansion tanks, make-up tanks, cooling tower, unit shelters, etc. shall be cleaned, primed, undercoated and finished in a high quality gloss paint of approved colour.
• All external plant exposed to the weather must be cleaned, primed and painted with two coats of epoxy paint.
• The lagged surface of calorifiers, headers and pipes shall be primed, undercoated and finished in a high quality gross of approved colour.

Machinery, Structural Steelwork Colors:

<table>
<thead>
<tr>
<th>Description</th>
<th>Color</th>
</tr>
</thead>
<tbody>
<tr>
<td>Checker plates, Pipe supports, Handrails, Base plates</td>
<td>Black</td>
</tr>
<tr>
<td>Body portions of machines</td>
<td>Olive Green</td>
</tr>
<tr>
<td>All machinery external to the building (except piping, valves and fittings)</td>
<td>Dove Grey</td>
</tr>
<tr>
<td>All moving parts which are visible when operating In-side surfaces of all machine guards, belt guards etc.</td>
<td>Orange</td>
</tr>
<tr>
<td>All handles, levers, hand wheel centres adjustment knobs, etc.</td>
<td>Yellow</td>
</tr>
<tr>
<td>All lagging on boilers, calorifiers, tanks, cylinders etc. except on piping and pump sets and ducting)</td>
<td>Aluminium</td>
</tr>
</tbody>
</table>

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Electrical distribution boards (except where transparent covers are used) | Light Grey
---|---
Control panels and Indicator panels, Water treatment plant (except on piping), Air Conditioning plant (except on piping) | Light Blue
All points which constitute a physical hazard, e.g. (stay-wires, low pipes, access areas) | Yellow and Black
Doorways, Cross Hatch, Drainage piping | Black

**Piping, Pumps, Valves, Fittings, etc.**

- Except where otherwise specified all piping on surfaces shall be painted with a primer, an undercoat and a finishing coat in approved high quality gloss paint to the colour indicated in the schedule below. This also applies to all holder bolts, supports, anchors, fittings and valves.
- Pump sets, valves, fittings, etc. shall be painted the same basic colour as the pipelines, except those of firefighting services, which shall be painted red.
- Where bands are painted for identification purposes over a base colour, the length of the band shall be same as the final pipe diameter, but not less than 100 mm. Where three strips are required per band, each strip shall be one third of the final pipe diameter but not less than 35 mm.
- The direction of flow shall be indicated with a 25 x 100 mm long black arrow at intervals of approximately 4 m and at valves and junctions. Flow lines shall be marked with an F and return lines with an R at each arrow.
- Where outlets require identification the colour identification shall take the form of coloured centre pieces on hand wheels or cocks, and/or other suitable approved marking on the neck of the outlet fittings as specified. The colour shall primarily be that of the pipe colour and where banding is used, the colour shall be that of the band and stroke.
- All radiators, pipes, fittings etc. in finished areas such as wards, offices, passages, etc. shall be cleaned, primed, undercoated and finished in a high gloss paint to match the existing finish.

**Identification Colours:**

<table>
<thead>
<tr>
<th>Basic Pipe Colour</th>
</tr>
</thead>
<tbody>
<tr>
<td>Drinking Water</td>
</tr>
<tr>
<td>Condenser Water</td>
</tr>
<tr>
<td>Boiler Feed Water</td>
</tr>
</tbody>
</table>

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<table>
<thead>
<tr>
<th>Boiler Condensate</th>
<th>Brilliant Green (D10)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chilled Water lines</td>
<td>Brilliant Green (D10)</td>
</tr>
<tr>
<td>Domestic Hot Water</td>
<td>Brilliant Green (D10)</td>
</tr>
<tr>
<td>Fire Fighting Mains</td>
<td>Signal Red (A11)</td>
</tr>
</tbody>
</table>

### 4.5.3 Mechanical Plant/Equipment

- The mechanical plant, supplied and installed by the Contractor shall comply with the requirements set out in this document as well as all relevant SANS requirements.
- The water line providing the main supply to building facilities shall be metered in order to simplify the control and monitoring of the water usage.

**Type of Air-conditioning Units**

- Individual ceiling cassette unit variable refrigerant flow air conditioning units shall be installed in each of the following areas:
  - Open plan office
  - Kitchenette/mess room
- The units shall be of a specification equal or similar approved by the Project Manager's to that provided.
- It is essential that the acoustical characteristics of the units are considered during selection and that they are installed to ensure compliance with the noise criteria laid down. The sound pressure level from these machines shall be within the set criteria throughout the frequency range.
- The indoor units shall be equipped with a suitable control thermostat, drain pan and drain piping, controls and control panel and complete wiring, including interlocking with outdoor unit.
- The outdoor units shall contain the matching compressor unit, air-cooled condenser, condenser fan within a waterproof painted and corrosion protected casing.
- The indoor/outdoor units shall be interconnected with refrigerant piping (separately insulated suction and delivery piping for reverse cycle units), electric wiring and interlocking control cabling. Where visible and/or exposed to the weather or possible mechanical damage refrigerant piping and cabling shall be run inside galvanised sheet steel trunking, neatly erected and painted as specified.
- Provision shall be made in all cases for the drainage of excessive condensate to the nearest building drain by means of uPVC tubing.
- For reverse cycle heating units, including split type units, a proper drip-pan with drainage piping as above shall be provided for the outdoor units where dripping can create unacceptable conditions.
- Where drainage piping is required to be installed flush mounted, positioning and chasing shall be done in good time to meet construction programmes.
- All panels shall be neat fitting with hardwearing exposed surfaces of baked enamel or equal finish of approved colour.

Signature of Bidder/s: ___________________________ Date: _______________
• Electrical interlocking shall be provided to ensure that:
  • Compressor cannot run without both indoor and outdoor fans running,
  • Electric heating elements can only be switched on if the indoor fan is running,
  • It shall not be possible to switch cooling and heating on simultaneously.

Fans
• The fans shall be of a specification equal or similar approved to that provided. The fans shall be selected to comply with the ventilation requirements of SANS 10400.
• All fans shall be selected for the highest possible efficiency and comply with the noise criteria specified.
• Fans shall not be directly connected to ducting either on the inlet or outlet sides, approved flexible connections shall be provided between the fan inlet/discharge and ducting or Plant as appropriate. Flanges are required with flexible connections.
• Fans shall be installed with anti-vibration mountings to match the fan characteristics.
• Where fan noise characteristics cannot meet the requirements of this specification such fans shall be replaced or other approved steps taken by the contractor at his own expense until the installation meets the requirements.
• Fans shall be selected for the highest possible efficiency with the lowest possible blade tip speed.
• Fans shall be fitted 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.
• Indicating arrows for both direction of rotation and direction of airflow shall be provided on fan casings.
• Fans shall 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.
• The complete fan unit shall be statically and dynamically balanced to ISO 1940 G6.3.
• Fan performance shall be based on tests carried out in accordance with BS 848: Part 1 as amended.
• Fan motors shall be totally enclosed squirrel cage induction type with protection to IP 55.
• Fans shall be suitable for continuous operation in high humidity conditions.
• All fan Casings and fasteners shall be hit dip zinc galvanised steel.
• All Plant shall be positioned with the manufacturer minimum clearances allowed for to provide sufficient space for the correct operation and maintenance.

Sound Attenuators
• Where required, in order to comply with the noise and vibration criteria already laid down, or where specified in the drawings, sound attenuators shall be provided for ventilation, air conditioning and all other equipment (Duct mounted and/or as applicable).
• The attenuators selected shall match the specific fan or plant characteristics to ensure the correct insertion loss to meet the sound criteria laid down.

Signature of Bidder/s: ___________________________ Date: ____________
• Unless otherwise specified, sound attenuators shall be installed with flexible connections at the inlet and outlet connections.
• The sound attenuators shall in addition be selected to produce the minimum pressure loss across the attenuator coupled to the least re-generated noise level produced by the flow through the attenuator.
• Unless otherwise specified, air path sound attenuators shall be manufactured from galvanised sheet steel with the sound absorption material moisture repellent and erosion resistant up to 20 m/s air speed, and preferably flange connected.
• Wherever possible attenuators shall be proprietary type supplied by the same manufacturer as the equipment manufacturer to ensure complete compatibility.
• The internal free area of sound absorbers shall be not less than the cross sectional area of the connecting duct as indicated on the drawings

Air Filters
• Air filters shall be provided on all air inlet points in order to maintain good air quality in the facilities.
• Filter efficiency and arrestance shall be in accordance with ASHRAE Test Standard 52-76.
• Construction and manufacture of all components shall be such that under no circumstances any unfiltered air can by-pass filters or filter banks.
• Sufficient space shall be allowed in front or behind filters, as applicable, to enable inspection and servicing.
• Tubes for the measuring of the pressure drop across each filter bank shall be fitted as standard to enable connecting a manometer or other instrument as specified.
• All filters shall be fitted with inclined pressure differential manometer gauges, clearly marked with filters clean (green) and filters dirty (red) indicators of a permanent type.
• Fan and system selection shall allow for expected final filter resistance to ensure a supply air quantity in excess of 90% of design air quantity immediately prior to filter replacement.
• Filter duct casings shall be made of galvanised sheet steel with de-contaminable powder coating RAL 9010.
• The filter duct casing shall ensure precise fitting of the filter elements.

Grilles/Diffusers
• Grilles/diffusers (except door grilles) shall be manufactured of stamped, extruded or rolled galvanised steel sections, finished as specified and mounted in a neat frame.
• Each diffuser shall be selected in accordance with the manufacturer's recommendations to be capable of passing the specified air quantity without creating excessive resistance, noise or local draughts.
• Door grilles shall be manufactured from aluminium extruded sections, natural anodised (9E6-C-0).

Louvres
• Weather louvers shall be manufactured from 316 stainless steel finished in natural anodised aluminium.
• Weather louvers shall be watertight even with nominal air velocity up to 3,0m/s.

Signature of Bidder/s: ______________________ Date: ____________
• Weather louvers shall in all cases be selected with free air passage areas not less than that indicated on the drawings.
• The louvers shall be fitted with 6mm opening size galvanised metal mesh screen
• Top and bottom blades shall be fitted flush with the frame and smooth without grooves, channels or recess where dirt or water can collect.

Pumps
• All pumps shall comply with the requirements already laid down for noise vibration and noise criteria.
• Each pump motor shall be sized so that it will not overload.
• The Contractor shall provide raised concrete plinths of the appropriate structural integrity to hold the weight of each pump. A single plinth may be provided for pumps which are located next to each other. The plinth surfaces must be completely horizontal and even.
• Each pump base-plate shall be hot dip zinc galvanised to a minimum mean coating thickness of 200μm.
• A low flow switch shall protect the pump from damage due to closure of valves in the pumping circuit.
• Each pump shall be mounted on a concrete inertia base which shall include Mason Industries (or other accepted) spring mounts selected by the suppliers of the pumps.
• All pumps shall have mechanical seals of types to suit the service application and as recommended by the pump manufacturer. The seals shall be guaranteed by the pump manufacturer for the service intended.
• Provide an emergency latching type stop button adjacent and within reach of the respective pump motor.
• When connecting the pump to the piping, the pump should not be used as an anchorage point for the piping. The pipelines shall be anchored in close proximity to the pump and connected without transmitting any stresses or strains. The forces exerted at the pump nozzles shall be kept below the maximum permissible forces as per the pump manufacturer’s directions.
• The suction lift line shall be laid with a rising slope and the suction head line with a downward slope towards the pump.
• In order to stabilise the flow before entering the pump, the suction piping entering the pump shall have a straight length equivalent to at least two and a half times the diameter of the suction flange.
• Before installing the pump in the piping, remove the flange covers on the suction and discharge nozzles of the pump to check that the inside of the pump is free from any foreign objects.
• The pump and motor shafts shall be aligned to prevent damage to the pump.

Water Pipework and Fittings
• Full radius bends and sweep fittings must be used wherever possible. Elbows may only be used under exceptional conditions and only with written permission of the Project Manager. Where it is necessary to reduce pipes in size, reducing sockets only shall be used and not bushes.
• Piping shall not be bent or formed in any manner during installation.
• In horizontal runs of piping, where there is only a slight fall eccentric fittings are to be used.

Signature of Bidder/s: ___________________________ Date: ____________
• Under no circumstances shall any piping be directly connected to noise generating equipment such as pumps, heat pumps etc. Connections to such equipment shall be made with correctly selected flexible rubber type connectors of the spherical type.
• Where tubing passes through walls or ceilings, etc., neat PVC sleeves shall be used. The inside diameter shall be such that the insulated piping can pass through the sleeves. Gaps between the insulation and PVC sleeves must be sealed with a non-hard setting putty.
• All underground piping shall be HDPE Class 12 unless otherwise indicated.
• All above ground cold water pipework shall be Class 1 copper and shall comply with the minimum standard when tested in accordance with the latest edition of SANS 6509.
• All solder, fluxes and the method of soldering shall comply with the latest edition of SANS 460.
• All fittings shall comply with the requirements of the latest edition of SANS 1067, as relevant.
• All pipework shall operate effectively under all normal conditions likely to be experienced when the water installation is in service.
• All cold water pipework shall be able to withstand up to 40 °C water temperature.
• Piping shall be supported (unless otherwise indicated on the drawings) as per figure 3 below:

<table>
<thead>
<tr>
<th>DIAMETER</th>
<th>MAXIMUM SUPPORT SPACING METERS</th>
</tr>
</thead>
<tbody>
<tr>
<td>15mm</td>
<td>1.8</td>
</tr>
<tr>
<td>22 – 28mm</td>
<td>2.4</td>
</tr>
<tr>
<td>34 – 54mm</td>
<td>3.0</td>
</tr>
<tr>
<td>76 – 108mm</td>
<td>3.6</td>
</tr>
</tbody>
</table>

**Figure 3**

• All supports and anchors shall compensate for thermal expansion of the piping. Pipe supports fixed to sensitive building elements shall not be permitted.
• Fittings shall be ANSI (ASA) B16.9 standard thickness with table flanges up to 1000kPa.
• All butterfly type valves shall include for spool pieces to enable removal of equipment.
• Before piping is installed the internal surfaces shall be cleaned of all mill scale and oil to prevent the clogging of strainers, plate heat-exchangers, control valves and constant flow valves.
• Before any pump is operated, thoroughly flush out piping systems and remove, clean and reinstall all strainers elements and built-in strainer elements of water balancing valves. Repeat periodically until all water circulating systems specified herein are completely free of foreign matter.
• In order to avoid clashing of services and unnecessary disputes the Selected Subcontractor shall liaise with the Plumbing, Electrical and Fire Services Subcontractors with regard to piping, ducting, cable trays, cable racks, etc., routes shown on the drawings and co-ordinate the installations with them.

Signature of Bidder/s: ___________________________ Date: __________
- All low points in the water circuit shall have drain points to allow the circuit to be drained.
- All high points in the water circuit shall have automatic air purge valves to allow for purging of air.
- Stop valves shall be installed close to the entering and leaving water connections to the Heat Pumps.
- All rubber components that are in contact with potable water, such as joint rings, tap washers and flange packings, shall, in order to control the multiplication of Legionella pneumophila bacteria in water installations, be of a composition that will not promote microbiological growth. Rubber joint rings shall comply with the relevant requirements of the latest edition of SANS 4633.

**Strainers**

- Water strainers shall be of the pot or angle type. Strainers shall be designed for not less than 1000kPa or 1.5 times the maximum system working pressure whichever is the greatest. Strainer screens shall be of bronze or stainless steel and shall have maximum perforation as per Figure 4 below.

<table>
<thead>
<tr>
<th>Strainer Size (mm)</th>
<th>Perforation Size (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2 - 50</td>
<td>0.8</td>
</tr>
<tr>
<td>65 - 150</td>
<td>1.6</td>
</tr>
<tr>
<td>200 - 300</td>
<td>3.2</td>
</tr>
<tr>
<td>over 300</td>
<td>6.4</td>
</tr>
</tbody>
</table>

**Figure 4**

- The effective free area of the screen shall in all cases be not less than 3 times the cross sectional area of the inlet opening.
- Strainers shall be installed in accessible positions where the strainers can be easily removed and cleaned.

**Pressure Gauges and Thermometers**

- Pressure gauges shall have at least a 100mm dial and be calibrated in kPa with the maximum range not exceeding 1.5 times the system working pressure. Forged brass or gunmetal gauge cocks must be fitted with each pressure gauge.
- Thermometers shall be of the replaceable glass type with bronze casings, fitted into pockets for removal without draining the system. The thermometers shall be calibrated in °C and the scale length shall be at least 170mm. Pockets shall be of brass, filled with oil and shall be installed vertically. On pipes smaller than 50mm diameter, pipe sizes must be increased locally to install the sockets.

**Air Release Valves**

- Automatic air release valves shall be provided where shown on the drawings, but shall in addition also be fitted to piping at all high points and other places where air...
may accumulate. As these points depend on the installation of the system, full
responsibility for fitting these valves rests with the Contractor.
• Valves shall have either integral shut-off valves or be preceded by a lock shield valve.
• Connections to the service pipe shall be made at the highest point to ensure
complete venting. Valves shall be mounted with the inlet connection exactly vertical.

Valves
• All valves shall comply with the regulations of the latest version of SANS 1808.
• Drain valves shall be fitted to all low points in the installation to ensure full draining
of the system.
• Diaphragm type valves and gate valves shall not be used for balancing or throttling
purposes.

Insulation
General
• Insulation shall in all instances be applied by specialist Contractors
and be of the highest standard. Any section not installed to the
approval of the Project Manager’s Representative shall be re-done at
the Contractor’s expense.
• Data sheets for all insulation and accessories shall be submitted to
the Project Manager’s Representative for acceptance to ensure that the
listed requirements are met.
• Material shall be delivered in non-broken, factory furnished
packaging and stored in a clean, dry indoor space that provides
protection against the weather.
• Progressive testing of the systems to be insulated shall have been
completed, inspected and approved by the owners' representative
before the insulation is applied.
• Insulation shall not be applied until all surfaces are clean, dry, and
free of dirt, dust, grease, frost, moisture and other extraneous
elements.
• Insulation, cladding and vapour barriers shall be painted as specified.
• All items of plant likely to operate at temperatures below the
surrounding ambient dew point shall be insulated and provided with
a vapour barrier.

Fire Hydrants
• Hydrants shall be 65 mm size screwed inlet gunmetal construction to SANS 1128,
fitted with 65 mm instantaneous female coupling with removable blank cap and
retaining chain.
• The valve hand wheel shall be 150 mm minimum diameter and marked with "OPEN"
and "SHUT" direction plate and shall normally be secured with strap and padlock.
• Hydrants shall be supplied complete with 30 m lay-flat hose and fittings and
fiberglass storage cabinet.

Hose Reels

Signature of Bidder/s: ___________________________ Date: __________

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- Internal hose reels shall be provided complete with 30m hose C.P. stopcock, shut-off nozzle and wall bracket all supplied and installed in accordance with SANS 543, SANS 10105 -1.

**Fire Extinguishers**
- Portable fire extinguishers shall be provided as per the drawings as per SANS 1910. The fire extinguishers shall be hung on purpose made hardwood backing boards.
- The fire extinguishers shall be supplied and installed in accordance with SANS 1910, 1475-1 and SANS 10105-1.
- All equipment and material to be supplied for the project shall be designed assembled inspected and certified in accordance with the relevant standards.

**Fire Hose Cabinets**
- Each fire hose shall be provided with a cabinet.
- These shall be constructed from SANS approved polyester resin and materials, closed back, red finish with break-glass key storage, sized to suit rolled lay-flat 30 m hose.
- These shall be wall mounted by means of stainless steel raw bolts.
- Above ground Piping and valves for fire water

<table>
<thead>
<tr>
<th>ABOVE GROUND PIPING AND VALVES</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Service : Fire Water</strong></td>
</tr>
<tr>
<td><strong>Pressure/Temperature ratings:</strong></td>
</tr>
<tr>
<td>PN16/50oC</td>
</tr>
</tbody>
</table>

- Piping: Signal red (SANS 1091 -A 11)
- Foam concentrate piping: White (RAL 90160)
- Water -foam mixture: Light blue

**PIPING**

| 15NB to 40NB | Welded steel pipe manufactured to SANS 62-1 Medium grade/plain ended and galvanised to SANS 121. |
| 50NB         | Welded steel pipe manufactured to SANS 62-1 Heavy grade/plain ended and galvanised to SANS 121. |
| 65NB to 80NB | Welded steel pipe manufactured to SANS 62-1. Heavy grade/plain ended. |

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<table>
<thead>
<tr>
<th>Diameter</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>100NB to 400NB</td>
<td>Welded steel pipe manufactured to SANS 719 Grade B 6 mm wall thickness/plain ended.</td>
</tr>
</tbody>
</table>

**Ring Main Risers**

<table>
<thead>
<tr>
<th>Diameter</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>All piping rising from the underground ring main to above ground level shall be flanged fully galvanised (after pre fabrication) welded steel. The pre-fabricated risers shall be painted.</td>
<td></td>
</tr>
</tbody>
</table>

**FLANGES**

<table>
<thead>
<tr>
<th>Diameter</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>15NB to 50NB</td>
<td>Steel flanges to SANS 1123 1600/4 screwed.</td>
</tr>
<tr>
<td>65NB to 400NB</td>
<td>Slip on flanges to SANS 1123 Table 1600/3, unless otherwise specified or shown on drawings. All puddle flanges shall be to SANS 1431.</td>
</tr>
</tbody>
</table>

**Pipe to pipe**

<table>
<thead>
<tr>
<th>Diameter</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>&quot;Klambon&quot; or similar approved type fittings</td>
<td></td>
</tr>
</tbody>
</table>

**FITTINGS**

<table>
<thead>
<tr>
<th>Diameter</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>15NB to 50NB</td>
<td>SANS 14 Malleable cast galvanised taper thread and beaded.</td>
</tr>
<tr>
<td>65NB to 400NB</td>
<td>Buttweld seamless fittings to BS 1640 A234 Grade WPB. Wall thickness as per pipe line.</td>
</tr>
</tbody>
</table>

**BOLTS/NUTS**

<table>
<thead>
<tr>
<th>Diameter</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Galvanised black CS HRH nut and bolt SANS 1700 Grade 4,6 bolt and Grade 4 nut.</td>
<td></td>
</tr>
</tbody>
</table>

**GASKETS (Full face)**

<table>
<thead>
<tr>
<th>Diameter</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>All gaskets for steel to steel flanged joints shall be in accordance with the requirements of BS 3063 and be full-faced 3 mm thick compressed synthetic fibre {CSF} type gaskets to BS 2815: Grade A.</td>
<td>Thread Sealant P.T.F.E. Tape</td>
</tr>
</tbody>
</table>

**VALVES**

<table>
<thead>
<tr>
<th>Diameter</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gate 65NB to 350NB</td>
<td>CI. Body, Resilient gate, rising spindle. Handwheel operated. Flgd. SANS 1123</td>
</tr>
<tr>
<td>Check 15NB to 50NB</td>
<td>Bronze check valve, PN 32 screwed bonnet guided lifting type, newable composition disc. Ends screwed ISO-R7.</td>
</tr>
<tr>
<td>Check 65NB to 350NB</td>
<td>C.S. swing check valve PN 40.316 S/S flap, hinge and spring; valve to sandwich between SANS 1123 - 1600/3</td>
</tr>
</tbody>
</table>

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<table>
<thead>
<tr>
<th>HYDRANT VALVES</th>
<th>Handwheel operated, right angle, gunmetal/brass with 65mm instantaneous female outlet coupling and cap with attaching chain (e.g. CHUBB or similar approved).</th>
</tr>
</thead>
</table>

**Note:** All below ground piping or joints with exposed bolted connections that are in contact with the soil and all steel piping rising above ground shall be wrapped to 300 mm above ground level with suitable Denso or similar approved product.

### 4.5.4 The Crane Supplier and Lifting Machinery

The external service provider for the purpose of performing inspections / examinations on any Transnet Lifting Machinery, the following shall be adhered to at all times:

- The service provider must be registered with the DoL as LME and the LME registration number must be verified with DoL.
- The person performing inspection / examination, irrespective of being the owner of the entity, must be registered with ECSA as an LMI and the registration number must be verified with ECSA.
- If the person performing inspection / examination has applied for registration with ECSA, they must provide the service recipient with a copy of such application and which copy must bear the signature and stamp of the Commissioner of Oath.
- Correct and current Lifting Machinery Regulations shall be consistently applied when performing inspection / examination on Transnet Lifting Machinery.
- An affidavit signed and stamped by the South African Police Service and certified copies of any other pertinent documentation must be submitted to the service recipient prior to commencement of the work.
- All Lifting Machinery test certificates that are issued outside the above will be deemed null and void and all the Lifting Machinery affected by such non-compliance shall be deemed unfit for purpose and must be immediately withdrawn from service.

### Crane Specification

- Be designed and built to the latest British and/or Fem Standards and shall meet the requirements of the Occupational Health and Safety Act (Act 85 of 1993) with special reference to the Construction Regulations and the Code of Practice 29 of Transnet Engineering.
- The duty classification of the crane shall be:
  - Per BS 2573: Part 1:

**Signature of Bidder/s:** ____________________________  **Date:** __________
• Class of utilization U6
• State of loading Q2
• Group classification A6

b. Per FEM/DIN 15020
• Group 3 m

c. Per ISO
• Group M6
• All wiring must be to SANS 10142 Class A and C3 duty and all cabling must
have heavy duty PVC insulation. Tenderers shall indicate sizes of all wires
and cables and how these sizes were arrived at.

• The maximum safe working load, span, lifting height, and motion speeds
shall be as specified in the Specific Requirements.

• The crane shall be a double girder bridge construction with a full-length
service platform at least 600mm wide covered with 6mm checker plate
with kick plates and handrails on both sides of the crane, for maintenance
purposes, plus one cross-over walkway. Securing bolts must be
countersunk.

• Ensure easy access from the access ladder to the service platform.

Complete crane must be painted golden yellow and comply with
the construction regulation.

• The long travel wheel sizes shall be selected to suit the wheel loading and
travelling distance, be made of surface hardened chrome-molybdenum
alloy steel, be fitted with sealed long-life anti-friction bearings and have an
end float of not more than 10mm.

• Fit electrician's inspection cage at the point where the long travel pick-up
points, at the down shop leads, are installed.

• Fit protection bars on the crane at the down shop leads end.

• Long travel motion shall be by synchronized wheel drives designed for easy
fitting, removal and in situ maintenance.

• The hoist shall be fitted with a 6/36 manila or Jute fiber core cable, black
or un-galvanized and selected in accordance with SANS4308-1: Selection of
Wire Ropes.

• Robustness and ease of maintenance will be a deciding factor. (Please
provide details and substantiate the offer)

• All gears and rotating parts shall be fitted with covers.

• Crane shall be fitted with two sets of lights. The lights can be fitted to trap
doors on the service platforms or on a hinged attachment welded to the
side of the crane to ensure easy maintenance.

• Fit frequency inverters of the Commander SE Driver or Yaskawa Varispeed
– type with a safety factor of 25% on long travel, cross travel and hoist.

• The frequency drive panels must feature:
• Circuit breaker for incoming supply.

Signature of Bidder/s: ___________________________ Date: ____________
- Main switch on main panel must be able to be locked in the 'off' position with 3 locks.
- Braking resistors (With 60% duty cycle).
- Thermal overload protection to all motors.
- Fuse or circuit breaker protection for all control circuits.
- Short circuit protection to all different circuits.
- 110V control voltage to be supplied from a double wound transformer.
- Overload limiting device that cuts out only the hoist lifting motion when the safe working load is exceeded (this must be calibrated and a certificate supplied).
- Hoist upper and lower limiters.
- Laminated wiring diagram inside the doors of the main panel indicating the wire numbering.
- The long and cross travel and hoist motion of the crane shall be fitted with failsafe electro-mechanical brake assemblies (Binzi type) to suit the particular motor sizes. (Supply details at tender stage).
- The brake resistors shall be of the open wire wound resistor type for each motion of the crane. The brake resistors must be housed in steel mesh enclosures.
- Be radio controlled (Alpha 4000) with a mobile pendant as back up and featuring:
  - 6 directions, siren, lockable emergency stop, infra red start (to actuate the crane only when standing underneath it) and a spring loaded override button to allow further longitudinal movement after the crane was stopped by the anti-collision device.
  - Start button to also activate the lights.
  - Pendant to be mounted at hand rail level on the walkway
  - Pendant to be suspended by double steel wire cabling.
- Fit Telemecanique XUJMO 6031 anti-collision device on both sides of the crane (allow for maximum speed and load). A manual override, to inch up to the stop block or another crane, must be incorporated.
- Fit a warning siren (push button).
- Install a festoon system consisting of support brackets, 40mm heavy duty C-track rail, cable carriers, flat flexible cabling and all accessories.
- All sheet metal enclosures must be IP65 rated, have 180° horizontally opening doors, be fitted with anti-tamper devices and be painted orange (B46) inside and outside.
- All cabling must be routed in steel trunking and be fitted with metal glands at the junction boxes.
- Label contactors and wires, at the points where they terminate, with plastic wire markers of the "O" - type. Refer to specification "Example of Labeling".
- All motors, panels, trunking, etc. must be earthed.
- All switchgear shall be rated for 100 starts per hour minimum.
- Supply and install enclosed power supply system (down shop leads). Use
Liftco or equal of the 4-wire type. The system shall be selected for 125% of the total power demand of the complete crane. The pickup arm must be steel (NOT PLASTIC).

- Supply and install 4-core armored cable with separate earth conductor from the Transnet Rail Engineering main distribution board to the down shop leads main isolator.
- Supply and install a surface mounted over – current fuse protection main switch, lockable with 3 locks, to the main supply cable at the point of supply to the down shop leads.
- Fit one board on each side of the crane, with arrows indicating the four (4) directions of motion of the crane (longitudinal and cross travel). They must be visible within the full range of the remote control.
- The remote and pendant control markings must match the arrows on the board.
- Refer to Specification for Direction Plates for OHCs.
- Fit a chromo-deck plate, depicting the asset number, safe working load (S.W.L.) and supplier name in blue lettering on a white background, fitted into angle iron frame and bolted on to each side of the crane.
- Supply and install rubber compound type buffers, complete with buffer plates for easy removal, on both sides and ends of the crane.

**Crane stop blocks and Access Ladder**

- The crane stop blocks to be as per the design drawings (Drawing no 3526783-5-201-TLA-0005-01-3).
- Design, manufacture, supply, installation of service and maintenance access platforms (one on either side of the building) and required catladder to give adequate access for servicing and maintenance on both sides of the crane.
- Approved and signed drawings by the engineer must be submitted to Transnet for approval before fabrication commences.
- The stop blocks must be installed by a register crane supplier and tested.
- Stop blocks must be installed to stop cranes on the inside of the building.

**4.5.5 Testing, Commissioning & Balancing**

- The testing of the systems shall be done in the presence and to the satisfaction of an authorised representative of the Project Manager. The test results shall be forwarded to the Project Manager’s representative for acceptance.
- Commissioning shall be done by an ECSA registered Professional Engineer who shall be provided by the Contractor. The Engineer provided shall have adequate experience in the commissioning of similar types of systems. The Contractor shall

**Signature of Bidder/s:** ___________________________  **Date:** ___________

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provide in the Bill of Quantities and Programme for the time and cost associated with
the commissioning of all the mechanical works.

4.6 **LIST OF DRAWINGS ISSUED BY THE EMPLOYER**

The drawings listed below are issued by the Employer for tender purposes only.

The drawings were reduced in size and should not be used to scale off.

<table>
<thead>
<tr>
<th>Drawing Number</th>
<th>Description</th>
</tr>
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<tbody>
<tr>
<td><strong>Architectural</strong></td>
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<tr>
<td>3526783-1-201-A-LA-0002-01-2</td>
<td>New UFL Workshop Ground Floor Plans</td>
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<tr>
<td>3526783-1-201-A-LA-0001-01-2</td>
<td>New UFL Workshop Lower Ground Floor Plan</td>
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<tr>
<td>3526783-1-201-A-SE-0001-01-2</td>
<td>New UFL Workshop Elevations and Sections</td>
</tr>
<tr>
<td>3526783-1-201-A-LA-0003-01-2</td>
<td>New UFL Workshop Roof and Ceiling Layout</td>
</tr>
<tr>
<td>3526783-1-201-A-DE-0002-01-2</td>
<td>New UFL Workshop Carpentry and Joinery Details</td>
</tr>
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<td>3526783-1-201-A-DE-0001-01-2</td>
<td>New UFL Workshop Details</td>
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<tr>
<td>3526783-1-201-A-SC-0001-01-2</td>
<td>New UFL Workshop Door and Window Schedules</td>
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<td>3526783-1-201-A-SC-0002-01-2</td>
<td>New UFL Workshop Schedules</td>
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<td><strong>Structural</strong></td>
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<td>3526783-5-201-T-LA-0001-01-3</td>
<td>New UFL Workshop Pit Layout, Section and Details</td>
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<tr>
<td>3526783-5-201-T-LA-0002-01-3</td>
<td>New UFL Workshop Foundation Layout, Section and Details</td>
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<td>3526783-5-201-T-LA-0003-01-3</td>
<td>New UFL Workshop Surface Slab Layout, Section and Details</td>
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<td>New UFL Workshop Sections</td>
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<td>3526783-5-201-T-LA-0004-01-3</td>
<td>New UFL Workshop Lower Beam Level, Section and Details</td>
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<td>New UFL Workshop Roof Beam Layout, Section and Details</td>
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<td>3526783-5-201-T-LA-0006-01-3</td>
<td>New UFL Workshop Structural Steel Roof Layout, Section and Details</td>
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<td><strong>Civil and Perway</strong></td>
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<td>3526783-5-201-C-DE-0001-01-3</td>
<td>New UFL Workshop Stormwater Grid Inlet and Downpipe Sump</td>
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<td>3526783-5-201-C-DE-0002-01-3</td>
<td>New UFL Workshop Stormwater Manhole Details</td>
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<td>3526783-5-201-C-DE-0004-01-3</td>
<td>New UFL Workshop Sewer Pump Sump Details</td>
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**Electrical and OHTE**

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<td>3526783-5-201-E-SL-0001-01-OA-YL</td>
<td>New UFL Workshop Proposed Low Voltage Single Line Diagram</td>
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<td>3526783-5-201-E-LA-0002-01-OA-YL</td>
<td>New UFL Workshop Proposed Workshop Lighting and Power Layout</td>
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<td>New UFL Workshop Proposed Pit Lighting and Power Layout</td>
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<td>3526783-5-201-E-SL-0002-01-OA-YL</td>
<td>New UFL Workshop Proposed LV Distribution Board Layout</td>
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<td>New UFL Workshop Proposed Earthing and Lightning Protection Layout</td>
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<td>New UFL Workshop OHTE Layout</td>
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<td>3526783-5-201-M-GA-0001-01-3  New UFL Workshop HVAC Design</td>
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<td>3526783-5-201-M-LA-0001-01-3  New UFL Workshop Portable Water Layout</td>
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4.7 SUPPORTING SPECIFICATIONS

The specification must be read in conjunction with the following South African National Standards (SANS) codes and standards as applicable:

- National Building Regulations (SANS 10400:2010)
  
  **Standard No.**  **Description**
  SANS 10400 – Part A General principles and requirements
  SANS 10400 – Part C Dimensions
  SANS 10400 – Part D Public safety
  SANS 10400 – Part F Site Operations
  SANS 10400 – Part G Excavations
  SANS 10400 – Part J Floors
  SANS 10400 – Part K Walls
  SANS 10400 – Part L Roofs
  SANS 10400 – Part M Stairways
  SANS 10400 – Part N Glazing
  SANS 10400 – Part O Lighting and ventilation
  SANS 10400 – Part P Drainage
  SANS 10400 – Part S Facilities for persons with disabilities
  SANS 10400 – Part T Fire protection
  SANS 10400 – Part W Fire installation
  SANS 10400 – Part X Environmental sustainability
  SANS 10400 – Part XA Energy usage in buildings

- Standardized Specification for Civil Engineering Construction (SANS 1200)
  
  **Standard No.**  **Description**
  SANS 1200A – General
  SANS 1200AB – Engineer’s Office
  SANS 1200C – Site Clearance
  SANS 1200D – Earthworks
  SANS 1200DA – Earthworks (Small Works)
  SANS 1200DB – Earthworks (Pipe Trenches)
  SANS 1200DM – Earthworks (Roads, Subgrade)
  SANS 1200G – Concrete
  SANS 1200 GA – Concrete (Small Works)
  SANS 1200H – Structural Steelwork
  SANS 1200HB – Cladding and Sheetig
  SANS 1200HC – Corrosion Protection of Structural Steelwork
  SANS 1200L – Medium Pressure Pipelines
  SANS 1200LB – Bedding (Pipes)

Signature of Bidder/s: ____________________________________________  Date: __________
SANS1200LC – Cable Ducts
SANS 1200LD – Sewers
SANS 1200LE – Stormwater Drainage
SANS 1200LG – Pipe Jacking
SANS 1200M – Roads (General)
SANS 1200ME – Subbase
SANS 1200MF – Base
SANS 1200MH – Asphalt Base Surfacing
SANS 1200MJ – Segmented Paving
SANS 1200MK – Kerbing and Channelling
SANS 1200MM – Ancillary Roadworks

• Other applicable Standards
  SANS 10252 Water supply and drainage for buildings Part 1
  SANS 32/SANS121 Hot Dip Zinc (galvanised) Coatings
  SANS 181 Thermostats for Electric Storage Heaters
  SANS10100-1:2000 The Structural Use of Concrete Part 1: Design
  SANS 10100-2:2000 The Structural use of concrete – Part 2: Materials and execution of work
  SANS 10160 General Procedures and Loadings (Design of Buildings)
  SANS 1491-1:2005 Portland cement extenders – Part 1 Ground granulated blast furnace slag
  SANS 1491-2:2005 Portland cement extenders – Part 2 Fly ash
  SANS 1491-3:2006 Portland cement extenders – Part 3 Condensed Silica Fume
  SANS 2001: CC1 Construction Works: Concrete Works (Structural)
  SANS 10162-2:2011 – The structural use of steel Part 2: Cold-formed steel structures
  SANS 6891/ISO 6891:1993 – Timber structures – Joints made with mechanical fasteners – General principles for the determination of strength and deformation characteristics
  SANS10163-1:2003 – The structural use of timber Part 1: Limit-states design
  NHBRC Home Building Manual 2015
  Guidelines for Human Settlement Planning & Design (Red Book)

Please also take note of all other standard that are mentioned in this specification document that are not listed above.
### 4.8 SPECIFICATION COMPLIANCE MATRIX

<table>
<thead>
<tr>
<th>ITEM NO.</th>
<th>REQUIREMENTS</th>
<th>COMPLYING</th>
<th>COMMENT</th>
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Signature of Bidder/s: ___________________________  Date: ____________

Document Name: Specification for the Construction of a New UFL Workshop
Date: 28.05.2019
Reference No: LOC_RBA_SPEC_000
Revision: 0
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<tr>
<td><strong>4.6</strong> List of Drawings Issued by the Employer</td>
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<td><strong>4.7</strong> Specification Compliance Matrix</td>
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<tr>
<td><strong>5.</strong> Tender Evaluation Criteria</td>
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## 5. TENDER EVALUATION CRITERIA

### Technical

<table>
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<tr>
<th>No.</th>
<th>Pre-Qualification Criteria</th>
<th>Weightings</th>
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<tbody>
<tr>
<td></td>
<td><strong>TECHNICAL DESCRIPTION</strong> (The technical evaluation will be used as a threshold. All bidders who do not meet the minimum threshold of 70% will not proceed to the final stage of evaluation.)</td>
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<tr>
<td>1.</td>
<td><strong>Compliance to specification:</strong> Compliance with the specification including Completing the Specification Compliance matrix and signing of the specification (Sign on each page)</td>
<td>40</td>
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<tr>
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<td><strong>Points allocation will be broken down as follows:</strong> Fully Compliant = 40 points  Not Compliant= 0 points</td>
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</table>
| 2.  | **Organization and staffing.**  
- **Reporting Structure (Organogram) to be used for this contract (10 points)**  
- **Key staff personnel with at least a minimum of 3 years’ experience (Contractors Main Staff CV’s to be submitted):**  
  - Project Manager/Contracts Manager (2 points)  
  - Health and Safety Officer (1.5 points)  
  - Environmental Specialist (2 points)  
  - General Forman (1.5 points)  
- **Supporting Specialist professional personnel with at least a minimum of 3 years’ experience (CV’s in relation to the scope of work to be submitted):**  
  - Architectural and Structural Engineer(s) (3 points)  
  - Civil and Perway Engineer(s) (3 points)  
  - Electrical and OHTE Engineer(s) (3 points)  
  - Mechanical Engineer (2 points)  
  - Quantity Surveyor (2 points)  

*Full points will be allocated only if the case specialist professionals will be able to provide full supporting services required for each discipline.* | 30         |
| 3.  | **Lead time (Proposed delivery Schedule with time frames)**  
- Clear reasonable program with detailed activities and time frames = 10 points (8 months or less)  
- Clear reasonable program with detailed activities but longer time frames = 7.5 points (9 - 12 months)  
- Submitted a program but not clear / detailed or reasonable = 5 points (13 - 18 mos)  
- No program submitted = 0 points (18 months or more) | 10         |
| 4.  | **Successfully completed projects of similar nature.**  
Point allocation will be broken down as follows: | 10         |

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**Signature of Bidder/s:** __________________________ _ Date: _______________
<table>
<thead>
<tr>
<th>No.</th>
<th>Pre-Qualification Criteria</th>
<th>Weightings</th>
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<tbody>
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<td>5.</td>
<td><strong>SHE plan and requirements:</strong></td>
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<tr>
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<td>The tenderer must provide their health and safety plan and their environmental management policy and standard environmental management plan. The following documents is to be part of their SHE plan:</td>
<td></td>
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<tr>
<td></td>
<td>- Valid letter of good standing with insurance body.</td>
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<td>- Roles and responsibilities of legal appointees.</td>
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<td>- SHE Officer roles and responsibilities.</td>
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<tr>
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<td>- Safety, Health &amp; Environmental Policies.</td>
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</tr>
<tr>
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<td>- Overview of Tenderer's SHE system for project.</td>
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</tr>
<tr>
<td></td>
<td>- List of job categories for project and competencies required per category and plan to address and meet outstanding competencies.</td>
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<tr>
<td></td>
<td>- Overview of selection process of subcontractors.</td>
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<tr>
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<td>- SHE challenges envisaged for the project and how they will be addressed and overcome.</td>
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<td>- Signed statement acknowledging receipt and budget provision for SHE pack requirements.</td>
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<td><strong>Points allocation will be broken down as follows:</strong></td>
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### Total Weighting:

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Signature of Bidder/s: ________________________________  Date: ___________