

TECHNICAL SPECIFICATION FOR THE *WORKS*

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TECHNICAL SPECIFICATIONS

1 ARCHITECTURE

a) General Notes

All work on heritage building components must be undertaken by a suitably qualified Contractor, with several recent referrals for equivalent work successfully completed. Depending on the potential Contractor; and only if deemed necessary by the architect; these past projects should be inspected by the architect and heritage architect; and approved for quality prior to appointment of said Contractor.

b) Damage to remaining portions and items to be preserved (Fireplaces and selected doors)

All care should be taken to prevent; as far as possible; structural- or other damage to remaining portions of the building(s).
Make good all existing work damaged during alterations.

c) Services to remain operational to Heritage Library

Existing services to Heritage Library (portion) of the building (electrical, telephone, water supply etc.) must remain continuously operational during the entire duration of the contract.
Give timely notice to the architect/principal agent if disconnection or alteration is necessary.

d) Disturbance

Prevent disturbance and nuisance from dust and noise, as specified.

e) Recovered material

Recovered material (where indicated) to be repurposed and re-used elsewhere as specified.

f) Local Materials and Products

Use of locally manufactured materials and products.
Use materials and products manufactured in South Africa unless an imported product is prescribed specifically, or when no suitable locally manufactured product for a specific use is available.

g) Samples

Samples of all specified items and/or installations to be provided to site for approval by client/architect; prior to orders being finalised; to ensure appropriate Quality Control.

Furnish such samples and/or certificates as called for or may be called for by the architect/principal agent. Materials and/or workmanship not corresponding with approved samples may be rejected.

h) Scale

Use figured dimensions as preference to scaled dimensions.

i) Interpretation of drawings

Should any part of the drawings, specification or bills of quantities not be clearly intelligible or the materials or articles to be used in the execution of the works be considered insufficiently described; request the architect/principal agent for clarification in writing; failing which any alterations or substitutions rendered necessary through incorrect interpretation of such drawings, specification or bills of quantities shall be at the contractor's cost.

j) Description of items

The description of an item implies the complete supply, assembly/installation and operation of the item unless otherwise specified.

k) Trade names

Materials, components or products in this Specification are not specified by trade name but by reference to standards. The standards issued by the South African Bureau of Standards (SABS) are the main source of reference.

The appointed contractor may apply to the architect/principal agent for the use of materials, products or components that do not comply to the specified standards. In these cases, the architect/principal agent shall expect any one or all of the following:

- a sample for inspection
- proof of quality
- test reports
- factory capability reports
- a saving in cost.

Applications for the use of other materials, products or components must be approved in writing by the architect/principal agent before any such materials, components or products are ordered.

l) Compliance with standards

When so requested by the architect/principal agent, provide evidence in the form of delivery slips, certificates or other written proof that material or components comply with the standards as laid down in this specification.

Products that are specified as 'Mark bearing' must bear the mark of the relevant standards body.

1.1. Floor Finishes and skirtings

- 1.1.1. Glazed porcelain tiles: with granite inlays as accents to the perimeter and a 15% pattern. Brass strips to delimitate the changes in material and at a regular grid of 2m spacing for movement joints. [Main Reception Area].
- 1.1.2. Porcelain tiles: 600 x 600 mm colour bodied porcelain tiles to the floors, with brass movement joints at 2m centers on a grid. [Kitchen, Circulation, Toilet blocks, Restrooms].
- 1.1.3. Carpet tiles: 500 x 500 x 5mm thick, Heavy commercial carpet tiles. Manufactured from Solution dyed Nylon, Tufted multi scroll loop pile, 15-year warranty and 5-year guarantee, Made in South Africa. ISO 9001 & 14001 certified. [Boardrooms, enclosed office and open plan areas, storeroom to offices].
- 1.1.4. Existing Granolithic Floors:
Floors previously painted or painted and waxed:
Repainting floor: Remove excessive moss and algae using a sharp putty knife or similar pointed tool; Remove any wax and other grease; Mix a solution with half water and half bleach; Use a sprayer to cover the entire affected area and wait 5 minutes to soak; Scrub area using a wire or hard bristle brush; Hose off with clean water;
NOTE. Use protective clothing, rubber gloves and eye protection. Refer to floor finishes specifications and drawings. [Existing verandas, stoeps and Balconies].
- 1.1.5. Granolithic screed: min. 40mm thick Granolithic screed with screeded nosings. For furniture, maintenance, cleaners, or other technical storerooms). [Refuse Area, Cleaner's Storeroom].
- 1.1.6. Epoxy/ polyurethane flooring: screed to a min thickness to obtain a minimum of 25N/mm². All surfaces should be free from laitance, dust and other contamination, dry to 75% RH as per BS8204, and free from rising damp and ground water pressure. [Plant rooms].
- 1.1.7. Vinyl Floors: New Vinyl Sheetting, high performance, heavy-duty homogeneous covering is to be laid in pressure-sensitive or acrylic adhesive, with a notched trowel at the rate of 5.5 to 6.5 m²/litre on a previously prepared Class 1 sub-base, elsewhere described and measured.
The sheet is to be rolled in both directions with a 68 kg three-sectional metal floor roller, during the installation, immediately after the sheeting is laid in the adhesive. Factory edges of vinyl sheeting are to be removed before laying (10 to 20 mm) – recommended by some manufacturers.
Installation in accordance with SANS 786:2007.
Specify colour: (to be confirmed). Joints are to be butted, grooved to about half the depth of the sheet, (about 1 mm) and heat welded, with a welding rod. The finished width of the weld should be a width of 3 mm, and ensure a minimum 70% bond with the sheeting – all in accordance with the manufacturer's spec.
No concave or convex joints allowed – the joints must finish flush with the sheeting. All welds to be glazed and checked prior to polishing. No cross-joints allowed. On completion, high performance, heavy-duty homogeneous floor covering treated sheeting is to be washed down, and two coats of matt sealant is to be applied. This will prolong the life of the floor.
General installation work to be as per manufacturer's specification. [Clinic and Sick rooms].

1.2. Wall Construction

- 1.2.1. Wall Construction 1: [walls to perimeter of fire zones]:
Class A fire partition drywall, spanning from floor slab to soffit.
- 1.2.2. Wall Construction 2: [walls between offices and walls between boardrooms]:
Acoustic drywall panels, spanning from floor finish to bulkhead.
- 1.2.3. Wall Construction 3: [between office and passage, as well as boardrooms and Passages]:
Glazed acoustic partitioning spanning from floor to bulkhead. Allow for 50% Vinyl decals on all glazed partitions.
- 1.2.4. Wall Construction 4: Clay brick wall construction as per builder's work plans; comply to all relevant regulations.

1.3. Wall Finishes – Internal:

- 1.3.1. Wall finish 1: [Accent walls]: Wallpaper.
- 1.3.2. Wall Finish 2: [accent walls and free stranding columns]: Timber cladding.
- 1.3.3. Wall Finish 3: [Toilet Blocks]: Decorative interior coloured plaster finish with epoxy paint sealant, apply to sand/cement plaster.
- 1.3.4. Wall Finish 4: [Showers and rest rooms]: 600 x 600mm Porcelain wall tiles.
- 1.3.5. Wall Finish 5: [Kitchen, Kitchenette areas, Coffee stations and Pause areas]
100 x 200mm Porcelain wall tiles serving as a splash-back.
- 1.3.6. Wall finish 6: [Remaining Walls]: Plaster and Paint/Repaint existing surface:
One coat universal undercoat, one coat plaster primer and two coats water-based enamel matt, applied to two coat plaster - sand/cement plaster with skim coat.

1.4. Wall Surfaces – External:

Heritage Consultant (or related specialist) to inspect the status and condition of existing building and advise on heritage rehabilitation implementation with regards to original Sandstone walls, areas/surfaces to be stripped, treated into original state, or replacement and recommendation of plaster- and/or lime work.

- 1.4.1. Existing Condition: Cement or lime plastered walls painted with Acrylic PVA or enamel. Using a wire brush, remove all loose and flaking-, bubbling- and other deteriorating paint. Sand down rough areas and make good with external filler.
- 1.4.2. Existing Condition: Repair chipped plastered corners as follows: Plaster with PVA admixture to be used to adhere new plaster to areas where plaster is flaking off and crumbling.
- 1.4.3. Existing Condition: Installation of scratch coats. Preparation for new plaster.
Prepare and apply a scratch coat, to be mixed as follows:
1 part cement: 2 parts lime: 9 parts well graded, sharp, clean river sand and apply a final coat, to be mixed as follows: mix 1 part cement and 2 parts lime then add and mix 10 parts well graded, sharp, clean sand, then add the water and mix to even consistency.

1.4.4. Existing Condition: Crack Repairs.

1.4.4.1. Minor cracks:

Non-structural cracks in plaster, rake out all loose material using suitable hand tools (no power tools to be used unless approved by Architect), thoroughly clean, to be free of all loose material and dust and apply a suitable crack filler and leave surface smooth and ready for decoration.

1.4.4.2. Mild to moderate cracks. (Width of >1mm - <5mm):

Cut two grooves 150mm on either side of crack (parallel with crack) with an angle grinder and chisel out plaster between the two grooves, shot fix and apply 250mm wide galvanized wire mesh metal membrane over the length of the crack area, re-plaster the area with an approved 1:1:2 lime cement sand plaster with a compressive strength 5Mpa or an approved equivalent. An approved bonding agent must be added to the mortar mix.

1.4.4.3. Severe cracks (width >5mm <15mm):

Drill two holes at right angles to the crack (12 - 16mm dia. holes drilled 150mm on either side of crack and at 200mm centres), cut two grooves on either side of wall with an angle grinder between the two drilled holes and chisel a channel between the two holes, use ordinary galvanized binding wire 2mm in diameter and wrap it to 8mm galvanized rebar staples grouted into the pre-drilled holes. Fill the channel and crack with approved 1:1:2 lime cement sand plaster an approved bonding agent must be added to the mortar mix. See drawing 801 and 802.

1.4.5. Existing Condition: Calcification of brickwork. Repoint between face. Remove. Clean off areas of calcification, rake out loose pointing and vegetation and re-point using a mixture of 1 part lime, 1 part cement and 2 parts well graded, sharp, clean river sand.

1.4.6. Existing Condition: Repair to lime-based plaster.

Repair cracks and blemishes.

Lime putty for use as a filler or skim coat is a lime-rich, white cement-based product, ensure that surfaces are sound and free of dirt, grease and oil, to be mixed in small quantities and to be used within 30 minutes of mixing, dampen the surface before application, including immediately prior to application, skim coats to be applied in two very thin coats (1 - 2mm thick per coat), using a spackle tool and sponge, allow the first coat to dry overnight, dampen the following day by spraying a mist of water before applying the final coat, cure by dampening the surface at least once a day for the first three days after completion.

1.5. Doors and Door Frames

- 1.5.1. New 40mm thick Semi-solid timber door in steel door frame.
Semi-solid timber door with inner frames, constructed of SA Pine with two horizontal rails for extra stability and lock blocks to both sides of the door. Door cores are constructed of medium density fibre board cross grids. Door edges constructed of hardboard veneer with timber trimmings in pattern to matching existing doors. Painted.
- 1.5.2. Existing Timber Doors.
[Locations: See plan for doors to be preserved.]
- 1.5.2.1. Varnished Doors:
- 1.5.2.1.1. Existing Condition: Door in good condition, can open and close. Clean only. Wash down surfaces with mild soap solution and rinse with clean water.
- 1.5.2.1.2. Existing Condition: Varnish shows signs of failing. Wash down and remove flakes. Wash down surfaces with mild soap solution and rinse with clean water, sand down and re-seal as per "15. Paint Specification" below.
- 1.5.2.1.3. Existing Condition: Door is in poor condition, needed to be varnished. Prepare surface for varnish. Remove all loose and flaky residue. Sand down door using vertical motion using 100 - 200 grit sandpaper. Cut out damaged Timber and replace with new inlay by using waterproof glue (cold glue), clamp and re-seal as per "15. Paint Specification" below.
- 1.5.2.2. Varnished Frames:
- 1.5.2.2.1. Existing Condition: Door in good condition, can open and close. Clean only. Wash down surfaces with mild soap solution and rinse with clean water, re-seal as per Paint Specification.
- 1.5.2.2.2. Existing Condition: Varnish shows signs of failing. Wash down and remove flakes. Wash down surfaces with mild soap solution and rinse with clean water, and re-seal as per "15. Paint Specification" below.

1.5.2.3. Painted Doors:

- 1.5.2.3.1. Existing Condition: Door in good condition, can open and close, surface finish fairly new. Clean only. Wash down surfaces with mild soap solution and rinse with clean water.
- 1.5.2.3.2. Existing Condition: Paint shows signs of failing. Wash down and remove flakes. Wash down surfaces with mild soap solution and rinse with clean water. Lightly roughen surface using 100 - 200 grit sandpaper in vertical motion and repaint.
- 1.5.2.3.3. Existing Condition: Door mostly rotten, especially lower portions. Replace door. Replace door with same configuration. All to architect specification and repaint. New Timber to match existing or best match possible such as Kiaat, Balau or Rhodesian Teak.

1.5.2.4. Painted Frames:

- 1.5.2.4.1. Existing Condition: Door in good condition, can open and close, surface finish fairly new. Clean only. Wash down surfaces with mild soap solution and rinse with clean water.
- 1.5.2.4.2. Existing Condition: Paint shows signs of failing. Wash down and remove flakes. Wash down surfaces with mild soap solution and rinse with clean water.
- 1.5.2.4.3. Existing Condition: Rotten door frames. Replace frame. Remove existing frame, make good plaster reveal and refit new door to architect specification. New Timber to match existing or best match possible such as Kiaat, Balau or Rhodesian Teak.

1.5.3. New Fire Doors Class A: Timber trimmings fixed to fire doors in pattern to match existing doors. Painted.
[Location: Fire zones].

1.5.4. New Fire Doors Class B: Timber trimmings fixed to fire doors in pattern to matching existing doors. Painted.
[Location: Fire Escape routes, Plantrooms].

1.5.5. New Glass and Aluminium Doors.
Powder coated aluminium door frames with high security, clear laminated safety glass.
[Location: Main Entrance Door, Lower Ground Floor doors to Courtyard and Doors to suspended walkways].

1.6. Door Ironmongery:

- 1.6.1. Existing Condition: Ironmongery in fair to good condition, perhaps has minor rust marks.
Service lockset.
Oil moving parts using a light oil or WD40 to release lightly rusted parts.
- 1.6.2. Existing Condition: Not moving - badly rusted.
Depending on museum use, repair.
Remove ironmongery and repair in workshop if necessary.
- 1.6.3. Existing Condition: Ironmongery broken or missing.
Depending on museum use, replace.
Source ironmongery to match existing and replace.

1.7. Windows

- 1.7.1. Existing Steel Windows: (Restoration, maintenance and making good of all existing windows)
 - 1.7.1.1. Existing Condition: Paint chipped or flaking.
Repaint exposed steel:
Remove loose and flaking paint. Using grit 100 sandpaper, roughen all painted surfaces. Remove all dust and sanding residue by washing with lacquer thinners. Repair broken glass. Paint as per Paint Schedule.
 - 1.7.1.2. Existing Condition: Extreme poor condition with majority of steel rusted.
Remove all glass, sand down to metal surface and repaint.
Repair rusted window frame by removing all loose and flaking paint. Remove all rust by brushing down using steel bristled brush, in very bad cases using localised sand blasting. Clean all surfaces using lacquer thinners. Repaint one coat red undercoat, then install new glass. Once putty has dried, paint according to Paint Specification.
- 1.7.2. Existing Timber Windows:
(Restoration, maintenance and making good of all existing windows)
 - 1.7.2.1. Existing Condition: Extreme poor condition with majority of wooden members either rotten or badly damaged.
Remove glass and repair existing Timber.
Opening sections to be removed and repaired in workshop to match existing. Fixed frame and mullions to be repaired by sanding down and eliminating irreparable members. Sand down by hand to bare Timber to remove all past rendering, caulking and loose portions. Remove all sanding dust and residue preferably by using high pressure air hose.
Oil all exposed parts as follows. Apply liberally using brush or soft cloth. Wait 2 weeks, then repeat. Ensure this is done on days with low air moisture. New Timber to match existing or best match possible such as Kiaat, Balau or Rhodesian Teak.

1.7.2.2. Existing Condition: Rotten opening sections.

Replace with new factory manufactured opening section.

Remove badly damaged and un-serviceable opening sections and replace with new, manufactured using wedged mortice and tenon joints and pre-moulded Timber sections. Stain Timber if necessary to match existing frame. New Timber to match existing or best match possible such as Kiaat, Balau or Rhodesian Teak.

1.7.3. Sills External:

1.7.3.1. Existing Condition: Paint chipped or flaking.

Repair only major failing of paint and or plaster.

Establish if lime or cement mortar. Remove all loose masonry and plaster.

Patch using either lime or cement mortar; as applicable.

1.7.3.2. Existing Condition: Sill spalled and falling apart.

Remove sill and reconstruct.

Remove entire sill, ensuring all loose sand and dust is removed. Dust using brush. Replace with new cement mortar complete with galvanized rebar to engineer's specification.

1.7.3.3. Existing Condition: Brick-on-edge.

Remove mildew and clean.

Scratch out using a pointed metal device any mildew and growth in joints and between brickwork and window frame. Repoint joints forming rounded recessed jointing.

1.8. Window Ironmongery

1.8.1. Existing Condition: In good condition.

Clean only.

Oil moving parts using water displacing oil such as WD40.

1.8.2. Existing Condition: Lubricate moving parts.

Service only.

Oil moving parts using water displacing oil such as WD40 to release lightly rusted parts.

1.8.3. Existing Condition: Furniture corroded badly, with perhaps some broken parts.

Attempt to restore and replace broken parts.

Remove all furniture carefully retaining all fixing screws, bolts and nuts. Remove corrosion by electrolysis if necessary or any other suitable manner. Replacement parts to match existing and to be submitted as samples for approval by architect prior to procurement.

1.9. Sanitary ware

1.9.1. Toilet combination type 1: [Male- and Female Toilet Block, Rest Rooms]

- 1.9.1.1. Water Closet: Fully shrouded wall-hung WC with horizontal outlet.
Rimfree: white.
- 1.9.1.2. Actuator plate: WC flush control with electronic flush actuation, battery operation, dual flush actuator plate 12cm with Manual over-ride, brushed, polished stainless steel finish.
- 1.9.1.3. In wall Cistern: Concealed Kombifix element for wall-hung WC108 cm, with concealed cistern 12 cm.
- 1.9.1.4. Toilet Seat and Cover: Standard close, Duraplast WC seat: white with stainless steel hinges.

1.9.2. Toilet combination type 2: [Universal Toilet/Disabled Facilities]

- 1.9.2.1. Water Closet: extended. Wall-hung washdown WC, large projection 700mm; with horizontal outlet. Rimfree; barrier-free: white.
- 1.9.2.2. Actuator plate: WC flush control with electronic flush actuation, battery operation, dual flush actuator plate 12cm with Manual over-ride, brushed, polished stainless steel finish.
- 1.9.2.3. In wall Cistern: Concealed Kombifix element for wall-hung WC 108 cm, with concealed cistern 12 cm.
- 1.9.2.4. Toilet Seat and Cover: Barrier-free, fastening from above.
White duraplast finish, with continuous stainless steel hinge.

1.9.3. Urinals: [Male Toilet Blocks]

Rimless with horizontal outlet; Fully integrated flush actuation control, housed within the ceramic, with modular docking station for easy maintenance battery operation. For operating with automatic, water-saving flush.

1.9.4. Urinal screens: [Male Toilet Blocks]

Urinal division, plastic finish: white alpine colour. Hidden fastening.

1.9.5. Hand wash basin combination type 1: [Male- and Female Toilet Block, Rest Rooms]

- 1.9.5.1. Hand wash basin: Under-countertop washbasin; without tap holes.
Rectangular 530mm x 450mm internal dimension.
- 1.9.5.2. Taps/Mixer: Chrome Electronic basin mixer with temperature control battery operation mains connection 230 V. < 4L/min for Green Star Rating.
- 1.9.5.3. Waste: Chrome Waste set non-closing valve complete for washbasins.
Drain plug material stainless steel.

1.9.6. Hand wash basin combination type 2: [Universal Toilet/Disabled Facilities]

1.9.6.1. Hand wash basin: Square wall mounted hand rinse basin:
B450mm white with 1 centered tap hole.

1.9.6.2. Taps/Mixer: Chrome Electronic basin mixer with temperature control mains connection 230 V. < 4L/min for Green Star Rating.

1.9.6.3. Waste: Adjustable concealed trap for washbasin, with in-wall cabinet and ready-to-fit set, horizontal outlet: d50-56mm G1 1/4" d1=32mm bright chrome-plated finish.

1.9.7. Shower combination type 1: [Rest Rooms]

1.9.7.1. Shower head: Chrome Overhead shower 260 1jet EcoSmart.
Shower head size: 260 mm. Installation: wall.

1.9.7.2. Shower arm: Chrome Shower arm 24.1cm.
90° angle version.

1.9.7.3. Shower mixer: Chrome Thermostat for concealed installation for 1 function, thermostatic safety lock at 40 °C (safety feature) with adjustable temperature limitation; complete with Basic set watertight iBox universal.
< 9L/min for Green Star Rating.

1.9.7.4. Shower waste, trap and grid/cover.

1.9.8. Shower combination type 2: [Gym]

1.9.8.1. Shower head: Chrome Overhead shower 105 1jet Green.
Shower head size: 105 mm. Installation: wall.

1.9.8.2. Shower arm: Chrome Shower arm 12.8cm.

1.9.8.3. Shower mixer: Chrome Thermostat for concealed installation for 1 function, thermostatic safety lock at 40 °C (safety feature) with adjustable temperature limitation; complete with Basic set watertight iBox universal.
< 9L/min for Green Star Rating.

1.9.8.4. Shower waste, trap and grid/cover.

1.9.9. Kitchen combination:**1.9.9.1. Sink:** Insert Fraganite Double sink.

Sink Dimensions: 1160L x 500W mm.

Bowl Dimensions: 335L x 425W x 200D mm.

Cut-Out Dimensions: 1140x480mm.

Supplied with 90mm basket strainer waste fitting and 90mm basket strainer waste fitting with overflow kit.

1.9.9.2. Tap/Mixer: Solid Brass Construction mixer.

Ceramic Disk Cartridge. Colour matched to Fraganite sink.

360 Degree Spout Swivel.

1.9.9.3. Double Bowl Plumbing Kit.**1.9.10. Kitchenette combination:****1.9.10.1. Sink:** Insert Double sink.

Sink Dimensions: 1160L x 510W mm.

Bowl Dimensions: 360L x 420W x 200D mm.

Cut-Out Dimensions: 1144L x 490W mm.

Supplied with 90mm basket strainer waste fitting and 90mm basket strainer waste fitting with overflow kit. Sinks have a pre-cut tap hole. RHD or LHD to be confirmed prior to order being finalized.

1.9.10.2. Tap/Mixer: Arc Swivel Stainless Steel Mixer.

Water efficient 9.31L per minute aerator.

Strong, durable & anti-corrosive satin 304: stainless steel surface.

Tubular fixation set for an easier installation.

1.9.10.3. Double Bowl Plumbing Kit.**1.9.11. Coffee station combination type 1****1.9.11.1. Sink:** Undermount Single Sink.

Sink Dimensions: 380L x 440W mm.

Bowl Dimensions: 340L x 400W x 210D mm.

Supplied with 90mm basket strainer waste fitting and 90mm basket strainer waste fitting with overflow kit.

1.9.11.2. Tap/Mixer: Solid Brass Construction mixer.

Ceramic Disk Cartridge. Colour matched to Fraganite sink.

360 Degree Spout Swivel.

1.9.11.3. Single Bowl Plumbing Kit.**1.9.11.4. Hydroboil:** 7.5 Litre Stainless Steel Wall-mounted Hydroboil.

460H x 310W x 180D mm. Position to be confirmed on site.

1.9.11.5. HydroTap: 394 x 464 x 333mm Classic Chrome Zip HydroTap

Boiling and Chilled filtered drinking water on tap. Unit to be supplied with vent tray. Unit fitted over sink.

1.9.12. Coffee station combination type 2

1.9.12.1. **Sink:** Undermount Single sink.

Sink Dimensions: 380L x 440W mm.

Bowl Dimensions: 340L x 400W x 180D mm.

Supplied with 90mm basket strainer waste fitting and 90mm basket strainer waste fitting with overflow kit.

1.9.12.2. **Tap/Mixer:** Arc Swivel Stainless Steel Mixer.

Water efficient 9.31L per minute aerator.

Strong, durable & anti-corrosive satin 304: stainless steel surface.

Tubular fixation set for an easier installation.

1.9.12.3. Single Bowl **Plumbing Kit.**

1.9.12.4. **Hydroboil:** 7.5 Litre Stainless Steel Wall-mounted Hydroboil.

460H x 310W x 180D mm. Position to be confirmed on site.

1.9.12.5. **HydroTap:** 394 x 464 x 333mm Classic Chrome Zip HydroTap

provides Boiling and Chilled filtered drinking water on tap. Unit to be supplied with vent tray. Unit fitted over sink.

1.10. Sanitary Accessories [Male- and Female Toilet Block, Rest Rooms, Gym]

1.10.1. **Sanitary Towel Disposal Bin:** Surface mounted sanitary towel disposal bin.

Size: 205 x 134 x 305mm.

Manufactured from Grade 304: 1,2/1,5mm Stainless Steel, satin finished with surface treatment - InoxPlus (anti fingerprint).

Complete with a plastic container with a 3,8 litre capacity for the disposal of sanitary towels and minor waste; with Stainless Steel continuous piano hinge, including mounting kit.

1.10.2. **Waste bin:** 304/1,5mm thick satin finished stainless steel waste bin.

Size: 300 x 270 x 520mm high. Capacity: 34 litres.

Cylinder lock with standard key, plugged and screwed to the wall with stainless steel screws.

1.10.3. **Soap Dispenser:** Surface mounted soap dispenser.

Size: 100 x 134 x 304mm.

Manufactured from Grade 304: 1,2/1,5mm Stainless Steel, satin finished with surface treatment - InoxPlus (anti fingerprint).

The soap dispenser incorporates a replaceable and refillable 1 litre container, suitable for liquid and antiseptic soaps and lotions.

Cylinder lock with standard key, includes mounting kit.

1.10.4. **Toilet roll holder:** Toilet roll holder with spindle system for wall mounting.

Size: 156 x 141 x 303mm.

Manufactured from Grade 304: 1,2/1,5mm Stainless Steel, satin finished with surface treatment - InoxPlus (anti fingerprint).

Cylinder lock with standard key; for 2 rolls maximum 108 mm diameter.

Reserve roll not visible; dropping automatically into the dispensing position after finishing of the first roll; includes mounting kit.

- 1.10.5. **Paper Towel Dispenser:** Surface mounted paper towel dispenser.
Size: 300 x 134 x 305mm.
Manufactured from Grade 304: 1,2/1,5mm Stainless Steel; satin finished with surface treatment - InoxPlus (anti fingerprint).
Cylinder lock with standard key.
Capacity: 300 - 400 towels depending on the type and folding.
Suitable paper towel sizes:
Min 240 x 85mm.
Max 250 x 105mm.
Ideal 250 x 95mm.
- 1.10.6. **Hand Dryer:** Sensor operated wall mounted hand dryer.
Size: 280 x 207 x 245mm.
Manufactured from Grade 304: 1.2mm Stainless Steel, satin finish.
Automatic cut-off feature. Warm air output of 28m/s at 65°C.
Adjustable sensitivity from 100 to 300mm.
Vandal resistant lock, screws and key wrench.
- 1.10.7. **Double Toilet Roll Holder: [Universal Toilet/Disabled Facilities]**
Wall mounted double toilet paper roll holder.
Size: 335 x 128 x 100mm.
Manufactured from Grade 304: 3mm Stainless Steel, satin finish, with a controlled delivery spindle.
Standard lock and key; complete with screws and dowels.
The dispenser to take two rolls with a maximum 120mm Ø each.
- 1.10.8. **Cistern & Flush Valve Back Rail: [Universal Toilet/Disabled Facilities]**
750 x 260mm Grab rail; manufactured from Grade 304:
Stainless Steel, satin finish to prevent slipping,
Diameter 32mm; complete with screws and dowels.
- 1.10.9. **Paraplegic Grab rail: [Universal Toilet/Disabled Facilities]**
300 x 96 x 300mm Grab rail; manufactured from Grade 304 Stainless Steel, satin finish to prevent slipping,
Diameter 31,8mm; complete with screws and dowels.

1.11. Joinery finishes

1.11.1. Worktops:

650mm Wide worktop to continue over floor unit cupboards OR as shown on typical detail plan.

30mm Luxury engineered quartz polished finish.

Colour to be confirmed.

1.11.2. Carcass:

Carcass shall be of 16mm particle board, foiled and edged on all exposed faces with white Renolit pvc foil.

NOTE: Exposed end edges of carcass to be the same HPL colour as doors and drawer fronts.

1.11.3. Joinery Doors:

16mm particle board veneer in Formica HPL.

Doors are predrilled for automatic hinges.

Colour: Formica HPL.

1.11.4. Drawers:

Drawers' bodies shall be of 12mm particle board, sides, back and fronts with 3,2 Masonite bottoms. Edged and foiled on all sides in white melamine PVC Foil. Drawer runners shall be of epoxy coated steel two part telescopic slides running on nylon runners, with soft-close mechanism.

Drawer Fronts to match doors: 16mm particle board veneer in Formica HPL.

1.11.5. Joinery Hinges:

Hinges shall be concealed type, fitted to predrilled doors.

1.11.6. Plinth/Kick Plates:

Plinth, Aluminium, Matt Black, 150mm x 3m

1.11.7. Joinery Handles:

Push-to-open latches, hidden pulls.

1.12. Ceiling Finishes and shadow lines

- 1.12.1. **Ceiling Construction 1:** Plastered soffit with painted finish.
[Plant Rooms, retail units].
- 1.12.2. **Ceiling Construction 2:** Suspended with cables from soffit at height as per drawings and QS measurement. [Open plan areas and circulation areas, pause areas, Museum].
- 1.12.3. **Ceiling Construction 3:**
Suspended acoustic ceiling panels with 1m perimeter bulkhead. Acoustic panels for Privacy, premium biologically absorbable mineral wool ceiling tiles, CAC Value - 41dB, Fire classification A2- s1, d0, weight - 6.5 kg/m², Size 600 x 600x 20mm with Reveal-edge and white painted finish, laid on fire rated exposed demountable suspension system, comprising galvanized main tees and cross tees with main tees suspended by means of galvanized hangers at centres not exceeding 1200mm, and all installed to manufacturer's instructions. Construct shadow line, plugged and screwed at centres not exceeding 200mm. [Enclosed offices and boardrooms].
- 1.12.4. **Ceiling Construction 4:**
Suspended plasterboard ceilings. [Storerooms, kitchen, Clinic].

1.13. Handrails and Concrete Balustrades (Preserve)

- 1.13.1. Handrail **HR01:**
See handrail detail on DRAWING 5605.02 DETAILS | Suspended Walkways
1m high stainless steel and glass handrail.
- 1.13.2. Handrail **HR02:**
1m high mild steel handrail, not to permit a ball of 100mmØ, paint to paint specifications.
- 1.13.3. Concrete Balustrades: refurbish to match existing.

1.14. Roofing

1.14.1. Replace metal roof covering:

Remove and replace roofing.

Replace existing Sheetmetal roofing and structurally damaged purlins and replace. Install new purlins with stand-offs as required to achieve minimum fall of 2 degrees and installation of thermal breaks at every connection between purlins and roof sheeting. Replace existing insulation with new thick pink aerolite insulation, 100 mm thick.

0.53mm thick 700mm cover profile min. AZ200.

Enduring White finish topcoat and Shadow Grey backing coat roof sheeting, fixed to steel intermediate purlins at max. 2300mm centers and eaves and ridge purlins at max. 1900mm centers (final spacing to be calculated by an Engineer) using KL700 plus clips fixed with 10No.16 x 16mm long self-drilling wafer head PH2 screws, No. 3 drill point fasteners (fastener lengths may vary depending on the insulation used or requirements), all following the manufacturer's specifications by an approved contractor.

Type of Building: commercial.

Roof Pitch: 2°.

Climatic Condition: inland - Zone C1/C2 Low Corrosion Risk.

Material Gauge: 0.53mm.

Colour: Enduring White.

1.14.2. Replace gutters & downpipes:

Remove and replace gutters & downpipes.

Replace existing gutters and downpipes. Gutters to be sized by engineer. Industrial gutters must accommodate foot traffic for regular access and maintenance, as well as integral hail guards and emergency overflows. Allow for safety hooks for attachment of safety equipment for work at height. Downpipes to be routed at same locations as existing and also matching the existing outside diameter if possible. New downpipes to be galvanized mild steel, thick gauge, with painted finish.

1.14.3. Waterproofing on Concrete Flat Roofs:

1.14.3.1. New Screeds to flat roof:

1.14.3.2. Repair existing screeds:

Ensure falls to existing flat roofs are a minimum of 1:80. If not, remove existing and replace with new.

1.14.3.3. Install new:

6 parts well graded clean sharp river sand, 1 part cement all laid to minimum 1:80 falls to outlets, with lightweight screed according to engineers' specification.

1.14.3.4. Existing concrete roof - torch on:

Install new torch on waterproofing:

One layer torch-on waterproofing membrane, with 75mm side laps and 100mm end laps, sealed to primed surface to falls and crossfalls by 'torch-fusion' finished with two coats bituminous aluminium paint. Waterproofing to be installed by an Approved Waterproofing Contractor under a ten-year guarantee.

1.14.4. Large-span roofing/Skylight (Central Courtyard):

Ethylene tetrafluoroethylene (ETFE) lightweight roof.

Industrial-strength construction plastic for exterior cladding/roofing, applied in layers welded together around the edges and held by a metal framework.

1.15. Paint Specification**1.15.1. Paint System 1:**

On previously enamel painted wall surfaces. For internal walls not affected by damp:

Surface Preparation:

Remove loose, flaking and peeling paint and any unsound material back to a firm edge by scraping or sanding and feather edges. Scrub with sugar soap solution to remove dirt, powdery residues and other contaminants. Rinse thoroughly with fresh water and wait to dry. Remove all cementitious repair works.

Make good plaster cracks with 1:1:2 sand, hydraulic lime, cement mortar.

Smooth crack treatment off whilst still wet and allow to dry and then sand to a smooth finish. Sand old enamel paint to an even matt finish to provide key. All surfaces must be clean, sound and dry before painting.

Product Application:

Professional Superior Matt to interior new cement plaster. Surface to be assessed and the appropriate surface preparation clauses selected for remedial procedure. Prime with one coat Professional Plaster Primer with an overcoating time of 16 hours and finish with two coats Professional Superior Matt with 2 hours drying time between coats, for a maintenance cycle of 7 years in a C1 - inland environment.

Environment: C1 – inland.

Topcoat: Professional Superior Matt.

Number of coats of topcoat: two coats.

Overcoating time for topcoat: 2hour.

Primer/Base coat: Professional Plaster Primer.

Overcoating time for primer/base coat: 16hour.

Specification document: RD107t.

1.15.2. Paint System 2:

On previously acrylic / latex or similar wall painted surfaces. For internal walls not affected by damp:

Surface Preparation:

Remove loose, flaking and peeling paint and any unsound material back to a firm edge by scraping or sanding and feather edges. Scrub with sugar soap solution to remove dirt, powdery residues and other contaminants. Rinse thoroughly with fresh water and wait to dry.

Remove all cementitious repair works. Make good plaster cracks with 1:1:2 sand, hydraulic lime, cement mortar.

Smooth crack treatment off whilst still wet and allow to dry and then sand to a smooth finish. Sand old enamel paint to an even matt finish to provide key. All surfaces must be clean, sound and dry before painting.

Product Application:

Professional Superior Matt to interior new cement plaster. Surface to be assessed and the appropriate surface preparation clauses selected for remedial procedure. Prime with one coat Professional Plaster Primer with an overcoating time of 16 hours and finish with two coats Professional Superior Matt with 2 hours drying time between coats, for a maintenance cycle of 7 years in a C1 - inland environment.

Environment: C1 – inland.

Topcoat: Professional Superior Matt.

Number of coats of topcoat: two coats.

Overcoating time for topcoat: 2hour.

Primer/Base coat: Professional Plaster Primer.

Overcoating time for primer/base coat: 16hour.

Specification document: RD107t.

1.15.3. Paint System 4:

New and Unpainted Wood (Excluding Timber Windows and Doors / Frames):

Surface Preparation:

Sand surfaces all round smooth with 150 grit paper working in the direction of the grain, round off all sharp edges with a finger break and dust off.

Surface to be dry, sound and clean. Wash knots and resinous areas with Lacquer Thinners and coat with Knot Seal and apply one coat of Pretreatment, overcoated within 48 hours with a moisture content, measured with a Doser Hygrometer (or equivalent), of BD 2 scale (A1-A5) & lt; 14% or less.

Product Application:

Prime with one coat Professional Wood Primer with an overcoating time of 16 hours and finish with two coats Premium quality satin finish non-drip enamel Water Based with 4 hours drying time between coats, for a maintenance cycle of 12 years in a C1 - inland environment.

Environment: C1 – inland.

Topcoat: Premium quality satin finish non-drip enamel Water Based.

Number of coats of topcoat: two coats.

Overcoating time for topcoat: 4hour.

Primer/Base coat: Professional Wood Primer.

Overcoating time for primer/base coat: 16hour.

Specification document: NW362t.

1.15.4. Paint System 5:

Previously Enamel Painted Wood:

Surface Preparation:

Holes and defects - Interior and exterior – Wood.

Fill holes and defects using Ready mix adhesive filler working off smoothly while wet. Allow 8 hours to dry. Sand to a smooth finish. (Solid Colour Finish). For a clear varnish finish, mix sawdust from sanded wood and varnish to a stiff paste for filling. Allow at least 16 hours drying.

Providing a 'key' to old paint: sugar soap and sanding – wood. Wash surface with Sugar Soap solution - 500 g Sugar Soap Powder dissolved in 5 litres water to remove surface contaminants. Rinse thoroughly with fresh water and allow drying. Sand paint to a matt finish using 120 grit paper, finishing with 220 grit paper. Dust off.

General – Wood: Ensure surfaces are clean, sound and dry. To determine the moisture content, use a Doser Hygrometer scale A1-A5 (or equivalent) depending on generic wood type. Measurements should be <14 % before painting.

Sand wood with 120 grit paper and finish off with 220 grit paper in the direction of the grain. Dust off.

Product Application:

Surface to be assessed and the appropriate surface preparation clauses selected for remedial procedure. Prime with one coat Professional Wood Primer with an overcoating time of 16 hours and finish with two coats Premium quality satin finish non-drip enamel Water Based with 4 hours drying time between coats, for a maintenance cycle of 12 years in a C1 - inland environment.

Environment: C1 – inland.

Topcoat: Premium quality satin finish non-drip enamel Water Based.

Number of coats of topcoat: two coats.

Overcoating time for topcoat: 4hour.

Primer/Base coat: Professional Wood Primer.

Overcoating time for primer/base coat: 16hour.

Specification document: RD362t.

1.15.5. Paint System 9:

New INTERIOR smooth concrete:

Surface Preparation:

Ensure that surfaces are dry, sound and clean. Concrete must cure for minimum 28 days and cement plaster 14 days before painting. Remove any hollow and soft/underbound plaster and re-plaster. Remove dirt and loose particles. Remove any oil, grease and other contaminants with Water rinsable degreaser working it well into affected areas with bristle broom or brush. Leave for 20 minutes to react, then rinse thoroughly with fresh water to remove all traces of water rinsable degreaser, using high pressure water jet or scrubbing with brush or broom. Allow to dry completely.

Remove fungi and algae by scrubbing with a solution of household bleach (3,5% sodium hypochlorite) - 1 part bleach to 2 parts water by volume. Leave for 1 hour, then brush off with a bristle brush. Rinse thoroughly with tap water to remove all traces of bleach and allow to dry.

Fill cracks and other surface defects with the appropriate filler - refer Surface Preparation, SP4 Crack Repair. Moisture content measured with a Doser Hygrometer (or equivalent) must not exceed the following limits before painting: concrete, off-shutter, pre-cast: BD 4 scale - 5% cement plaster, brickwork, fibre-cement: BD 2 scale - 8%.

Product Application:

To suitably prepared surfaces apply one primer coat and two coats gloss enamel Primer. Coat full primer coat with Professional Gypsum and Plaster Primer. Allow 16 hours to dry. Finishing Coats: Apply two full coats of Professional Eggshell enamel to achieve complete obliteration, allowing 16 hours drying between coats.

1.15.6. Paint System 12:**Silver Paint:****Surface Preparation:**

Preparation of Various Substrates to receive Silver Paint Galvanized iron in good condition. Apply Galvanized Iron Cleaner to all bare galvanized areas by brush, broom or spray. Allow to react for one minute.

Rinse off with tap water using medium hard bristle brooms or brushes to remove all surface contaminants. Check if surface is water-break free. If not, repeat the cleaning process. Allow to dry completely.

Zinc salts (white rust) - galvanized iron.

Scour entire area with Water rinsable degreaser in conjunction with Scouring pads. Allow to react for 20 minutes. Remove water rinsable degreaser and surface contaminants by hydro blasting or with medium/hard bristle scrubbing brushes or brooms in conjunction with tap water. Check if the surface is water break-free. If not, repeat process.

Allow surface to dry.

Old galvanized iron partially rusted: A premium epoxy coating Where the Zinc has been depleted the corroded areas must be prepared to ISO 8501-1: 2007 St 3 (bright metal finish, e.g. mechanical wire brushing).

Patch Prime using A premium epoxy coating to a DFT of 100-200 μm or WFT of 125-250 μm at a theoretical spread rate of 5.3 m^2/litre .

Old galvanized iron totally rust: A premium epoxy coating Where the Zinc has been depleted the entire corroded areas must be prepared to ISO 8501-1: 2007 St 3 (bright metal finish, e.g. mechanical wire brushing).

Prime with one full coat of A premium epoxy coating to a DFT of 100-200 μm or WFT of 125-250 μm at a theoretical spread rate of 5.3 m^2/litre .

Product Application:

Solvent Cleaner: Genuine Turpentine Application: Brush, roller or Spray Spreading Rate: $\pm 10\text{m}^2/\text{Litre}$ Over coating Time: 24 hours Primer: Prime the entire surface Universal Primer to achieve a continuous film. Allow 16 hours to dry.

(Solvent based topcoat) Undercoat:

Apply one coat of Professional All Purpose Undercoat to achieve a continuous film. Allow 16 hours to dry. Finishing Coats: Apply two full coats of Premium Aluminium Paint to achieve complete obliteration, allowing 16 hours drying between coats.

1.15.7. Paint System 14:

Previously painted Internal and External steel components:

Surface Preparation:

General cleaning - unpainted surfaces: water rinsable degreaser - mild steel: Surfaces must be clean, dry and rust free. Remove surface contaminants using Water rinsable degreaser in conjunction with bristle scrubbing brushes or brooms, alternatively Scouring pads.

Rinse thoroughly with tap water using medium bristle brooms, bristle scrubbing brushes or hydroblast to remove all traces of Water rinsable degreaser and achieve a water break-free surface. Dry surface rapidly to prevent flash rust formation.

Rust - mechanical removal - wire brushing, grinding and coarse sanding - mild steel: Remove rust by mechanical wire brushing, grinding or coarse sanding to ISO 8501-01:2007 - St 3 to attain a bright metal finish. Remove dust.

Spot prime with a premium epoxy coating series. Mix base and hardener thoroughly in a 4:1 ratio by volume before use. Spot prime bare and repaired areas with A premium epoxy coating.

Premix both components of the premium epoxy coating using a power mixer for 3 minutes and then apply (preferably) by brush to a minimum DFT of 100-200 µm or WFT of 125-250 µm @ a theoretical spread rate of 5.3m²/litre. Allow 16 hours to cure. NOTE: Overcoating times - "should the primer be left for long periods surface contaminants should be washed off using a sugar soap solution and if high temperatures have been experienced sanding or Scouring pads should be used to provide a key for good inter-coat adhesion for topcoat".

Product Application:

To suitable prepared surfaces apply "Rust Converter", one coat zinc phosphate primer and two coats gloss enamel.

Rust converter - mild steel: In areas where rust cannot be removed completely, remove all loose rust by scraping and wire brushing. Apply Corrosion protection paint copiously, but only to areas where tightly adherent rust remains.

Allow coating to turn black (minimum 4 hours) before overcoating. Remove Corrosion protection paint with water where it has not reacted and turned black.

Substrate: mild steel Surface to be assessed and the appropriate surface preparation clauses selected for remedial procedure.

Prime with one coat Zinc Phosphate Alkyd Primer with an overcoating time of 12 hours and finish with two coats Premium quality satin finish non-drip enamel Water Based with 4 hours drying time between coats, for a maintenance cycle of 7 years in a C1 - inland environment.

Environment: C1 – inland.

Topcoat: Premium quality satin finish non-drip enamel Water Based.

Number of coats of topcoat: two coats.

Overcoating time for topcoat: 4hour.

Primer/Base coat: Zinc Phosphate Alkyd Primer.

Overcoating time for primer/base coat: 12hour.

Specification document: RD296t.

1.15.8. Paint System 15:

Internal and External Galvanized Iron in good condition:

Surface Preparation:

Galvanized iron in good condition: Apply Galvanized Iron Cleaner to all bare galvanized areas by brush, broom or spray. Allow to react for one minute. Rinse off with tap water using medium/hard bristle brooms or brushes to remove all surface contaminants. Check if surface is water-break free. If not, repeat the cleaning process. Allow to dry completely.

Zinc salts (white rust) - galvanized iron: Scour entire area with Water rinsable degreaser in conjunction with scouring pads. Allow to react for 20 minutes. Remove water rinsable degreaser and surface contaminants by hydro blasting or with medium hard bristle scrubbing brushes or brooms in conjunction with tap water. Check if the surface is water break-free. If not, repeat process. Allow surface to dry.

Old galvanized iron partially rusted: a premium epoxy coating: Where the Zinc has been depleted the corroded areas must be prepared to ISO 8501-1: 2007 St 3 (bright metal finish, e.g. mechanical wire brushing).

Patch Prime using A premium epoxy coating to a DFT of 100-200 μm or WFT of 125-250 μm at a theoretical spread rate of 5.3 m^2/litre .

Old galvanized iron totally rust: a premium epoxy coating: Where the Zinc has been depleted the entire corroded areas must be prepared to ISO 8501-1: 2007 St 3 (bright metal finish, e.g. mechanical wire brushing).

Prime with one full coat of A premium epoxy coating to a DFT of 100-200 μm or WFT of 125-250 μm at a theoretical spread rate of 5.3 m^2/litre .

Product Application:

Surface to be assessed and the appropriate surface preparation clauses selected for remedial procedure. Prime with one coat Zinc Phosphate Alkyd Primer with an overcoating time of 12 hours and finish with two coats Premium quality satin finish non-drip enamel Water Based with 4 hours drying time between coats, for a maintenance cycle of 7 years in a C1 - inland environment.

Environment: C1 – inland.

Topcoat: Premium quality satin finish non-drip enamel Water Based.

Number of coats of topcoat: two coats.

Overcoating time for topcoat: 4hour.

Primer/Base coat: Zinc Phosphate Alkyd Primer.

Overcoating time for primer/base coat: 12hour.

Specification document: RD296t.

1.15.9. Paint System 16:

Internal and External Mild Steel - NOT galvanized:

Surface Preparation:

Surface to be clean and dry. Remove surface contaminants using Water rinsable degreaser with bristle brush or steel wool scouring pads. Rinse thoroughly with tap water until surface is water break-free.

Remove rust and millscale by abrasive blasting to ISO 8501 - 01:1988 - Sa2½ or by hand/mechanical wire brushing to St3 of the same standard. Allow to dry completely and prime within 4 hours of cleaning. Prime with one coat Universal Primer with an overcoating time of 8 hours.

Product Application:

Finish with two coats Premium quality satin finish non-drip enamel Water Based with 4 hours drying time between coats, for a maintenance cycle of 5 years in a C1 - inland environment.

Environment: C1 – inland.

Topcoat: Premium quality satin finish non-drip enamel Water Based.

Number of coats of topcoat: two coats.

Overcoating time for topcoat: 4hour.

Primer/Base coat: Universal Primer.

Overcoating time for primer/base coat: 16hour.

Specification document: NW284t.

1.15.10. Paint System 17:

Flaking or peeling paint on steel:

Surface Preparation:

Surface to be clean and dry. Remove surface contaminants using Water rinsable degreaser with bristle brush or Steel wool scouring pads. Rinse thoroughly with tap water until surface is water break-free.

Remove rust and millscale by abrasive blasting to ISO 8501 - 01:1988 - Sa2½ or by hand/mechanical wire brushing to St3 of the same standard. Allow to dry completely and prime within 4 hours of cleaning. Prime with one coat Universal Primer with an overcoating time of 8 hours.

Product Application:

Finish with two coats Premium quality satin finish non-drip enamel Water Based (VLW) with 4 hours drying time between coats, for a maintenance cycle of 5 years in a C1 - inland environment.

Environment: C1 – inland.

Topcoat: Premium quality satin finish non-drip enamel Water Based.

Number of coats of topcoat: two coats

Overcoating time for topcoat: 4hour.

Primer/Base coat: Universal Primer.

Overcoating time for primer/base coat: 16hour.

Specification document: NW284t.

1.15.11. Paint System 18:

Badly rusted steel:

Surface Preparation:

Remove all rusted parts and paint by sandblasting door (and frame) in situ; if external, remove internal door to be sand blasted in workshop.

Rust/millscale - abrasive blast clean - mild steel: Remove millscale and rust by abrasive blast cleaning to ISO 8501-01:2007, Sa 2 1/2. Blast profile 50 to 70µm. Remove dust.

Product Application:

Depending on the blasting profile a primer of up to 100microns DFT may be required as anything with a lower film thickness might result in the steel still being exposed. Plascotuff Surface Tolerant Primer Pex 3500 can be applied to achieve either 100 or up to 182microns DFT. depending also on the level of protection and lifespan desired. If no other primer has been applied, Prime with one coat Universal Primer with an overcoating time of 8 hours.

Finish with two coats Premium quality satin finish non-drip enamel Water Based with 4 hours drying time between coats, for a maintenance cycle of 5 years in a C1 - inland environment.

Environment: C1 – inland.

Topcoat: Premium quality satin finish non-drip enamel Water Based.

Number of coats of topcoat: two coats.

Overcoating time for topcoat: 4hour.

Primer/Base coat: Universal Primer.

Overcoating time for primer/base coat: 16hour.

Specification document: NW284t.

1.15.12. Paint System 19:

External steel and cast iron surface paint system:

Surface Preparation:

Surface to be clean and dry. Remove surface contaminants using Water rinsable degreaser with bristle brush or steel wool scouring pads. Rinse thoroughly with tap water until surface is water break-free. Remove rust and millscale by abrasive blasting to ISO 8501 - 01:1988 - Sa2 1/2 or by hand/mechanical wire brushing to St3 of the same standard.

Allow to dry completely and prime within 4 hours of cleaning. Prime with one coat Universal Primer with an overcoating time of 8 hours.

Product Application:

Finish with two coats Premium quality satin finish non-drip enamel Water Based with 4 hours drying time between coats, for a maintenance cycle of 5 years in a C1 - inland environment.

Environment: C1 – inland.

Topcoat: Premium quality satin finish non-drip enamel Water Based.

Number of coats of topcoat: two coats.

Overcoating time for topcoat: 4hour.

Primer/Base coat: Universal Primer.

Overcoating time for primer/base coat: 16hour.

Specification document: NW284t.

1.15.13. Timber Paint System 1:

Sealant on previously Varnished Timber. Only to be used where explicitly specified. In general, no varnish is to be used.

Surface Preparation:

Clean all surfaces with Lacquer thinners and clean cloths to remove oily and other contaminants.

Knots and resinous areas – wood: Wash area thoroughly with Lacquer Thinners to remove all traces of resin.

Treat knots with Knot Seal. Allow 1 hour to dry. (Apply two coats if resin is excessive).

Holes and defects - interior and exterior – wood: Fill holes and defects using Ready mix adhesive filler working off smoothly while wet. Allow 8 hours to dry.

Sand to a smooth finish. (Solid Colour Finish).

For a clear varnish finish, mix sawdust from sanded wood and varnish to a stiff paste for filling. Allow at least 16 hours drying.

Providing a 'key' to old paint: sugar soap and sanding – wood:

Wash surface with Sugar Soap solution - 500 g Sugar Soap Powder dissolved in 5 litres water to remove surface contaminants. Rinse thoroughly with fresh water and allow drying. Sand paint to a matt finish using 120 grit paper, finishing with 220 grit paper. Dust off.

General – wood: Ensure surfaces are clean, sound and dry. To determine the moisture content, use a Doser Hygrometer scale A1-A5 (or equivalent) depending on generic wood type. Measurements should be <14 % before painting. Sand wood with 120 grit paper and finish off with 220 grit paper in the direction of the grain. Dust off.

Product Application:

To suitable prepared surfaces apply two coats of polyurethane varnish. Spot prime bare and repaired areas with Sunproof thinned 3 parts Sunproof to 1 part Genuine Turpentine by volume.

Allow 24 hours to dry.

Sand lightly with 220 grit sandpaper to denib. Remove dust.

Finishing Coats:

Apply two further coats of Sunproof allowing 24 hours drying between coats. Sand lightly between coats to dry and dust off.

Please Note: Always maintain a wet edge and avoid downing tools during the application process to prevent lap marks and variances in colour or texture. Work from corner to corner, or from a natural cut off point to another. Do not attempt touch ups, but redo complete panels.

1.15.14. Timber Paint System 2:

Sealant on new timber only; to be used where explicitly specified. In general, no varnish is to be used.

Surface Preparation:

Ensure that surfaces are clean, dry and sound. Moisture content measured with a Doser Hygrometer B2 scale A1-A5 (or equivalent), depending on the wood type, must be <14 % before painting. Sand wood to a smooth finish with 150 – 220 grit paper in the direction of the grain depending on the smoothness required. Sharp edges must be rounded off. Dust off. Ensure that sharp edges are well rounded. Wash knots and resinous areas with Lacquer Thinners.

Apply Knot Seal to all knots and resinous areas. Allow 1 hour to dry.

Stopping: Fill holes and other surface imperfections with Woodstopping to match the colour of the wood. Allow 1 hour to dry and sand smooth in the direction of the wood grain. Dust off.

Product Application:

Brush Application Sealer Coat.

Apply a first coat of Ultra Varnish thinned 3 parts; Ultra Varnish; to 1 part Genuine Turpentine by volume. Allow 6 hours to dry.

Sand lightly with fine paper (600 or 800 grit) to dry. Remove dust.

Finishing Coats: Apply two further coats of Ultra Varnish, un-thinned allowing 6 hours drying between coats. Also sand lightly between coats to dry and dust off. One bottle (100mℓ) of Universal Fungicide can be added to each 5 litre of final coat used in damp, wet areas. For severe conditions, two bottles (2 x 100mℓ) can be added to each 5ℓ of final coat used.

1.15.15. Emulsion (Acrylic Pva) Paint System 1:

For internal cement plastered walls not affected by damp:

Surface Preparation:

Remove loose paint and peeling paint and any unsound material back to a firm edge by scraping or sanding, feather edges. Scrub with sugar soap solution to remove dirt, powdery residues and other contaminants. Rinse thoroughly with fresh water, dry.

Make good plaster cracks with e.g. Ready mix adhesive filler or refer to Flexible Joint Sealing Compound System. Smooth off whilst still wet and allow to dry and then sand to a smooth finish. All surfaces must be clean, sound and dry before painting.

Loose and flaking/peeling paint - dry preparation - masonry, plaster, etc.

Remove loose and peeling paint back to a firm edge by scraping, sanding or other suitable means. Feather the edges with 100 grit sandpaper and ensure surface is dust free.

Providing a 'key' to old paint - sugar soap and sand - masonry, plaster, etc. Wash surface with Sugar Soap solution - 500 g Sugar Soap Powder dissolved in 5 litres water to remove surface contaminants. Rinse thoroughly with fresh water and allow drying. Sand paint to a matt finish using 100 grit paper. Dust off.

Plaster cracks (<4mm):

Rake out cracks using an angle grinder to a minimum of 3mm wide and deep. Remove dust and prime repair areas with Professional Gypsum & Plaster Primer. Allow 16 hours to dry. Fill with Ready mix adhesive filler and smooth off to match existing plaster. After 8 hours sand smooth and prime repaired areas with Professional Gypsum & Plaster Primer.

Optional:

After 16 hours make the repaired areas invisible by rolling (using a medium pile roller), a coat of thinned (5% with water) Professional Waterproofing Compound, applied at a wet film thickness of 400 µm; whilst wet taper the edges to zero using a water wet brush.

Fungal and algae growth: sodium hypochlorite treatment - masonry, plaster, etc. Scrub the affected areas using a solution of household bleach (3, 5 % sodium hypochlorite solution) mixed 1 part bleach to 2 parts water, brush onto surface and allow 30 minutes to react. After 30 minutes or a marked colour change (lighter), brush clean using a hard bristle brush. Then rinse thoroughly with fresh water to remove all traces of bleach and allow drying.

Defects (holes and voids): ready mix adhesive filler (<4mm) Make good defects using Ready mix adhesive filler. Smooth off while wet. Allow 8 hours to dry before sanding smooth with 120-220 grit sandpaper depending on finish required.

Fine crack repairs (0.08-3mm): multiseal Ensure any debonded or hollow sounding plaster is removed and repaired (refer SP 13). Cracks exhibiting algae or fungal growth should be scrubbed with sodium hypochlorite solution. (Bleach mixed 1 part bleach two parts water, brush onto surface and allow 30 minutes to react).

Rinse well with clean water and allow drying. Before bridging the crack, apply one coat of Plaster Primer to fine cracks and allow 16 hours drying at 23 °C before overcoating. Brush Multiseal thinned 5-10 % with water over the entire fine cracked area to a wet film thickness of 400 µm (a medium pile or short pile roller maybe used with thinned material to avoid texturing the coating. Stipples should be smoothed out while still wet using a water wet brush).

Crazed cracking:

A second diluted coat will be required after a drying time of two hours to fill and bridge these cracks.

Product Application:

To suitable prepared surfaces Primer Coat Spot prime bare and repaired areas with Professional Gypsum and Plaster Primer. Allow 16 hours to dry. (Water based topcoat) Finish Coats Apply two full coats of Polvin Super Acrylic OR Superior Matt to achieve complete obliteration, allowing 1 hour drying between coats.

1.15.16. Emulsion (Acrylic Pva) Paint System 2:**Ceiling Finishes:****Surface Preparation:**

Defects - interior boards - composite boards: Fill defects on MDF Board and hardboard using Ready mix adhesive filler; use Plaster crack filler Interior on Gypsum Plaster Board. Allow to dry. Sand smooth with 220 grit sandpaper. Substrate: hardboardSP61 Underbound - gypsum plaster Soft underbound surfaces may be restored to a sound surface by applying a coat of Bonding Liquid thinned 20 % by volume with Genuine Turpentine. Allow 16 hours to dry before painting.

Substrate: vermiculited, retarded hemihydrate Gypsum plaster.

Removing loose and peeling paint - dry method - gypsum plaster Remove loose and peeling paint carefully with scraper and/or sanding, taking care not to damage the substrate.

Substrate: vermiculited, retarded hemihydrate Gypsum plaster.

Repairing minor defects: Plaster crack filler interior - gypsum plaster Prime defects with Professional Gypsum and Plaster Primer. Allow 16 hours to dry Make good defects using Plaster crack filler Interior. Allow at least 30 minutes to dry and sand smooth with 220 grit paper and dust off.

Substrate: vermiculited, retarded hemihydrate Gypsum plaster. Crack on internal gypsum 2 coat plaster finish (<2mm): fine crack filler.

Rake out crack and dust off. Prime crack with Professional Gypsum & Plaster Primer. Allow 16 hours to dry. Fill crack with Plaster crack filler Fine Crack Filler. Once dry sand to a smooth finish and dust off. Prime repaired area with Professional Gypsum & Plaster Primer and allow drying.

Substrate: vermiculited, retarded hemihydrate Gypsum plaster Defects - interior boards - composite boards Fill defects on MDF Board and hardboard using Ready mix adhesive filler; use Plaster crack filler Interior on Gypsum Plaster Board. Allow to dry. Sand smooth with 220 grit sandpaper.

Substrate: gypsum plaster board.

Rusted nail heads in ceiling boards and rusted nail heads to bright metal. Patch prime using allow drying time of 6 hours. Fill recessed nailheads with Ready mix adhesive filler smooth off while wet, sand smooth after 6 hours. Patch prime using Professional Gypsum & Plaster Primer allowing 16 hours to dry.

Substrate: gypsum plaster board.

Product Application:

To suitably prepared surfaces Two coats of Professional Super Acrylic Application Prime all repaired and skimmed areas with Plaster Primer thinned 5 parts Primer to 1 part Genuine Turpentine by volume. Allow to dry overnight.

Final Coat: Apply two full coats of Super Acrylic to achieve complete cover allowing 1 hour drying at 23°C between coats. It is important to avoid overspreading.

1.15.17. **Emulsion (Acrylic Pva) Paint System 3:**

Paint System for Cementitious based External Surfaces Not for lime plastered walls:

Surface Preparation:

Apply sodium hypochlorite solution (household bleach thinned 1 part bleach to 2 parts water) to all areas containing algae and fungi. Leave for at least one hour. Remove all loose and peeling paint, dirt, chalked material and algae residues by hydroblasting using a low pressure system and scraping or with other suitable means. Allow to dry. Open and rake out structural cracks. Where excessive plaster has been removed, re-plaster using masonry patching plaster leaving a 5mm valley, to be filled and smoothed off with Ready mix adhesive filler. Repair plaster cracks with approved crack filler

NB: The texture of plaster should be imitated as close as possible. All surfaces must be clean, sound and dry before painting.

Hammer test suspect areas for cohesive failure. Hollow sounding plaster must be removed. The surface must be clean and sound. Repair areas using Plaster crack filler Masonry Patching Plaster in layers up 10mm per layer and allow 24 hours to dry.

Plaster cracks (<4mm): ready mix adhesive filler.

Rake out cracks using an angle grinder to a minimum of 3mm wide and deep. Remove dust and prime repair areas with Professional Gypsum & Plaster Primer. Allow 16 hours to dry. Fill with Ready mix adhesive filler and smooth off to match existing plaster. After 8 hours sand smooth and prime repaired areas with Professional Gypsum & Plaster Primer.

Optional:

After 16 hours make the repaired areas invisible by rolling (using a medium pile roller), a coat of thinned (5% with water) Professional Waterproofing Compound, applied at a wet film thickness of 400 µm; whilst wet taper the edges to zero using a water wet brush.

Product Application:

Suitably prepared surfaces apply: Primer Coat: Full primer coat with Professional Gypsum and Plaster Primer. Allow 16 hours to dry.

Intermediate Coats for Selected Substrates: 3 Coats only exterior Window frames, ledges, parapets, plaster bands, protruding plaster detail, etc.:

Apply three full coats of Professional Waterproofing Compound at a spreading rate of approximately 1.5m²/ℓ per coat. Allow 4 hours drying between coats. Stipples should be smoothed out while still wet using a water-wet brush.

Finishing Coats: Apply two full coats of Extremely durable fine textured UV-resistant water based coating using a honeycomb sponge roller to achieve complete obliteration, allowing 2 hours drying between coats.

1.15.18. Oil:

Paint System for previously oiled or varnished wooden windows, doors and door frames:

Surface Preparation:

Prepare wood for oiling. The following oils may be used: Tung oil Raw Linseed oil.

Product Application:

Strip existing previously varnished and oiled timber to bare substrate using 100 or 120 grit sandpaper. Apply matching colour wood putty to cracks and low spots using a putty knife to even out the surface. Remove all sanding dust and other residue using a high pressure air hose.

Apply first coat consisting of 1 part Genuine Turpentine (NOT genuine turpentine) and 1 part Tung or Raw Linseed oil to all exposed timber using a soft brush or cloth. Apply 2nd coat consisting of 1 part Genuine Turpentine (NOT genuine turpentine) and 2 part Tung or Raw Linseed oil to all exposed timber using a soft brush or cloth at least 2 weeks after first coat. Install glass preferably using timber cleats and paneling nails. Lightly re-oil frames every 6 months for the 1st year, then yearly.

1.15.19. Polywax Sealer:

Sealant system for previously treated timber, for exterior application. Default finish to all exterior timber including timber windows and doors.

Surface Preparation:

General: Wood must always be clean, dry & smooth before use of product. Never wash/wipe wood with water before use of product.

New wood: Sand until smooth. Remove dust with clean, dry cloth. Then wipe with mineral turpentine.

Previously varnished wood: Remove varnish by sanding/using paint stripper. Neutralise paint stripper according to manufacturer's instructions. Allow wood to dry completely. Sand until smooth. Remove dust with clean, dry cloth. Then wipe with mineral turpentine.

Oiled wood: Sand until smooth. Then scrub well with steel wool and mineral turpentine. Clean off residue with clean, dry cloth. Allow surface to dry.

Wood previously treated with: Scrub well with steel wool and mineral turpentine. Clean off residue with clean, dry cloth. Allow surface to dry.

Product Application:

Stir well before and during application. Do not shake or dilute product. Apply product with good quality brush. Apply first coat until surface remains evenly glossy for at least 10 minutes after application. Apply more product to dull/dry areas. Allow coat to dry completely.

Sand lightly with steel wool. Remove dust with clean, dry cloth. Then wipe with mineral turpentine.

Apply two more coats in the same way. Do not sand after third coat. Always apply a minimum of three coats.

Proper film build on surface is essential. Seal end grain very well.

Extreme weather conditions, e.g. very high/low temperatures can influence the appearance (gloss) of the final finish.

Apply 3 finishing coats of Polywax Sealer - Exterior.

1.16. Other Services:**1.16.1. Lighting****1.16.1.1. [External façade lighting]**

Lighting at pavement level for pedestrians as well as strips and flood lights to illuminate the building at night for high visibility.

High level of illumination of the "drop-off parking area on the North boundary required.

1.16.1.2. [Reinstated Verandas and Existing Balconies, External Refuse area]

Subtle lighting, automatic day-night switched.

1.16.1.3. [Main Reception and Museum].

High spec lighting, chandeliers, LED strip lights, spotlights for artwork

1.16.1.4. [Boardrooms and Enclosed offices]

Zone selectable and dimmable LED lighting, with wall mounted control panel per individual office and boardroom.

1.16.1.5. [Open plan areas and Heritage library]

LED lighting, with occupancy sensors and wall mounted light switch per zone not exceeding 20 occupants.

1.16.1.6. [Bulkheads to perimeter of boardrooms and enclosed offices, storerooms].

Down-lights installed to ceilings, with occupancy sensors.

1.16.1.7. [Plantrooms]

Surface mounted LED fittings or specialized vapor-resistant fittings to engineer's specification.

1.16.1.8. [Toilet blocks]

LED lighting with occupancy sensors.

1.16.2. Audio / Visual

For each boardroom - two off 65" Monitors, with integrated commercial grade video conferencing camera, microphones, and speaker system, including remote control and secure wireless presentation features.

1.16.3. Electrical & Data

Allow for a separate DB and separate metering per individual shop.

1.16.4. HVAC

Allow for mechanical ventilation and air-conditioning, with each store separately controlled. Heat exchangers to be mounted on the roof (as per building standard).

1.16.5. Security

Allow for each shop to have a secure remote controlled roller shutter door. Alarms and CCTV to be installed by tenants if required.

1.17. Artwork

1.17.1. Graffiti Artwork [Wall in main reception drop-off area]

1.17.2. Sculpture [Central courtyard]

Allowance should be made for commissioned artwork at certain focal.

This will be a local artist, often the artwork is applied / constructed directly on site as an ad-hoc bespoke installation.

1.18. Signage

Large backlit signage to all sides of building exterior, installed on the roof with sub frame.

Signage at street level for wayfinding to the entrance and building identification.

1.19. Perimeter Fencing

1.19.1. A high-security fencing system, coated with unique Fusion bond to Galvanized high tensile steel core. Internal fixtures - all fixtures shall be on the inside of fence line.

1.19.2. Panel shall have 2 x 30° flanges along top and toe (integrated rigid angle).

1.19.3. Panel post shall have a flush panel post finish with no climbing aid.

1.19.4. Panel shall be affixed to post over 48 line wires using 8 x Double bolt comb clamps and 8 x Single bolt comb clamps using 24 x Anti vandal bolts.

1.19.5. Panel and fixtures shall be Galvanized.

1.19.6. Topping Options: Electrical detection topping.

1.19.7. Anti-Burrow Options: A 200mm Concrete Sill shall be secured to the panel's lower edge integrated angle.

1.20. Landscaping

1.20.1. Grass sods:

Loosen existing topsoil throughout to a depth of 100 mm and mix thoroughly with 2:3:2 fertiliser in the ratio of 20 kg fertiliser to 150 m² of topsoil.

Wet, level off and compact slightly on flat surfaces and mildly on inclined surfaces.

1.20.2. Ground cover and shrub beds:

Provide topsoil throughout to a depth of 200 mm and mix thoroughly with 2:3:2 fertiliser in the ratio of 30 kg fertiliser to 150 m² of topsoil and with compost in the ratio of 6 m³ compost to 100 m² of topsoil. Wet, level off and compact slightly on flat surfaces and mildly on inclined surfaces.

1.20.3. Shrubs

Remove shrubs from containers and plant in backfilled holes so that the top of the soil originally in the containers is level with the finished ground level.

Compact around shrubs and form 500 mm diameter x 150 mm deep soil

Wet thoroughly after planting with 25 litres of water per shrub.

1.20.4. Twelve x 1000 litre indigenous trees

At distances from buildings, drains and freestanding walls that take into account the type of soil, especially expansive soils, and mature height of tree.

Remove trees from containers and plant in backfilled holes so that the top of the soil originally in the containers is level with the finished ground level.

Compact around trees and form 1000 mm diameter x 150 mm deep soil dams.

Wet thoroughly after planting with 40 litre of water per tree.

Support every tree with a 2,5 m long x 50 mm diameter treated eucalyptus support driven 500 mm into the soil.

Tie each tree to support with two steel wires sleeved in a 300 mm long plastic hose-pipe section.

1.20.5. Compost means properly decomposed organic material, free from deleterious salts, waste products and impurities and with a pH-value between 4 and 7.

1.20.6. Fertilizer means a mixture of material complying with the specification under Law 36 of 1947. Order and store in plastic bags.

1.20.7. Garden Furniture: Allowance for garden furniture, benches, stone seats, wooden benches, umbrellas and drinking water fountains.

1.20.8. Central Water Feature: Allow for central water feature complete with pump.

Drainage Note:

Geo pipes and submerge drainage to landscaped areas.

Stormwater drainage, To Civil Engineer detail and specification.

1.21. Hard Landscaping

- 1.21.1. Existing concrete surface bed [Ventilation Trenches to perimeter of building].
Repair cracks:
Remove all loose concrete, open broken construction joints by removing loose pieces and creating a mechanical profile of the exposed area to be repaired. If any weld mesh is exposed, these to be cleaned of rust by using a wire brush.
- 1.21.2. New Paving to Central Courtyard: 40mm thick Cobble paver:
Lay pavers true to line and level on a loose and evenly spread sand bedding of compacted thickness of 25 ± 10 mm. Lay full units first. Joints must be between 2 and 6 mm wide.
Fill areas in which a full unit will not fit with clean-cut units or, if less than 25 % of a full unit, with concrete left for 24 h before compacting. Compact the surface as soon as practicable, not closer than 1 m from free edges or working faces, with a high frequency, low amplitude mechanical flat plate vibrator capable of producing a centrifugal force of 7-16 kN at a frequency of approximately 75-100 Hz on a plate size of 0,35-0,5 m².
Make sufficient passes to compact the sand bedding to between 15 and 35 mm thickness. Make at least two passes, or as specified. Brush joint filling sand into joints after the first pass. Remove excess sand on completion.
- 1.21.3. New Paving to Drop-off, parking area, pedestrian walkways:
80mm thick Cobble paver: smooth, commercial paver to provide significant strength suitable for both vehicular and pedestrian traffic. Lay pavers true to line and level on a loose and evenly spread sand bedding of compacted thickness of 25 ± 10 mm. Lay full units first. Joints must be between 2 and 6 mm wide.
Fill areas in which a full unit will not fit with clean-cut units or, if less than 25 % of a full unit, with concrete left for 24 h before compacting. Compact the surface as soon as practicable, not closer than 1 m from free edges or working faces, with a high frequency, low amplitude mechanical flat plate vibrator capable of producing a centrifugal force of 7-16 kN at a frequency of approximately 75-100 Hz on a plate size of 0,35-0,5 m².
Make sufficient passes to compact the sand bedding to between 15 and 35 mm thickness. Make at least two passes, or as specified. Brush joint filling sand into joints after the first pass. Remove excess sand on completion.

1.22. Gates (as applicable)

- 1.22.1. Existing Condition: Generally, in good condition, with dirt and grease marks. Clean gate. Wash all metal with mild soap solution to remove grease and dirt. Rinse with clean water.
- 1.22.2. Existing Condition: Gate has minor rust marks. Repair rusted areas. Remove rusted parts and repaint according to paint specification.
- 1.22.3. Existing Condition: Badly rusted gate (and frame). Remove rust. Remove rust by scraping off existing paint and shot blasting rusted portion to remove rust. Sand down using 80 - 120 grit sandpaper or other non-mechanical means. Clean with lacquer thinners and repaint.

1.23. **Gate Ironmongery** (as applicable)

1.23.1. Existing Condition:

Rusty in places, sticky operation. Service lockset. Oil moving parts using a light penetrating oil or WD40 to release lightly rusted parts.

1.23.2. Existing Condition: Lockset in poor condition. Depending on museum use, repair.

Remove ironmongery and repair in workshop if necessary.

1.23.3. Existing Condition: Not moving - badly rusted. Depending on museum use, replace.

Source ironmongery to match existing and replace if necessary.

2 STRUCTURAL ENGINEERING WORKS

2.1. Concrete, Formwork and Reinforcement

This section covers the construction of all new reinforced concrete and associated concrete works requirements for the proposed construction of the security wall, as directed by the Engineer.

2.1.1 Particular specifications

The following specifications shall apply:

NB: All in situ concrete work (mass and reinforced) shall comply with SANS Specification 1200G ("8 Measurement and Payment" is not applicable) supplemented by the clauses in this section. Where SANS Specification 1200G and the clauses in this section are in conflict the clauses in this section shall take precedence.

In addition the "Model Preambles for Trades" as recommended and published by the Association of South African Quantity Surveyors, 1999 Edition, shall be read in conjunction with and shall apply to all items in the Bill of Quantities not covered by the 'SANS Standardised Specifications' SANS 1200 Series

Where the term "plain concrete" appears in SANS Specification 1200G it shall be read as "mass concrete".

- SANS 1200 G Concrete
- SANS 2001: CC1 Construction Works: Concrete Works (Structural)
- SANS 1083: 2006 Aggregates from natural sources
- SANS 10100-2:2000 The Structural use of concrete – Part 2: Materials and execution of work.
- SANS 50197-1:2000 Cement – composition, specifications and conformity criteria. Part 1: Common cements
- 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

2.1.1.1 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 Supervisor 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.

Bags of cement shall be stacked in a waterproof, solidly constructed shed with a central door and a floor rendered damp-proof with a tarpaulin. The bags of cement shall be closely stacked (but not against walls) in order to reduce air circulation in such a manner that the cement is used in the order in which it was received, i.e. first in first out.

2.1.1.2 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)

2.1.1.3 Aggregates

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

No aggregate shall be delivered for use in the works until approval is given.

Sand (fine aggregate):

The fine aggregates shall comply with the requirements of SANS Specification 1083. Other aggregates may be approved if they have a satisfactory history and / or test results.

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 Supervisor for test purposes. Samples having a mass of 25kg shall be forwarded every 3 months during concreting work and also if the source of supply is changed. Allowance must be made for possible delay in that the tests may take 14 days to carry out.

2.1.1.4 Admixtures

Admixtures containing chlorides will not be permitted in reinforced concrete.

2.1.1.5 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.

2.1.1.6 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.

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

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

2.1.1.7 Unreinforced concrete

Class A Concrete:

Filling to cavity of hollow walls.

2.1.1.8 Unreinforced concrete cast against excavated surfaces

15 Mpa/19mm Concrete

Surface blinding under footings and bases.

2.1.1.9 Reinforced concrete

30 MPa/19mm Concrete:

- Foundation bases,
- Columns,
- Precast panels.

2.1.1.10 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 weigh-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.

2.1.1.11 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.

2.1.1.12 Grouting

25 MPa non-shrink cementitious grout:

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

2.1.1.13 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.

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.

2.1.1.14 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 1200 G 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 1200 G when the following climatic conditions occur:

1. Wind velocity greater than 5 m/s
and/or

2. Ambient temperature is above 25 °C

and/or

3. 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.

2.1.1.15 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 be included the time for which forms are still in place after the pour.

2.1.1.16 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 Project Manager:

- i. The date and time during which concrete was placed
- ii. Identification of the part of the structure in which the concrete was placed
- iii. The mixed proportions and specified strength
- iv. The type and brand of cement
- v. The slump of the concrete
- vi. The identifying marks of test cubes made
- vii. Curing procedure applied to concrete placed
- viii. The times when shuttering was stripped and props removed
- ix. The date of despatch of the cubes to the testing laboratory
- x. The test results

The records shall be delivered to the Project Manager each week except in the case of sub-standard concrete, when the Project Manager shall be informed immediately.

2.1.1.17 Tolerances

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

2.1.1.18 Testing and monitoring

Frequency of sampling and testing shall be as specified in SANS 1200 G

2.1.1.19 Cost of test

The costs of making, storing and testing of concrete test cubes as required under clause 7 'Tests' of SANS 1200 G shall include the cost of providing cube moulds necessary for the purpose, for testing costs and for submitting reports on the tests to the Project Manager. The testing shall be undertaken by an independent firm or institution nominated by the *Contractor* to the approval of the Project Manager (Test cubes are measured separately)

If the quantity of concrete from which samples were taken exceeds 40 m³, it shall be subject to the testing of a minimum of 3 sets of samples per day from each grade of concrete placed in each independent structure.

If the quantity of concrete from which samples were taken is less than 40 m³, it shall be subject to the testing of a minimum of 2 sets of samples per day from each grade of concrete placed in each independent structure.

If the *Contractor* disputes the results of the tests on concrete cubes, the concrete represented by the cubes will be considered acceptable if the *Contractor*, at his own cost, proves to the satisfaction of the Project Manager that the estimated actual strength of cores taken from the structure, determined in accordance with SANS Standard Method SM 856, is not less than the specified strength.

If the strength of the concrete fails to meet the acceptance criteria stipulated, the Project Manager may in his sole discretion and in addition to the options listed in SANS 1200 G:

- i. Accept the concrete subject to approved remedial measures being undertaken by the *Contractor*, or
- ii. Permit the concrete to remain subject to the payment of a penalty

The penalty referred to will be determined as follows:

$$\text{Penalty} = V \times R \times F$$

Where,

V = Volume (in the opinion of the Project Manager) of concrete of unsatisfactory strength represented by the test result.

R = Relevant scheduled rate

$$F = 1 - \sqrt{\frac{\text{Average strength of unsatisfactory concrete}}{\text{Specified strength} + 6 \text{ MPa}}}$$

Where the relevant scheduled rate (R) includes the cost of formwork or

$$F = 1 - \frac{\text{Average strength of unsatisfactory concrete}}{\text{Specified strength} + 6 \text{ MPa}}$$

Where the relevant scheduled rate (R) excludes the cost of formwork or where no formwork was involved.

2.1.1.20 Formwork

Rough formwork (degree of accuracy ii)

Rough Formwork to Sides:

- Strip footings.
- Bases.
- Rectangular columns in foundations.

2.1.1.21 Reinforcement

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
- High tensile steel reinforcement to structural concrete work
- Fabric reinforcement:
- Fabric reinforcement type as specified on structural drawings.

2.1.1.22 "No Fines" Concrete

"No-fines" concrete, for grading flat concrete roofs and the like to falls, shall be in the proportion of 12 parts 19 iron cubical stone to 1 part cement mixed with 20 litres water per bag of cement and be laid to falls of not less than 15mm per linear metre for mastic asphalt and not less than 20mm per linear metre for sheet roof covering. For heavy load applications special mix designs may be required

2.1.1.23 Steel Work

Governing Codes and Standards

ANSI/AWS D1.1	:	Structural Welding Code - Steel
BS-EN 287 Part 1	:	Approval testing of welders/fusion welding
BS-EN 288 Part 3	:	Specification and approval of welding procedures for metallic materials
BS 5135	:	Metal arc welding of carbon and carbon manganese steels
BS 4360/SANS 50025	:	Weldable structural steel
BS 2573 Part 1	:	Classification, stress calculations and design of structures
BS 3923	:	Methods for ultrasonic examination of welds
BS 2600	:	Radiographic examination of fusion welded butt joints in steel

DIN 1026	:	Metric channels
ISO R657	:	Angles
SANS 10094	:	The use of high strength friction grip bolts and nuts
SANS 135	:	ISO metric bolts, screws and nuts (hexagon and square) (coarse thread free fit series)
SANS 136	:	ISO metric precision hexagon-head bolts and screws, and hexagon nuts (coarse thread medium fit series)
SANS 435	:	Mild steel rivet

2.1.1.24 Structural Steelwork

The design of all structural steelwork shall be such as to provide a robust and rigid structure requiring the minimum of maintenance and providing a long service life. In the design of steel structures, due cognisance shall be taken of environmental and wind load conditions as specified in the main specification.

Due to the highly corrosive conditions experienced in South African coastal regions, the permissible stresses shall not exceed those set out in British Standard No. 2573.

All steel sections shall be manufactured in accordance with the following standards :-

i.	BS 4360/SANS 50025	:	Weldable structural steel
ii.	BS 4 Part 1	:	I and H sections
iii.	DIN 1026	:	Metric channels
iv.	BS 4 Part 1	:	Structural steel, hot rolled sections
v.	ISO - R657	:	Angles
vi.	BS 4848 Part 2	:	Hot finished hollow sections
vii.	BS 6363	:	Cold formed sections
viii.	BS 29	:	Forgings
ix.	BS 3100	:	Steel castings
x.	BS 1452	:	Cast iron

All steel plates and rolled steel sections used in the construction of the structures 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 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.

Forgings and drop forgings shall be free from flaws and surface defects of any kind and be accurately finished to the prescribed dimensions.

Steel castings shall be sound, clean and free from all defects and distortion of any kind and should, except where otherwise specified, conform with the conditions and tests specified in B.S. No. 3100/Latest Edition, for grades A, B and C according to requirements. They shall be thoroughly annealed and all working parts and bearing surfaces shall be machined and turned accurately with correct finish.

The dimensional and out-of-square tolerance as specified in the above Standards shall also apply to built-up components. Edge preparations, welding techniques, straight beds and material fit-up shall be considered when welded joints are designed.

The shape of all members and connections must allow easy accessibility for maintenance painting of all surfaces. No members shall comprise a double member which cannot be painted and maintained.

Structural details must be so designed as to eliminate or seal off any cavities or pockets where water or condensation could collect and promote corrosion. Horizontal members with upstanding flanges require special drainage.

All hollow sections shall be completely closed and airtight, and all welding is to be of such size and quality as to ensure complete airtightness. No tapping or drilling of holes into sealed sections will be permitted.

2.1.1.25 Welding

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

Design of weld joints shall be such that crevices, overlaps, pockets, arc strikes and dead ends do not exist.

All joints shall be completely seal welded in accordance with BS 5135. Special care must be taken to prevent the ingress of moisture into the tubular members by ensuring that each such tubular member is airtight. "Stitch" welding will not be permitted. Only continuous welding will be accepted.

Weld cracks, undercut, or pock marks will not be accepted.

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.

Steel, except in minor details, which has been partially heated, shall be properly annealed. (Electrically welded structural members excepted.)

All brackets, clamps, lugs, straps, suspenders, etc. required for attaching mechanical and electrical equipment must be welded on prior to erection and special precautions must be taken not to damage welds or puncture tubes during erection.

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 BS-EN 288 Part 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.

2.1.1.26 Fasteners

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

- SANS 135 : Commercial bolts and nuts Grade 4.6
- SANS 136 : Precision bolts and nuts Grade 8.8
- SANS 10094 : Friction Grip Bolts and nuts Grade General
- SANS 435 : Rivets

All friction grip fasteners shall be hot dip galvanized, 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.

The holes, after assembly of the parts, shall be true throughout the thickness of all the parts and perpendicular to the axis of the member.

Rivets shall be cup-headed or countersunk as required, unless otherwise specified. No rivet head shall contain less metal than does a length of the rivet equal to 1,25 times its diameter. All loose and defective rivets shall be cut and replaced by sound ones; also others when required for the purpose of examining the work. Rivets shall be driven with pressure tools whenever possible and pneumatic hammers shall be used in preference to hand driving.

All field rivets must be supplied with shanks of suitable length for pneumatic riveting.

Bolts shall be of such a length as to accommodate a full nut when tightening up, and project at least two thread pitches beyond the nut. Excessive projection of threads beyond the nuts should be avoided.

All bolts having countersunk heads shall have strong feathers forged on the neck and head to prevent turning and the bolt holes shall be cut to receive same. All nuts and bolts (excluding countersunk bolts) shall be furnished with circular washers of sufficient thickness, the outside diameter being at least twice the nominal diameter of the bolt, and washers fitted correctly.

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

2.1.1.27 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:

- i. 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.
- ii. 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.
- iii. After being cleaned and primed the surface shall be joined together and the joint so formed shall be seal welded.
- iv. 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.

2.1.1.28 Fabricated Parts

All fabricated parts shall be properly fitted during assembly to result in properly aligned equipment having a neat appearance. Fabrications of load bearing members shall have no abrupt changes in cross section and regions of severe stress concentration. All sharp corners accessible by personnel during erection or operation shall be ground, rounded, or removed by other methods. Burrs, welding spatter and stubs of welding wire shall be removed.

2.1.1.29 Corrosion Protection

Scope

TRANSNET requires that the *Contractor* supply, install and guarantee a robust, climatically suited, grade corrosion protection system for use on all steelwork. The *Contractor* may select either a 3-Coat or 1-Coat system. The corrosion protection system selected for use shall be from an internationally recognised and reputable supplier. The selected corrosion protection system shall carry a minimum 5year guarantee, defined as a maximum of 1% of the total area of corrosion protection breakdown per year. The *Contractor* shall be required to repair yearly, any corrosion protection breakdown exceeding 1% of the total surface area. The paint supplier shall carry the guarantee for the first 5years. A guarantee certificate, from the paint supplier, is required prior to the construction Works.

The final paint selection by the *Contractor* shall be approved by the Engineer before its application.

Typical Accepted Sequence of Corrosion Protection Application – 3 coat system

- High pressure wash, clean and remove oils and contaminants,
- Descale,
- Grit blast to SA 2 ½,
- Remove all slag and waste,
- Stripe coat using 1st coat primer: angles, stiffeners, edges, corners, welding seams and all areas inaccessible by spray painting,
- Spray 1st primer coat to all surfaces,
- Allow sufficient drying time,
- High pressure wash to remove dust before next coat application,
- Stripe coat using 2nd coat primer: angles, stiffeners, edges, corners, welding seams and all areas inaccessible by spray painting,
- Spray 2nd primer/intermediate coat to all surfaces,
- Allow sufficient drying time,
- High pressure wash to remove dust before final coat application,
- Stripe coat using final coat: angles, stiffeners, edges, corners, welding seams and all areas inaccessible by spray painting,
- Spray final coat to all surfaces,
- Allow sufficient drying time.

Paint specification – 3 coat system

- 1st Coat Primer to be 150 microns DFT,
- 2nd Coat Primer to be 150 microns DFT,
- Coat to be 160 microns DFT.

Paint Application

The application instruction covers surface preparation, application equipment and application details for corrosion protection to steelwork according to the requirements of IMO Resolution MSC.215 (82): Performance Standards for Protective Coatings on Steelwork.

- The steel surfaces shall be prepared so that the coatings achieve an even distribution at the specified nominal dry film thickness. Adequate adhesion ensured by removing weld spatter and any other surface contamination,
- All welding seams shall be partially dressed to remove irregular profiles,
- Surface pores, pits and craters shall be sufficiently open to allow penetration of the paint,
- Sharp edges shall be treated to a round radius of minimum 2mm,
- Before blasting any deposits of grease or oil must be removed from steel using a suitable detergent followed by fresh water hosing,
- Minor spots of oil grease may be cleaned with thinner and clean rags,
- Steel must be abrasive blast cleaned to SA 2 ½,
- Welds as well as shop primed areas with damage, burn marks and rust must be blasted to SA 2 ½,
- Surfaces with deposits of black iron oxides from gas cutting markings shall be cleaned by light abrasive sweep blast,
- Welds coated with temporary primer after welding must be cleaned by hard abrasive sweeping, preferably abrasive blast,
- Spot checks for possible salt contamination of the surfaces must be executed,
- Overlap zones must be treated with great care,
- Relative humidity shall be 85% or below, the steel temperature shall be 3-5 degC above the dew point,
- The paint layer must be applied homogeneously and as close to the specification as possible,
- The finished coatings must appear as a homogeneous film with a smooth surface. Any defects of bubbles, voids, visible abrasive residue shall be marked and appropriate repair affected.

2.1.1.30 Security Fencing (Double Welded Steel Mesh)

The fence must conform to the following specifications:

- The minimum life span installed shall be a minimum of 10 years prior to any maintenance being required.
- The fence must be HSF with unobstructed views
- The fence shall have a minimum embedment of 500mm below finished ground level.
- Post shall be strengthened taper locking post. Post shall include 'Locking Recess Mechanism' to secure panel edge. Post finish shall be galvanized, then coated.
- Panel width shall be of manufacturer specification and 3m and 4m in height. (modular split to manufacturer specification).
- Panel aperture size (centers) shall be to manufacturer specification with a minimum wire diameter of 3mm.
- Panel post shall have a flush panel post finish with no climbing aid
- Panel and fixtures shall be galvanized. then coated. Panel Post connection minimum break force.
- Including composite infill – Reinforced with specialised tube to resist an angle grinder, reciprocating saw and acetylene torch.
- All steel materials shall be of good commercial quality, galvanized steel.
- All pipes shall be galvanized, one piece without joints. Furnish moisture proof caps for all posts.
- Zinc coating shall be smooth and essentially free from lumps, globs, or points.
- Miscellaneous material shall be galvanized.
- All HSF posts shall be set as per the construction drawings
- A 100mm high toughened steel Shark Tooth spike shall be affixed to panel edge, internally at 150mm intervals using Anti-vandal bolts.
- Spike finish shall be Galvanized, then coated.
- A 500mm deep 'underdig' shall be secured to the lower edge integrated angle.

Requirements

- Certificate of compliance for materials and coatings
- Shop drawing for HSF panels and gates. These must be approved prior to erection.
- Quality control program shall be submitted to the Project Manager for review prior to commencement of any work
- Product Performance Guarantee Certificate (min 10 years)

2.1.1.31 Gates

- Gates shall be swing gate or sliding gates as specified in drawings
- All connections and joints shall be welded to form rigid frames or assembled with corner fittings.
- Hinges shall not twist or turn under the action of the gate, shall be so arranged that a closed gate cannot be lifted off the hinges to obtain entry.
- All fittings, brackets and rear wheel tracks shall be standard manufactured products for the intended application.
- This Contract calls for the design, supply, fabrication and installation of a sliding HSF gate.
- The gates must be manufactured of steel and match the HSF panel specification as listed above. It must be to the full fence height.
- The gates must be galvanized and corrosion protected using the same method as for the fence.

Posts

All gate posts shall be as per the drawings with a minimum 30 MPa (28-day compressive strength) concrete, 19 mm aggregate.

2.1.1.32 Fence and Gate construction

Install all fencing and gates in accordance with the drawings, specifications, instructions, and as specified lines and grades indicated. Line posts shall be spaced at intervals specified by manufacturer. Terminal posts shall be set at abrupt changes in vertical and horizontal alignment.

Posts

- Post holes shall be cleared of loose material. Waste material shall be disposed of by the *Contractor*. The ground surface irregularities along the fence line shall be eliminated to the extent necessary
- Posts shall be set plumb, and follow the indicated alignment. All posts shall be set to the depth indicated on the design documents. Concrete shall be thoroughly consolidated around each post, free of voids, and finished with a domed shaped surface, with the base of dome at grade elevation. Concrete shall be allowed to cure prior to installing any additional components to the posts.

Concrete

- Concrete footings shall be carried down to at least the depth indicated on the design documents and shall not be smaller than the dimensions shown. Where a rock layer is encountered within the required depth to which the post is to be erected, a hole of a

diameter slightly larger than the largest dimension of the post may be drilled into the rock and the post grouted in. Then the regular concrete footing shall be placed between the top of the rock and the top of the footing elevation as shown on the design documents. Posts shall be approximately centered in their footings. All concrete shall be placed promptly and consolidated by tamping or other approved methods.

- Where the ground is firm enough to permit excavation of the post hole to neat lines, the concrete may be placed without forms by completely filling the hole. Curing may be achieved by covering the concrete with not less than four inches of loose moist material immediately after placing concrete, or by using a curing compound. All excess material from footings, including loose material used for curing, shall be disposed of as directed by the Engineer
- Where the ground cannot be satisfactorily excavated to neat lines, forms shall be used to place concrete for footings. Under these conditions the earth and forms coming in contact with the concrete shall be moistened and all ponded water shall be removed from the hole prior to placing concrete. When forms are removed, the footing shall be backfilled with moistened material, and thoroughly tamped. The top of the concrete shall then be covered with not less than 100 mm (4 in) of loose moistened material or use curing compound if the 7-days cure is not completed. All excess material from footings, including loose material used for curing, shall be disposed of as directed.

Gates

- Gates shall be installed at the locations shown. Hinged gates shall be mounted to swing as indicated. Latches, stops, and keepers shall be installed as required. Slide gates shall be installed as recommended by the manufacturer.
- Adjust gate to operate smoothly, easily, and quietly, free from binding, warp, excessive deflection, distortion, nonalignment, misplacement, disruption, or malfunction, throughout entire operational range. Confirm that latches and locks engage accurately and securely without forcing or binding.
- Lubricate hardware and other moving parts.

3 ELECTRICAL AND ELECTRONICS WORKS

3.1 General

The *Contractor* will be responsible for the stripping existing electrical installations, supply, delivery, installation, testing, commissioning and handing over in proper working condition of the complete upgrading of the new electrical installation, as specified in detail in these documents. Also included in the scope is the supply of as-built drawings, operating and maintenance manuals and on-site training of the Employer's staff.

The Scope of Work shall include the supply of all necessary required Equipment and *Contractor's* Personnel to properly perform the *Contractor's* obligations under the Contract, including:

- 1) Construction Site surveys (dimensional, layout, checking etc.);
- 2) ensuring that the completed Works shall comply with the Codes and Standards and any applicable statutory requirements;
- 3) selection of suitable Plant and Materials (where not already specified herein);
- 4) offloading of Plant and Materials at Site;
- 5) safety equipment (guards, notices, etc.;
- 6) construction, erection and the supervision of the Works;
- 7) specialist installation and installation supervision;
- 8) removal and disposal, as approved by the Employer, of all scrap and rubble generated by the *Contractor* within the Site to a demarcated area on the Site;

The Contractor must return all returnable documents on the attached specification of this document with the tender's returnable document.

3.1.1 Summary of Scope

The site is at 96 Rissik street Johannesburg CBD; this is an existing Transnet Heritage building. The existing building shall be renovated and upgraded. The external façade shall be retained as this is the Heritage building; however, the internal of the building shall be changed, break down walls to suit the new client requirements.

The scope consist of the following: stripping of existing electrical installation, provision of new substation at the lower ground level with the following - 11kV, 3phase-400VAC MV switchgears panel, 11kV/0,4kVAC dry type transformer, 1500kVA, 400VAC diesel generator set with changeover panel, UPS 20kVA, 400VAC, main low voltage distribution board and sub-distribution boards, photovoltaic solar system, building management system, security system like CCTV, access control and other building electrical and electronics installation.

The *Contractor* shall proceed with the application of power supply for the building, this process has started by the Engineer. Currently, the building is fed from PRASA substation. Transnet wants to be fed directly by the Municipality and disconnect power from PRASA substation. Therefore, *Contractor* shall terminate existing supply and connect new from the municipality.

The electrical *Contractor* shall have numerous sub-*Contractors* to work with and to manage under this contract. This will include the following specialist sub-*Contractors*, unless the specialist *Contractor* is available within the *Contractor* company:

- Photovoltaic solar system *Contractor*
- Generator specialist
- Public Address system *Contractor*
- Building Management System (BMS) specialist
- Lightning protection *Contractor*
- Security system *Contractor* – for CCTV and access control
- ICT *Contractor* – Transnet shall indicate *Contractor* to deal with information technology infrastructure

The bill of quantities has provisional sums for the specialist *Contractors*. The *Contractor* shall be required to submit three (3) quotations per specialist *Contractor*. The ICT *Contractor* is already appointed under a different framework.

The buildings shall have new distribution boards essential sections from generator section and section fed from solar section with surge arrestors. The buildings shall have LED luminaires, cable racks, trunking and power poles in offices.

The building shall be provided with earthing, bonding and lightning protection.

Provisional amounts for tele-communications and security systems have been provided.

Test and commissioning shall be carried out by the *Contractor*. Test results, operations manual, Certificate of Compliance (COC) and 'As Built' drawings shall be issued by the *Contractor*.

The electrical installations shall comply with Transnet standards, SANS 10142-1 and SANS 10142-2 and OSH Act and all other related and relevant standard.

3.1.2 Electrical Supply

There is a new application for new supply connection to the building. Required supply is for the building 1,6MVA, 11 000V, 3-phase with earth at 50Hz. There shall be supply from solar system which will form part of the supply for the building.

The main breakers shall have 2500A, 3-poles (400VAC) with neutral and earth, 40kA.

All cables are PVC/SWA/PVC earth continuity conductor copper cable except for 1 core cable.

*1c core unarmoured XLPE insulated PVC sheathed 600/1000

Refer to schematic drawings for details.

Temporally LV supply shall be made available by the *Contractor* for other services such as lighting, small and welding points during construction, etc. These shall form part of the *Contractors'* scope and contract.

3.1.3 INSTALLATION OF EQUIPMENT

The *Contractor* shall be responsible for the installation of all equipment supplied by him/her under the contract.

3.1.3.1 General

All electrical equipment supplied under this contract shall be designed to perform effectively under the full range of conditions of temperature, pressure and voltage regulation prevailing.

The equipment shall also be capable of withstanding the corrosive effects of a moist saline atmosphere. All enclosures of electrical equipment and indoor electrical equipment shall have a minimum degree of protection of IP 54 and all equipment shall be able to withstand the vibrations present on the structures. Junction boxes shall be of the bottom gland-entry type only.

3.1.3.2 Electrical Equipment

All equipment and fittings supplied and installed under this contract, shall be in accordance with the standard and project specifications of this document. All distribution boards shall be manufactured as per SANS 1973. All electrical panels' equipment shall be designed and manufactured in accordance with SANS 1973/60439. The equipment shall conform to SANS 60947 Parts 1 -7, unless otherwise stated, and shall be suitable for operation on supply voltages of 230/400 Volts, plus neutral and earth, 50 Hz, AC. All DBs shall be stainless steel grade 316 with epoxy finish and or as per drawing.

3.1.3.3 Medium and Low Voltage Switchgear

All MV and LV installation work shall be carried out strictly in accordance with SANS 10142-1 and SANS 10142-2.

The *Contractor* working on the 400V system and equipment must be deemed competent electrician and authorised to work on LV switchgears by the Department of Labour with particular regard to safety rules, systems operating regulations, underground mains cabling and substation maintenance. The responsible *Contractor* or personnel from the *Contractor* must be competent to work on an 11 000VAC system and have proven track record to have executed such work previously.

3.1.3.4 Electrical Panel Feeder

3.1.3.4.1 Metering

Metering shall be provided for the main low voltage distribution board as per specification of this document.

The power monitor master meter complete with CT's and fuse protection with facilities using Modbus communication.

3.1.3.4.2 Main Distribution boards / Electrical Panel

The Main DBs / electrical panels shall consist of the incoming circuit breaker, 3-phase LCD digital power meter (to measure kilowatt, current, voltage, frequency, etc.), and local board with small breakers.

The Main DBs shall be as a minimum partially type tested with type 2 co-ordination and have a minimum internal separation of "Form 3b". The Main DBs and all internal control shall be rated for maximum full load currents and a minimum three phase fault level of 40kA.

The Main DBs shall be designed for front access with top entry for busbars and bottom and top cable entries / exit and shall be enclosed.

The panel shall be constructed of stainless steel grade 306 and powder coated with electric orange. Essential section of the board plate shall be red plate

The Main DBs shall include for a marshalling all auxiliary equipment sections.

The marshalling/PLC section will communicate linked with the TP SCADA system where applicable.

- All supply circuit breakers are to be supplied with lockable isolation handles and are to comply with the OHS Act and N.O.S.A. standard for "locking out" electrical equipment.
- Main incoming circuit breakers are to be housed in their own individual panel
- All busbars are to run at the top of the panels. All busbars are to be insulated and coloured to correspond to the appropriate phase
- The panels are to have vertical ways for easy accessibility to distribution cables
- All cables will be top entry and top exit
- The control circuitry voltage shall be 220V AC and be protected by means of a circuit breaker. Interposing relays are to be provided to pick up the start and stop signals from the PLC where applicable
- All contactors are to be type 2 co-ordination is called for

3.1.3.4.3 Incomer Compartment

The incomer main ACB shall be rated as follows:

- Main DB at 2500 Amps 3 phase each with adjustable to 2400A

Each Main DB incomer section shall include but not necessarily be limited to the following equipment:

- 1 No. suitably rated 3 pole 40 kA withdrawable Air Circuit Breaker complete with integral power measurement equipment or door interlocked MCCB of suitable KA rating with extended rotary handle 400V, Amps as per Main DB withdrawable Air Circuit Breaker;

- Digital Power Monitor Meter;
- Surge Arrestors. To be installed on its own compartment

3.1.3.5 Cables

3.1.3.5.1 General

The *Contractor* shall allow for the numbering and labelling of cables. The *Contractor* shall produce a cable-pulling schedule, which must be approved by the Project Manager prior to the installation of any cables.

The entire cable installation must meet with the Employer's requirements and standards. Should any cable be installed and not meet with these requirements it will be re-laid at the *Contractor's* own cost. All cables are to be meggered or pressure-tested prior to final connections after termination.

3.1.3.5.2 Low Voltage Cables

All low voltage (LV) cables are to be manufactured in accordance with the SANS 1507 standard code of practice and shall be of the 600/1000V PVC/SWA/PVC type with stranded copper conductors unless otherwise specified. Four core cables shall be used to supply motors with the fourth core used as the earth conductor.

Cables shall be provided with a separate earth conductor strapped to the cable at intervals not exceeding 1 (one) metre.

Corrosion proof Enviro cable glands with an IP65 rating shall be used.

All cables shall bear the SANS mark.

All cables shall be installed in accordance with SANS 10198, Transnet standards and the Manufacturer's specifications.

No cable joints shall be permitted unless otherwise approved by the Project Manager.

All exposed copper conductors shall be tinned.

After installation of cables, all sleeves, cables etc. entering buildings shall be sealed with fire retardant "Pratliperl" to prevent ingress of vermin and water.

3.1.3.5.3 Instrument Cables

Single pair overall screened cable shall be used for cables between instruments and junction boxes. Conductor size shall be 1.5 mm² minimum.

Cabling between junction boxes, control stations, purpose made control panels and Main DBs marshalling cubicles shall be multi-core and multi-pair, armoured, overall screened, conductor size shall be 1.5mm² minimum.

3.1.3.5.4 Cable Slack

At every termination, sufficient slack shall be provided for future repairs to the cable end should this become necessary due to a fault or some unforeseen circumstances on site.

3.1.3.5.5 Cable Identification

Every power distribution cable, switchboard interconnecting cable, and any other cable, shall be provided at both ends of the run with an approved Bowthorpe Hellerman tag showing the size and details of the cable. All identifications shall correspond with the Employer's requirements.

Cables shall be labelled at all terminations with suitable and approved labels (stainless steel Dymo-tape or Irvine white ivorene label written in black) indicating:

- i) Origin and Destination; (e.g. from Substation to DB-1);
- ii) Cable size and no. of cores; (e.g. 16 mm² -4-core);
- iii) Conductor type. (e.g. PVC/SWA/PVC Copper ECC cable).
- iv) Phase rotation

3.1.3.5.6 Cable Glands

The *Contractor* to terminate all cables with the appropriate cable glands that conforms to the SANS requirements and specific to the cable.

3.1.3.5.7 Cables Installed Underground

Cables shall be laid with the upper surface at the following minimum depths below ground level:-

- LV Cables : 700mm
- MV Cables : 1000mm

Before excavation of cable trenches the *Contractor* shall acquaint himself with the route and site conditions and with existing services.

The *Contractor* shall ensure that the excavation can cause no danger or loss to property, structures or equipment on or adjacent to the site. The sides of trenches shall be shored up and the trenches pumped to maintain them dry. Temporary access bridges shall be provided where the route crosses paths and roads. Any nuisance to other services, works or access shall be avoided.

Excavated material shall be placed alongside the trench. The base of trench shall be smoothed.

Cables shall be bedded in river sand or soil, (no clay), sifted through 6mm mesh, 75mm below and 75mm over the cables before backfilling. The bedding under joint boxes shall be compacted to prevent later settling.

Concrete cover blocks shall be placed over the length of the cable trench in accordance to Transnet standards specifications, to protect them against accidental damage from future excavations. Surplus material shall be removed from site.

Yellow PVC marker tape, 150mm wide, inscribed "Buried electric cable below – caution", shall be laid 300mm below final ground level.

Cable markers shall be installed on cable routes at every change of direction and at spacing's not exceeding 50m on the straight routes. The positions shall be confirmed with the Employer prior to installation. The cable markers shall consist of 150mm x 150mm x 300mm high concrete blocks with "Electric Cable" and with the voltage rating and the route direction.

Where Cables run beneath roads and built structures then the cables shall run in cable sleeves.

All Cable sleeves shall be of the PVC type and shall be installed in the ground.

The cables shall be removed from the cable drum without stressing the cable beyond manufacturer's recommendations.

For cable runs exceeding 50 metres in length then cable rollers shall be used to prevent any damage occurring to the cables during installation.

Parallel cables shall be spaced apart by the following minimum distances:

- LV/LV/Instrument : 2 (two) diameters of the larger cable horizontally.
- LV/MV : 300mm horizontally.
- MV/MV : 300mm, horizontally or vertically.

Communication cables shall be spaced at least 1 (one) metre from nearest low voltage and high voltage cables.

3.1.3.5.8 Cable Support Systems

All cable rack shall be hot dip galvanized steel with a minimum required thickness as per SANS for cable ladder and cable tray. The *Contractor* shall allow for all brackets as detailed, fixings, cutting, welding and cleaning of welding. All spring nuts are to be hot deep galvanized. The cable ladder/tray routes are indicated on the drawing. Care has been taken in planning the routes; however the *Contractor* is still to check with other services routes to ensure that there are no clashes.

Additional earth terminals are to be provided on the cable rack, as the use of a joiner clip is insufficient.

The method of fixing the cable racks shall be confirmed with the Supervisor prior to installation. No drilling of structures shall be permitted for mounting of cable racking.

All cable ladder and cable tray are to be unpainted only hot deep galvanized finish.

Cable racks carrying cables of other voltages shall not be painted but shall be marked at 10m intervals by a 100mm thick paint strip of the relevant colour (as per the Employer's painting specification).

Sizes of racks used are generally:

- MV and LV power cables : 300mm
- Instrumentation cables : 300mm
- Lighting and Power cables along gantries : 200mm

Details of the routing of cable racks are shown in the layout drawing.

3.1.3.5.9 Cable Rack

All cable trays and ladders shall be hot deep galvanized steel. Cable tray shall be in accordance with IEC 61084-1 specifications. It shall be of the Cable tray type with a specified on the drawing. The cable tray width shall be sized as required with a + 20% spare capacity and the side wall height shall be no less than 100mm. Cable tray mounting height shall be as per site requirement and all trays shall be mounted above all access openings.

Cables shall be strapped to the cable tray with stainless steel cable straps.

Allowance must be made for all brackets and additional hot deep galvanized supports that are required to adequately support the fully loaded tray in accordance with the manufacturer's specifications.

MV and LV and instrument cables shall be installed on separate trays with a minimum spacing of 300mm where practical. Cables shall be individually strapped to the cable tray with PVC cable ties or clamps.

All new cabling will be run on new cable racking fixed to buildings or existing structures where possible.

Cable trays shall be earthed at the point closest to the source of supply and continuity shall be maintained across joints by means of jumpers. The minimum size of the earth continuity conductor shall be 6mm² and it shall be green PVC insulated with tinned lugs.

40mm x 40mm x 5mm angle iron manufactured from hot deep galvanized shall be used to support short lengths of cable from the cable tray to the equipment.

3.1.3.6 Lighting

Transnet building lighting installations are shown on the drawing and the *Contractor* shall carry out this work in accordance with the relevant specifications. The layout of the luminaires as indicated on the drawings must be adhered to as far as possible.

The final mounting positions of luminaires shall be verified on site. All luminaires shall be placed symmetrically with respect to beams and columns or other architectural features of the space. The layout as shown in the lighting drawing shall generally be adhered to, but any discrepancies of clashes with structural or other features must be referred to the Supervisor, before commencing installation.

Where provision has not been made for the fixing of luminaires, the *Contractor* shall supply the necessary supports, hangers, conduit extensions, angle brackets or any other fixing method approved by the Supervisor.

All luminaires comply with the SANS safety standard.

Refer to technical specification for details of the fittings.

Samples of all luminaires must be approved by the Supervisor before any order is placed. All luminaires must be complete with necessary accessories, control gear. All control gear shall bear the SANS mark.

All luminaries are to have respective control gear. All luminaries to be supplied by an approved SANS supplier and must meet all minimum requirement and SANS approved standard.

3.1.3.7 Earthing

Earth conductors shall be drawn in with the circuit wiring and connected to the earthing terminal of all luminaires in accordance with the SANS 10142-1.

3.1.3.8 Electronics

3.1.3.8.1 Telecommunications

The voice over IP, public address system, cabling and telecommunications equipment shall be installed by the TP accredited installer under this contract. Wireways such as cable tray and conduit shall be installed by the *Contractor* under this contract. *Contractor* shall submit quotation from the accredited installed for Project Manager's/Electrical Engineer's approval, provisional sum has been allowed for.

3.1.3.8.2 Security Systems

Face recognition, card scanner with key pads and closed circuit television (CCTV) and all required security system equipment shall be installed by the TP accredited installer under this contract. Wireways such as cable tray and conduit shall be installed by the *Contractor* under this contract.

Cameras shall be on the walls inside and outside. Only the PTZ cameras will be installed on top of the building. The cameras shall be installed by the CCTV specialist. A good workmanship between electrical *Contractor* and the CCTV *Contractor* is required.

3.1.3.8.3 Supply for Electronics System

Electrical *Contractor* shall supply power to the security room with all the NVRs, switches, and storage server.

3.1.3.9 Lightning Protection

The Lightning Protection installation shall be carried out by a specialist in accordance with the applicable SANS 10313.

Reinforced or structural steel is to be used as down-conductors. These are to be bonded to a central area conductor at suitable spacing's as specified in SANS 10313. Finials are to be installed if they are required by the SANS standards.

The new installation will comply with the SANS codes and Occupation Health and Safety Act of South Africa and certificates will be handed over on takeover by the client.

SANS 10313 states the site should have a valid Lightning Protection system installation safety report which is completed by a Lightning Protection System designer or an SABS approved installer, this report will also include a Lightning protection system maintenance certificate.

The *Contractor* will ensure the compliance to SANS 10142-1 and lightning protection test results and certification shall be issued.

Earthing rods are to be sleeved/conduits. Test box shall be installed above ground as per drawing.

The *Contractor* shall allow for a soil testing.

Tests results are to be submitted to the Project Manager.

All distribution boards must have surge arrestors.

3.1.3.10 Earthing & Bonding

The *Contractor* is to ensure that all earthing and bonding is carried out in accordance with SANS 10142, Transnet standard specifications and the local authority's requirements. The earthing installation is to be carried out by a specialist.

The *Contractor* should note that as this installation is a Class II Division 2, all metal parts, and equipment are to be earthed and bonded to eliminate static build up. An earth mat is to be installed and the *Contractor* shall allow for a survey by a specialist and installation of it according to the relevant SANS code. The *Contractor* shall submit all test results to the Project Manager.

The *Contractor* shall install an earth point on all motors and metal structures in the buildings.

A schedule of the work shall be carried out by an Earthing Specialist.

Earthing shall be provided for the MV installation and LV installation equipment.

The earthing shall be carried out by a specialist and comply with SANS 61024 Parts 1 and 2.

3.1.3.11 Drawings

The *Contractor* produces the detailed layout design and individual wiring diagrams for each starter, panel and MV switchgear panel in AutoCAD format fully in compliance with the Project Manager's requirements. All drawings are to be submitted for approval prior to the start of manufacture.

In addition, the *Contractor* submits all cable pulling schedules, termination schedules as well as lightning protection and earthing system designs, for approval. Any installation or manufacture of equipment prior to the approval of drawings is entirely at the *Contractor's* own risk. Similarly, the cable numbering systems, plant ID numbers and tag numbers will be in accordance with the Employer's requirements.

3.1.3.12 Work Required In the Commissioning Of Protection Equipment:

The commissioning of protection equipment for LV systems and electronics can be broken up into a number of broad categories.

- a) Panel tests and visual Inspection;
- b) Implementation of applicable technical instructions;
- c) Secondary tests;
- d) Primary tests;
- e) Review and submission of documentation;
- f) Energisation and on load checks;
- g) Sign off and handover of electrical and electronic plants for use and operation by the owner.
- h) Switch On all cameras and NVRs; Energisation and on load checks;
- i) Commissioning of all cameras installed;
- j) Sign off and handover of electronic system for use and operation by the owner.

Each of the categories requires documentation to reflect that the test(s) required have been completed. The documentary evidence must include:

- a) The relevant equipment or panel name.
- b) The checks performed;
- c) The name of the person who performed the checks;
- d) The date on which the checks were performed;
- e) The signature of the person who performed the checks.

3.1.3.13 Panel Tests and Visual Inspection.

The purpose of this group of activities is to check and produce documentary evidence that:

- a) The panel and all contained equipment is visibly intact and mechanically sound,
- b) The panel and contained equipment has not been damaged in transit,
- c) The panel is wired according to the application drawings supplied, and that the design version between the equipment and the drawings is the same.
- d) The equipment contained in the panel corresponds in make, model and function to the application drawings.
- e) The panel and associated equipment is correctly earthed according to the SANS standards.

3.1.3.13.1 Implementation of Applicable Technical Instructions.

The purpose of this activity is to ensure that modifications to the protection panels required by approved technical instructions are implemented to the protection equipment prior to secondary injection. Documentation is to be in the form of the instruction with reference number, the name of the person who implemented the instruction and the date of implementation is required

3.1.3.13.2 Secondary Tests

This group of activities comprises the following:

- a) Application of settings of all protection devices.
- b) Relay characteristic tests and logic functions according to settings provided and manufacturer specifications.
- c) End to end checks for Impedance and current differential schemes.
- d) Verification that any transducer outputs are correct.
- e) Supervisory controls, alarms, indications and analogue outputs are correct to the control centre.
- f) To ensure that test blocks and shorting strips function correctly.

3.1.3.13.3 Primary Tests

All primary tests must be according to relative SANS regulation.

3.1.3.13.4 Normalization of Circuits

During the primary and secondary injection tests, the trip and alarm circuits are usually rendered inoperative by the removal of isolating links, relay trip latches and so on. It is therefore essential that, when the primary and secondary injection tests have been completed, the tripping and alarm circuits be checked. Certain settings may have been altered during testing and these have to be normalized. Certain protection functions may have been deactivated in order to test other complimentary functions and these have to be reactivated as per the settings and configuration documentation.

3.1.3.13.5 Consolidation and Review of Test Results

The purpose of this group of activities is to consolidate the test results and;

- a) Ensure sure that all tests originally planned have been completed
- b) Ensure that all test results are consistent with reasonable Employer expectations
- c) Ensure that any defects have been addressed
- d) Ensure that the head of commissioning is satisfied that the equipment is ready to be made live and arrangements have been made with an authorized person and to clear all outstanding work permits.

- e) Complete the equipment test sheet that permits the equipment to be energised.
- f) Certificate of Compliance (CoC) must be issued with all other test results reports.
- g) Aiming of cameras and provide test results

3.1.3.13.6 Energization and on load checks

There are some checks and tests that cannot be performed while the equipment is de-energised.

It must be stressed that the equipment cannot be considered to be completely commissioned until on-load checks have been completed and results documented.

The following checks are required:

- a) Correct phase rotation.
- b) Current measurement checks / on-load confirmation of CT ratios.
- c) On-load stability checks for differential schemes
- d) On-load directional checks for directional overcurrent and impedance relays.
- e) Confirmation of transducer loading if applicable.

On the successful completion of the on-load checks, a handover document / mechanism is required that indicates that the equipment has been fully commissioned.

3.1.3.14 Training

3.1.3.14.1 Electrical Installations

Contractor shall train the TP staff on new equipment on how to operate the MV and LV panel, transformers and other electrical related installations. Training shall include how to clear faults on the system once it has been attended to. Training to include all other electrical related issues that will be required by maintenance and operating TP staff.

3.1.3.15 Electronics installations

Contractor shall train the TRANSNET staff on new equipment on how to operate CCTV, access control system and other electronics and telecommunications system related installations. Training shall include how to clear faults on the system once it has been attended to. Training to include all other related issues that will be required by maintenance and operating TRANSNET staff.

Training shall include training of TRANSNET operators and or representatives (allow minimum of 10 people). Training on CCTV operations, on system software, clear system faults (before calling for suppliers' technicians' assistance) and all other related and relevant training that will educate and equip TRANSNET representative in order to understand operation of the CCTV system and access control.

3.1.3.16 Final Documentation

The purpose of this phase of the process is to ensure that all documentation and test results are compiled and submitted to the Employer.

- a) Handover Certificate: is to be signed by the *Contractor* and the Supervisor.
- b) Completed Checklists: A hard copy of the all of checklists of completed activities to be forwarded to the Project Manager. All appropriate tests, dates, responsible persons and signatures are required. Electronic copies of scanned hard copy documents are also acceptable.
- c) Commissioning Test Results: four sets of hard copies of the Commissioning Test Results, including hard copies of manuals, etc are required to be submitted to the Employer. Dates, responsible person's name and signatures are required. Electronic copies of scanned hard copy documents are acceptable. The above shall be included in the data packs to prove completion.
- d) Proof that all applicable technical instructions have been implemented:
 - i. Technical Instructions that may be applicable to the equipment concerned.
- e) Proof of Applied Settings: All settings applied to all relays to be retrieved from the relays (downloaded) and hard or electronic copies to be forwarded to the Project Manager.
- f) Software: Integration of CCTV system software with existing system. The CCTV software must be able to operate independently.

3.1.3.17 SPECIFICATIONS

Detailed specification for medium, low voltage, electronics materials and equipment is attached with this document. The *Contractor* must complete and submit technical returnable documents attached on the specification.

The list is as follows:

- C1037-002-EE-001 - Low Voltage Installation Specification
- C1037-002-EE-002 - Medium Voltage Specification (with returnable schedule)
- C1037-002-EE-003 - Stand-By Generator Scope of Work and Specification
- C1037-002-EE-004 - Backup Generator Set General Specification
- C1037-002-EE-005 - Generator Set - Schedules of Information Schedule (with returnable schedule)
- C1037-002-EE-006 - Standard Specification For An Uninterruptable Power Supply
- C1037-002-EE-007 - Electronics Specification

4 MECHANICAL ENGINEERING WORKS

4.1 WET SERVICES

4.1.1 Hot Water Heaters

Supply, deliver and install water heaters (Heat pump and hot water tanks) as indicated on the drawings accompanying this specification. A hot water plant shall be set up in the basement for the whole facility. The plant shall consist of a heat pump as the main water heater. The hot water storage tank shall be fitted with electric heating elements with the same heating capacity as the heat pump. The design is based on appliances manufactured by kwikot, other equally approved manufacturers may be used.

The specifications are as follows:

Heating capacity	: 91.2 kW
Power input	: 24 kW
Rated Current	: 40 A
Hot Water Output	: 2000 lt/h
Noise Level	: <60db (A)
Water Connection	: G3"
Refrigerant Gas Weight	: R407/2.4kg x 4
Power Supply	: 380/3ph/50Hz
Compressor Type	: Scroll/Copeland
Fan Direction	: Vertical
Heat Exchanger	: Tube in Shell
Water Temperature	: 28°C to 60°C
Air Temperature	: -10°C to 43°C
Water proofing	: IPX4

- Intelligent Defrosting
- Electronic Expansion Valve
- Failsafe double pole resettable thermostat.
- Integral electrical connections between the element and thermostat.
- 50mm thick fiberglass wool insulation on the outside of the hot water storage tank and clad with 0.8 mm galvanized iron outer casing.
- Temperature and pressure safety valve.
- Spiral heating element completes thermostat pocket and integral terminals for thermostat electrical connection.
- The safety valve will release water at 1MPa or if the temperature approaches 60°C.

Refer to the drawings for piping configuration. Refer to drawings for the location of these water heaters and plant arrangement.

4.1.1.1 Domestic Water Piping and Insulation

The cold water reticulation shall be carried out by connecting to the existing Municipal water line.

- All copper and copper alloys used in the domestic water system are to be in line with 5.2.1 of SANS 10252
- All domestic water piping reticulation inside the buildings shall be copper tubing manufactured to SABS 460 Class 2 half-hard drawn tubing.
- All copper tubing shall be SABS approved 460 Class 2, hard drawn tube for use without bending.
- When cutting copper tubes with cutters or hacksaws, care should be taken to produce a square end and to remove the burr produced.
- All copper tubing shall be joined by means of capillary fittings. Brass compression fittings may be used at the terminal points where sanitary ware are to be connected.
- These fittings should comply with SABS 1067 – Part 2 – 1985, or the related specifications ISO 2016, DIN 2856, and BSS 864.
- Capillary fittings when soldered with one of the recommended solders shall have a shear strength of 60 MPa (600 bar) and can, therefore, withstand a high degree of vibration, expansion, and contraction.
- The flux should be applied to clean surfaces.
- Prefabricated sections should be flushed before assembly, particularly in large projects where the system might stand before final flushing.
- All solders containing lead should be avoided for health reasons.
- Only the following solders are acceptable:
 - 97/3 (97% tin and 3% copper) – SABS 24 – 1971 amended 1987 – DIN 1707.
 - 96/4 (96% tin and 4% silver) – SABS 24 – 1971 amended 1987 – DIN 170775/25 (75% tin and 25% zinc) – “universal soldier, must be used with “universal” flux.
- Resin core and acid core solders are not acceptable.
- For thermal expansion, loop requirements refer to specification.

- All water piping chassed on the wall shall be wrapped with Heavy brown paper as a sheath for expansion.
- All exposed piping to be clad with galvanized steel sheet metal, painted to architect's specifications.
- The cladding will be applied with a 50mm end and side overlap and wrapped snugly around the insulation and secured with aluminum pop rivets.
- All insulated piping shall be insulated using 25mm thick preformed Snap-On rock wool/fiberglass pipe sections for pipe sizes up to ø50mm & 40mm thick for pipe sizes larger than ø50mm.
- All sheet metal cladding work shall be of the highest possible standard and no bands shall be used to hold the cladding in position. All transverse and longitudinal joints shall be of the Joined interlocking type, banded at intermediate centers with suitable bands.
- All valves and flanges shall have cladding boxes and shall be removable and installed at right angles to the insulated pipework. Any work which is out of line will be rejected until properly carried out to the satisfaction of the Engineer.
- Pipe supports should be so positioned that they should be at least 500mm away from a change of direction fitting i.e. tee, elbow, etc.

4.1.1.1.1 Protection of Piping

During construction, all piping shall be protected from foreign matter entering completed pipe sections.

4.1.1.1.2 Isolation Valves And Fittings

Only SABS-approved valves and fittings shall be supplied and fitted on the domestic water system.

- Isolating valves
- Pressure-regulating
- Drain cock
- Vacuum breaker
- Safety valve T & P 400 kPa

Refer to the drawings for pipe schematics and sizes.

4.1.1.1.3 Holderbats – Tube Supports And Fittings

The use of nails, wire, etc as alternatives to the correct fixing will not be accepted.

4.1.1.1.4 Dissimilar Metals

The use of copper or other materials will not be permitted. Use steel or galvanized steel supports. These are to be approved by the engineer before procurement.

4.1.1.1.5 Allowance of Expansion

All support brackets or steel fixtures should be fixed to allow free movement of the pipe within the fixture. This is to allow for the expansion and contraction of the pipes during the operation of the system.

4.1.1.1.6 Positioning

Attention will be paid to the positioning of the supports. A fixture or support should be placed at least 500mm away from a change of direction fitting i.e., tee or elbow.

4.1.1.1.7 Guide to Maximum Spacing of Piping Supports

Pipe Nominal Size (mm)	Intervals for Vertical Runs (m)	Intervals for Horizontal Runs (m)
15,0	1,9	1,3
20,0	2,5	1,9
5,0	2,5	1,9
32,0	2,8	2,5
40,0	2,8	2,5
50,0	3,9	2,5
65,0	3,9	2,8
80,0	3,9	2,8
100,0	3,9	2,8
150,0	5,0	6,1

4.1.1.1.8 Painting

The paint color scheme shall comply fully with Clause 11.4 of SANS 1091.

Paint all exposed metalwork and equipment which is not a specified manufactured product as follows:

- Thoroughly descale, clean, and degrease then apply the following steps on various metals:

Black Metalwork

- One coat of PA10 primer
- One universal undercoat
- Two coats of high gloss enamel to ensure complete corrosion protection.

Galvanized Metalwork

- Degrease and prepare surfaces with a wash specifically designed for pretreatment of galvanized iron.
- One coat of calcium plumbate.
- One universal undercoat.
- Two coats of high gloss enamel to ensure complete corrosion protection.

4.1.1.1.9 General Painted Equipment

- Damaged and scratched paint surfaces shall be touched up with identical color paint.
- Coldwater insulated piping shall be painted.
- Paint shall be of the highest quality and shall be applied strictly in accordance with the manufacturer's specification.

4.1.1.1.10 Colour Coding

Colors as per the attached table "Colour Coding for piped Services" are to be used.

COLOUR CODING FOR PIPED SERVICES

Contents of Piping	Proposed
Hot Domestic Water	Brilliant Green (H10) Crimson (A03)
Cold Domestic Water	Brilliant Green (H10) Cornflower (F26)
Industrial Hot Water (i.e. Primary Circuit, Central Heating, etc).	Brilliant Green (H10) Golden Yellow (B49)
Firewater	Signal Red (A11)
Sewage	Black

LPG	Light Stone (C37)
Refrigerant	Light Grey (G29)
Diesel	Golden Brown (B13) White
Transformer Oil	Golden Brown (B13) Crimson (A03)
Fuel Oil	Golden Brown (B13) + Label

4.1.1.1.11 Electrical

All electrical installations should conform to the following codes.

- The latest revision of SANS 10142 Code of Practice for the wiring of premises.
- The latest revision of SANS 101765
- Machinery and occupational safety regulations
- Cable size for Hot Water Heater to be a minimum of 4,2mm² each.

4.1.1.2 HVAC

4.1.1.2.1 Painting And Cleaning

- Thoroughly clean and descale and paint all equipment pipes, metal parts with two coats zinc chromate, and two coats high gloss enamel. For galvanized surfaces use one coat of calcium plumbate, one universal undercoat, two coats of high gloss enamel.
- Factory painted equipment shall have scratched and damaged surfaces touched up with identical colour paint. Paint shall be of the highest quality and shall be applied strictly in accordance with the manufacturer's specifications.
- Damaged floors, walls, ceilings, etc. done by the HVAC contract, shall be repaired by him at his expense to the architects' specifications.
- Paint Colours will be approved by the engineer.
- During the progress of the work, the HVAC *Contractor* shall carefully clean up after his men and shall leave the premises and all portions of the building in which he is working free from debris.

4.1.1.2.2 Mechanical Ventilation Systems

The mechanical ventilation shall be through ducted systems. The mechanical extractor fans for the ablutions shall be on the roof resting on a steel structure. The axial flow fan should be capable of extracting 1500l/s at a static pressure of 500 Pa. The fans shall operate on a timer during business hours and operate on motion sensors during none-business hours. These fans will be described and detailed on the bills of quantities and the HVAC drawings.

The mechanical ventilation in the office space shall be through heat recovery units with at least 60% heat transfer efficiency. The units should be capable of supplying fresh air at a rate of 500 l/s. the sound power shall not exceed 45 db when the unit is running at its high capacity. The units shall be controlled by CO2 sensors which will switch the unit on when the oxygen levels drop below the allowable set point.

4.1.1.2.3 Air conditioning Units

In the open-plan offices, the air-conditioning system shall be through VRV (variable refrigerant volume) type concealed ceiling units, ductless systems are incorporated in the partitioned offices. The server room will be furnished with inverter-type air-conditioning units.

The room temperature shall be regulated through a wired controller which can act as an input device, the set temperature should be regulated automatically irrespective of the heat load gain/loss in the building/dedicated HVAC zone. The temperature shall be monitored through sensors placed within the strategic points of the zone. These items are detailed on the bills of quantities and the HVAC drawings accompanying this specification.

4.1.1.2.4 Ductwork

All ductwork to be galvanized sheet metal and constructed to "SMACNA" standard for low pressure ducting. The Thermaflex duct insulation will be applied to the ducting with Pekay V435 contact adhesive, applied to both the ducting and insulation left until touch dry, and then applied to the duct. The insulation must also be secured with nylon polyprop strapping and polyprop buckles.

4.1.1.2.5 Refrigeration Piping

- All refrigerant tubing shall be of the seamless, dehydrated de-oxidized, refrigeration class copper tubing manufactured to ASTM B280-88 and ASTM B 743-88.
- Joints or connections in tubing up to 15mm O.D may be flared or welded and the tubing may be soft drawn.
- The Director will accept Salkop or Maksal type "RC" and "RL" refrigeration class copper tubing. Salkop "M" class tubing is not acceptable.
- Fittings or flared joints or connections shall be equal and approved to those manufactured by Imperial Manufacturing Company. Flare nuts shall be of the short "frost-free" type.
- The tubing shall be run in a neat, straight, plumb, or parallel manner. Silver soldered or Silfos welded joints will only be acceptable and such joints shall be easily accessible for inspection purposes.
- Refrigerant tubing shall be supported at approved intervals, not exceeding one meter, and shall be given adequate gradient to ensure proper oil return. Hardwood treated timber batts and copper saddles shall be used to support the refrigerant tubing.
- The tubing shall be supported in such a manner that the suction line can be adequately insulated to prevent condensation drip.

- Tubing shall not be run in such a manner as to impede the removal of compressor heads, etc., and pipework shall not be run in positions where it will be subjected to mechanical damage.
- All tubing shall be accessible for repairs and shall be run in such a manner that it is not subjected to vibration from moving equipment.
- Refrigerant tubing may not be buried directly into wall or floor chases, however, suitable trunking or pipe ducts may be employed for this purpose.
- Where refrigerant tubing is to pass through walls, ceilings, or floors, neat metal or PVC sleeves shall be provided and installed. The sleeves shall finish flush with the faces of the walls, ceiling or floors shall be rodent-proofed after pipes, cables, etc., have been installed through them.
- Pipe sizes must be adequate to provide for the efficient operation of the plant. The general specific rule is that the pressure drop in the suction line when operating at design pressures, shall not exceed 10 kPA from the compressor to the cooling unit. The pressure drop in the liquid line from the liquid receiver to the expansion valve is not to exceed 30 kPA. Tubing sizes and methods of installation shall be such as to ensure proper oil return to the compressor.
- All suction lines shall be neatly insulated to prevent condensation drip, by using good quality insulation such as "Armaflex" or "Thermaflex" or other approved.

4.1.1.2.6 Condensate Drain Piping

HVAC *Contractor* to supply 25ø PVC class 10/ supplier approved insulated drain piping for air-conditioning systems.

The drain piping is to be insulated with 25mm thick Armaflex. This piping will be measured in the bills of quantities and positions indicated on the drawings, support this piping every 600mm with approved saddles.

4.1.1.2.7 Electrical

Site Wiring (Cable Tray and Cable Ladder)

- All references to cable trays in this document also refer to cable ladders.
- All cables are to be on a cable tray or cable ladder. The type of cable tray or cable ladder used must be approved in advance.
- Cable trays are to be hot-dip galvanized and are to be painted as follows:
 - Clean with Spick & Span galvanized iron cleaner.
 - Cold galvanize any cut edges
 - Prime with calcium plumbate paint
 - Paint orange
- Cable tray brackets are to be hot-dip galvanized, and painted in the same way as cable tray, except that they are to be black.
- As an alternative galvanized cable trays and brackets maybe plastic coated.

- Cable trays are not to be cut to form bends. Elbows and tees are to be factory-made items. Ascenders and descenders are to be beaten around a former.
- Cable trays may be horizontal or vertical unless the drawing is marked to the contrary.
- All take-offs from cable tray runs must be done using tees or bends.
- Cables must not be bunched on a cable tray.
- Only one layer of cables is permitted on cable trays.
- Cables may not cross over on cable trays.
- Here changes of size occur on a cable tray run, this must be done using bends and tees. Abrupt changes in size are not allowed.
- Cable trays must be spaced off the surface that they are fastened to. Unistrut must be used for cable tray over 100mm.
- Do not short-circuit vibration isolators on machinery with cable tray.
- Cable tray brackets and supports must be of sufficient strength to prevent sagging, twisting, etc. particularly in the case of large cables.
- Cable trays and conduits are to be properly earthed to the switchboard earth bar.

Earthing

- All equipment is to be earthed.
- All earths are to be made off to the switchboard earth bar.
- The earthing strands in ECC cable, surfix, etc. are to be made off to the proper earthing points at both ends of the cable.

Making Off and Terminating Wires and Cables

- All site made holes in switchboards for glands etc. must be done with a chassis punch. Hole saws are not to be used. In the case of switchboards mounted outside, or in damp conditions, the cut edges of these holes must be treated with cold galvanizing and touched up with the correct colour paint.
- Where cables are made off into boards, this must be done carefully, offsetting the cables neatly and evenly, without cross-overs.
- All cable tails must have sufficient slack to allow tong testers to be used.
- Allow sufficient slack when making cable off to allow for adjustment of pulleys, removal of actuators, etc.
- No more than two lugs or two conductors without lugs are permitted in any terminal.
- Wires connected to numbered terminals are to bear the same number. Wire numbers are to be Haley Partex type PA.
- All cables are to be numbered on both ends, directly above the gland shroud, with copper, brass, or stainless steel bands or strips with the number embossed or punched on the strip or band.
- All wires except as noted below are to have lugs crimped to the ends. Lugs on wires 6mm and under are to be insulated. Insulated bootlace ferrules are acceptable when the terminal is designed to accept them. The correct type of crimper is to be used.

Ratchet crimpers only are to be used on insulated terminals. No exposed conductors are to be visible on wires which have insulated lugs.

- Single-core conductors are not to have crimped lugs but are to have insulated bootlace ferrules. Wires 10 mm and over which are secured into saddle or screw terminals are to be twisted and bound.

Conduits

- All conduit is to bear the relevant SABS mark.
- Conduits are to be run neatly and parallel to each other.
- Conduits are to be bent and offset with the correct tool. Wrinkling of the inside of bends will not be accepted.
- Through boxes, end boxes and fittings are to be made of the same material as the conduit, except that galvanized boxes and fittings may be used with black conduit.
- Inspection bends, tees, or couplings may not be used.
- All unwired conduits are to have draw-wires installed.
- Open conduit ends and boxes are to be sealed to prevent the ingress of debris.
- Cut conduit ends are to be properly reamed.
- Conduits must be made off to switchboards, boxes, trunking, etc using a coupling and male bush.
- Solid brass bushes must be used on the iron conduit, plastic bushes on the aluminum conduit, and brass or plastic bushes on the plastic conduit.
- Where the enameling or galvanizing of conduit has been removed by threading or tools, then the bare metal is to be painted with cold galvanizing paint.
- Conduit fixings are to be manufactured items designed for the fixing of the conduit. The method of fixing is to be approved before the construction commences.
- Metal conduit is to be fixed at a minimum of 2.0m, and plastic conduit 0.75m. Also, the conduit is to be fixed 150mm before and after each bend, offset, and box. Sagging between fixings will not be accepted.
- Drawer boxes are to be installed after two right-angle bends, or after 10.0m of a straight conduit.
- All plastic conduit joints and fittings are to be glued.

Trunking

- Trunking may not be cut to form bends. Distribution outlets, elbows, tees, ascenders, and descenders are to be factory-made items and must be radiused.
- Internal splices are to be used for joints.
- Sharp fastenings are not to protrude into trunking.
- All cut edges are to be smoothed, and no sharp edges are to be left inside trunking.
- All brackets are to be galvanized.

General

- All conductors are to be stranded.
 - All cables are to be PVC SWA PVC.
 - Screened cable for low voltage controls may be 0.5mm 2 OAM in conduit.
 - No surfix or similar cable may be used.
- All cable trays, ladders, conduits, surface mounted cables, trunking, etc. is to be run parallel to or at right angles to walls and other surfaces and may not be solid over expansion joints.
- Wall-mounted switchboards are to be spaced away from the wall 20mm.
- All cut ends of galvanized material are to be painted with cold galvanizing paint.
- All iron or steel material and fastenings exposed to damp conditions must be hot-dip galvanized. Electro-galvanized or cadmium-plated material will not be accepted unless suitably painted.
- All switchboards, isolators, terminal boxes, etc. located outside, or in any area subject to dampness, must be bottom entry only.
- All installations and wiring are to conform to the following:
 - The latest revision of SABS 0142 code of practice for the wiring of premises.
 - Machinery and occupational safety regulations.
 - Local authority regulations.
- Electrical Compliance Certificates as required by the latest revision of SABS 0142 are to be produced before power is applied to the installation.
- All cable and cable tray routes, wiring methods, etc. must be approved in advance.
- DO NOT alter wiring diagrams, switchgear selections, cable sizes, cable types, equipment positions, etc. without permission.

4.1.1.2.8 Commissioning, Adjusting, and Balancing

- Equipment shall be commissioned and adjusted so that it will perform as specified and shown on the drawings. A letter from each supplier of equipment shall be sent to the Engineer stating that the equipment has been installed and commissioned entirely in accordance with the supplier's requirements and recommendations.
- The entire control system shall be adjusted and placed in operating by the supplier. Re-adjustments necessary to accomplish the specified results during the first year of operation shall be made without cost to the Employer.
- All duct systems shall be adjusted and balanced so that air quantities at outlets are as specified or shown on the drawings so that distribution from air terminals is free from draughts and uniform over the face of each air terminal.
- Adjustments shall be made so that splitters and volume adjusters close to air terminals will have the least pressure drop consistent with volume requirements. Additional pressure drop required for the balancing of shorter fans shall be obtained by

adjustment of the dampers at branch duct take-offs. Adjustable fan drives shall be used for making final adjustments of total air quantities.

- Direct reading velocity meters may be used for comparative adjustment of individual air terminals, but air quantities in ducts that have velocities of 5,0m/s or more shall be measured by means of pitot tubes. Factory fabricated plugged or capped openings for pitot tubes shall be provided as required.
- The setting of dampers, splitters, and other volume adjusting devices shall be permanently inscribed so that they can be restored to their original positions if disturbed at any time.
- Where variable or constant volume regulators or similar devices are installed, the *Contractor* shall remove one device of each size from the installation as directed by the Engineer and shall send such devices to the CSIR or other approved body, for certification of the installation and shall form the basis for performance comparisons of other devices of the same size if required by the Engineer.
- A full air volume reading shall be taken on the site before the device being sent for certification and the *Contractor* shall ensure that all conditions necessary, for the correct operation of the device, prevail before the first site volume reading being taken.
- In the event of the installation being in operation at the time of such certification being required, the *Contractor* shall install devices of the same size as those on which such certification is taking place, to ensure continuity of operation of the installation.
- Fan performance on variable volume systems shall, in addition to any other tests required by the Engineer, be recorded when all variable volume devices are switched to their maximum design volume.

4.1.1.2.9 General

- The design of the air-conditioning and ventilation systems offered must comply with the :
 - National Building Regulations.
 - Any additional requirements of any local authority including fire and health.
 - All wiring to SABS 0142.

4.1.1.2.10 Operating and Maintenance Manuals

- HVAC *Contractor* to provide manuals with the following contents.
- Descriptive information, operating instructions, inspection and maintenance, reference documents, and equipment reference documents.

4.1.1.2.11 Drawings and As-Built Drawings

- Workshop drawings to be drawn on CAD by the HVAC *Contractor* and submitted for approval to the engineer.
- These drawings will include all plans, sections, wiring, diagrams, builders' work, etc.
- At the end of the contract, these drawings will be updated and included with the O&M manuals as As-Built drawings.

4.1.1.2.12 Maintenance and operating instructions

- Three copies of the Operating and Maintenance Manuals and "As-Built" Drawings to be prepared and submitted to the Engineers Office for checking.
- All relevant names, addresses, and telephone numbers to be included in the manuals.
- The contract shall be considered incomplete until all tests have been conducted to the satisfaction of the Department and all drawings and manuals have been handed over to the Engineer.

4.1.1.2.13 Maintenance and servicing

- The HVAC *Contractor* shall be responsible for all maintenance and servicing of the installation during the 12 months guarantee period.

4.1.1.2.14 Guarantee Period

- The HVAC *Contractor* shall unconditionally guarantee all newly installed equipment for a minimum period of twelve months (12) from the date of hand over to the Client.
- The guarantee shall cover the performance of the works and any defects due to inferior materials or workmanship. The *Contractor* shall repair any such defects without delay.
- If any defects are not remedied by the *Contractor* the Client reserves the right to employ another *Contractor* to do repairs at the expense of the installation *Contractor*, during the guarantee period.

4.1.1.3 Fire Protection

In the following section, the specifications required as per regulations are divided into different sub-sections. Each sub sections reference the regulations of importance to the specific criteria and apply it to the Transnet building.

4.1.1.3.1 Partition Walls

Any partition walls must have a fire resistance of at least 30 minutes as per SANS 10400-T, section 4.9.

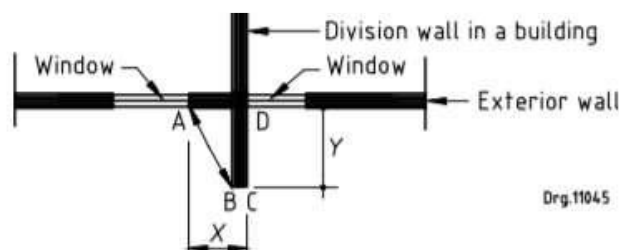
4.1.1.3.2 Structural Elements

For a 3 to 10 story office building, structural elements must have structural stability of not less than 60 min as per SANS 10400-T, Table 5, and 120 minutes for the basement.

4.1.1.3.3 Protection of Openings

Where an opening in any external wall of any division is less than 1 m measured horizontally or vertically from an opening in another division, a projection must be constructed between such openings, which ensures that the flame travel path from one opening to another is not less than

1 m as per SANS 10400-T, Section 4.10. Such projection shall have a fire-resistance of not less than half that required for the element separating the divisions concerned.



Dimensions X and Y should be such that the minimum path of flame travel ABCD is more than 1 000 mm.

Flame path travel condition

Where there is an opening in a separating element required to have a fire resistance of 30 min or more, such opening must be provided with a fire door or fire shutter as per SANS 10400-T, Table 6.

Class of fire doors or fire shutters (SANS 10400-T, Table 6)

1	2	3
Type of wall	Required minimum fire resistance of wall min	Class of fire door or fire shutter
Occupancy separation	60	A
	120	B
Occupancy separation – Plant rooms or other ancillary accommodation	120	C
	60	A
Divisional separation	60	A
	120	D
Emergency route	120	B
Protected corridor and protected stairs.	30	E
Service shafts not fire stopped at every floor level	60 or 120	A or B
Openings in all walls	30	F

Class B Fire doors with a rating of 120 min are required for the stairwells on the emergency routes of each floor. Any other divisional separating elements not on the emergency route must have a Class A fire door with a fire resistance of 60 min.

Plant rooms require a fire resistance for the walls of 60 min and Class A fire doors.

Occupancy separating elements between the office area and plant rooms requires a fire resistance of 120min as per SANS 10400-T, Table 4.

4.1.1.3.4 Hydrants

One fire hydrant is required for every 1000 m² or part thereof as specified by SANS 10400-T, section 4.35. Each floor requires 3 hydrants located at the emergency stairways for easy access.

4.1.1.3.5 Fire Hose Reels

Fire hose reels must be installed at a rate of one hose reel for every 500 m² or part thereof of the floor area in any storey. Approximately 6 fire hose reels are required per storey.

All fire hose reels must comply with the requirements in SANS 543 and must be installed in accordance with SANS 10105-2 and SANS 10400-W.

4.1.1.3.6 Fire Extinguishers

From SANS 10400-T, Table 11, one 4.5kg DCP is required for every 200 m² or part thereof for office areas and the library. Thus approximately 14, 4.5kg DCP's are required per storey. The plant room requires one 9kg DCP per 400 m².

4.1.1.3.7 Fire Detection

For an office building over 4 storeys in height, a fire detection system in accordance with SANS 10139 and a voice alarm system is required for each storey, including the basement (SANS 10400-T, Table 10). A point smoke detection system is recommended for the offices. Heat detection must be installed in any kitchen, kitchenette, or plant room.

4.1.1.3.8 Smoke Control

As per SANS 10400-T, Section 4.42, where any division has a floor area of more than 500 m² it must be provided with a system of mechanical or natural smoke ventilation designed in accordance with the relevant part of EN 12101.

Divisions can be kept under 500 m² by dividing the floor areas into smaller areas by means of cut-off fire doors.

For division areas larger than 500 m² and with up to 2500m² with no sprinkler system, the following applies:

- The storey must have roof ventilators, openable windows or panels to permit smoke ventilation.
- Must have an aggregate area of not less than 3 % of the floor area of the division.
- The smoke ventilation must be located in the roof or in the upper third of the walls and be distributed in such a way that smoke will be evenly extracted from all parts of the division.
- Be designed to open automatically when activated by heat or smoke detectors.
- Be designed to maintain a clear layer of 2,5 m above the floor. This clear layer shall be maintained for the designed evacuation period or 600 s.

Provided that the division is so situated that neither the roof space nor an external wall of the building form part of the division, the division must be equipped with a system of mechanical smoke ventilation.

Such mechanical ventilation must be designed to provide a clear layer of 2,5 m above the floor. The following is required for artificial ventilation systems used for smoke control (SANS 10400-T, Section 4.43):

- An air-conditioning system or artificial ventilation system in the building must be designed to prevent the distribution of products of combustion in the event of a fire in such a building.
- An air shaft or duct used for air conditioning or artificial ventilation, including any internal or external insulation thereto and any flexible joint, must be constructed of non-combustible material in accordance with SANS 10177-5, provided that;
 - combustible flexible connections may be used where the length of such connection does not exceed 1,5 m, and such connection does not pass through any wall or floor which is required to have specified fire resistance.
 - Combustible flexible joints not more than 200 mm in length can be used in any plant room where such plant room is equipped with a smoke detection system, designed, installed, and maintained by competent persons in accordance with SANS 10139.
- A fire damper, which shall comply with the requirements of SANS 193, shall be provided in an air duct in any position where the duct passes through a required division or occupancy, separating element or any element required for the enclosure of an emergency route, or asses into any duct.
- Any such fire damper must:
 - Close automatically upon the operation of a sensing device activated by the presence of smoke or heat in the air duct.
 - Be provided with access, the position of which shall be clearly marked, for inspection, maintenance, and resetting of the mechanism
 - Be so installed as to remain in position at the protected opening even if the air duct distorts during a fire
 - Be provided with an overriding fusible or resettable link.
 - Have the same fire-resistance rating as the elements of construction through which it passes.
- A plenum, the supports of which shall be non-combustible (excluding return-air intakes) that forms part of an air-conditioning system or artificial ventilation system, must be constructed of non-combustible material or material which has been evaluated in accordance with SANS 10177-5. Where the sum of the areas of all air supply and return-air intake grilles in such plenum is not more than 5 % of the area of the surface of such plenum exposed to the room below and no individual grille has an overall area of more than 0,09 m², such grilles may be of combustible material.

- In any plenum system, the fire stops, must be non-combustible and seal or close automatically upon the operation of sensing devices, or be activated when the temperature of the air in such space reaches 15 °C above its design temperature or 68 °C, whichever is the lesser.
- No plenum system can be used for storage or the accommodation of people.
- Where the air-conditioning system or ventilation system constitutes the whole, or part of a smoke control system, the installation shall comply with the requirements for smoke control in section 4.42.

4.1.1.3.9 Marking And Signposting

Signage will be installed throughout the building along escape routes, above exit doors, and above firefighting equipment.

As per SANS 10400-T, Section 4.29, signage must clearly indicate the direction of travel on all escape routes, location of exit doors, location of fire hose reels, fire extinguishers, and hydrants. The signage must be the photoluminescent type and must be illuminated to intensity of not less than 50 lux. The signage must be SABS approved and comply with SANS 1186-1, SANS 1186-3, SANS 1186-5, and SANS 1464-22.

4.1.1.3.10 Roof Covering

The roof construction must be non-combustible. SANS 428, Section A.3.2 requires the roof construction of any building with more than 2 storeys to be non-combustible. The roof assembly is considered as a single building component and consists of a ceiling, thermal insulation, structural components, and covering. The roof assembly must have structural stability of 60 min as per SANS 10400-T, Table 5.

Where roof space is formed between any ceiling and any roof covering, such space must be divided by means of non-combustible fire stops with a stability and integrity rating of at least 20 min into areas of not more than 500 m² (SANS 10400-T, Section 4.12.1.6). If any combustible materials are installed in such roof space, as combustible insulation, then the area for non-combustible fire stops will be not more than 250 m² and the distance between such fire stops shall not be more than 20 m. Any such roof space used as an air-conditioning or artificial ventilation system plenum will comply with the section for smoke control. No combustible elements, excluding purlins and battens, can penetrate the fire stop.

4.1.1.3.11 Ceilings

SANS 10400-T, Section 4.13.1 and SANS 428, Section A.3.2. states that combustible material cannot be used for any ceiling or suspended ceiling, or as a component thereof for buildings of more than 2 storeys in height.

As per SANS 10400-T, Table 5, structural stability of 60 min is required for the ceilings and 120 minutes in the basement due to ceilings forming part of the roof assembly.

A ceiling of an emergency route must have a fire resistance of not less than 120 min as required for the stability of structural elements or components, as given in table 5.

Glass ceiling nor suspended glass ceiling cannot be used in the building.

4.1.1.3.12 Flooring

Fitted carpet will be permitted for areas not protected by a sprinkler system only when the carpet has a Class 4 classification as per SANS 10400-T, Table 7. Balgotex certified class 4 carpets are recommended for the office area if carpets are preferred.

The basement requires Class 3 floor covering.

Combustible floor covering can be used where the covering does not exceed 5 mm in thickness or is made up of timber of up to 20 mm thickness and is fully adhered to the non-combustible substrate as per SANS 10400-T, Section 4.14.3.

4.1.1.3.13 Internal Finishes

Any internal finishes such as wall lining or decorative finish must have a class 4 classification as per Table 8 in SANS 10400-T. The basement requires Class 3 internal finishes.

4.1.1.3.14 Provision of Escape Routes

Each floor will be provided with not less than two escape routes. In addition, each escape route must have an emergency route that includes a stairway. The feeder routes must not exceed 45m in length. Every storey apart from the basement will have access to three different staircases, which form part of the emergency routes which exit at the ground level.

The distance to the nearest escape door can be more than 45m as long as an additional escape route is available and an emergency route is part of the escape route as per SANS 10400-T, Section 4.16.3.

The path of travel to access doors and escape doors shall be along a feeder route. The distance along the feeder route to the nearest access or escape door must not exceed 45m. A feeder route shall lead in two different directions to two or more independent emergency routes or escape doors. A common path of travel of no more than 35m is allowed as per SANS 10400-T, Section 4.16.6. A common path of travel is where the occupants of a room or building are limited to only one escape route up to joining a feeder route.

In terms of the basement where sprinkler protection will be installed the distance to the nearest escape door can be increased to 60m.

Any dead-end corridor must be less than 10 m in length as per Section 4.16.7.

Any hinged fire doors installed in section 4.10.5 shall open in the direction of egress and be hinged on the same side (SANS 10400-T, section 4.10.6). Every locking device fitted to an access door or escape door in any escape route shall be of a suitable type approved by the local authority, provided that in any building where an electronic locking device is installed, such locking device shall be of a failsafe design and be provided with a manual release device as per SANS 10400-T, Section 4.16.9.

As per SANS 10400-T, Section 4.27.2, no window, door or other unprotected opening in any facade of a building shall be closer than 3 m to an access door, passage, or an open stairway that forms part of an escape route, unless such opening is protected by a minimum of a Class F fire door or fire shutter that complies with SANS 1253 or fire damper that complies with SANS 193, provided that this requirement does not apply to an open passage where escape is possible in two directions.

4.1.1.3.14.1 *Width of escapes routes*

The width of escape routes must be at least 1500 mm as per Table 9, SANS 10400-T.

Table 1 Width of escape routes (SANS 10400-T, Table 9)

1	2	3
Maximum number of persons	Escape routes for buildings not required to provide facilities for persons with disabilities in terms of Part S of the National Building Regulations	Emergency routes for building which are required to provide facilities for persons with disabilities in terms of Part S of the National Building Regulations
	Minimum width mm	
≤100	1 000	1 500
≤120	1 100	1 500
≤130	1 200	1 500
≤140	1 300	1 500
≤150	1 400	1 500
≤160	1 500	1 500
≤170	1 600	1 600
≤180	1 700	1 700
≤190	1 800	1 800

NOTE This table does not contemplate simultaneous evacuation from multi-storey buildings.

4.1.1.3.15 Feeder Routes

As per SANS 10400-T, Section 4.18, where a building corridor forms part of a feeder route, the walls and partition walls enclosing such a corridor must be constructed of non-combustible materials and finishes be in accordance with the requirements in the flooring and internal finishes sections.

A door in the path of travel along any feeder route must be of the double swing type and shall not be provided with any means of locking.

4.1.1.3.16 Emergency Routes

A wall enclosing an emergency route must have a fire resistance of not less than 120 min or the appropriate time required for the stability of structural elements or components as given in table 5, whichever is the lesser.

A floor or ceiling of an emergency route must have a fire resistance of not less than 120 min or the relevant time required for the stability of structural elements or components as given in table 5, whichever is the lesser.

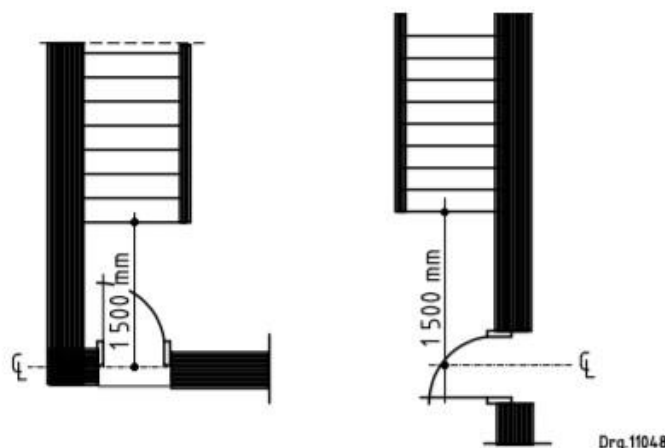
The finish of the floor of an escape route shall have a slip-resistant surface and shall be free from any projections, indentations, hollows, or covering which might cause a person to trip. Such finish or covering shall be of classification not inferior to that given in the section for flooring. Finishes of emergency routes shall be in accordance with the section for internal finishes.

A revolving or sliding door or automatically operated door or shutter may form part of an emergency route where such door or shutter is positioned at the end of the route discharging into a safe area, provided that there is an adjacent alternative hinged door that shall comply with all the rules relating to hinged doors in emergency routes, or such automatically operated sliding door or shutter shall be equipped with a failsafe system. Such revolving door shall be of a collapsible type (Section 4.19.8).

A door fitted with a locking device must be clearly indicated on the fire plan or general plan.

4.1.1.3.17 Stairways

- The following is required for stairways forming part of an emergency route (SANS 10400-T, Section 4.23):
- A stairway that forms part of an emergency route must discharge into a street, public place or an open space and may include a corridor or foyer.
- A stairway that forms part of an emergency route from any storey above ground level shall not have direct access to a basement.
- All stairways along emergency routes must be provided with handrails. Handrails must be in compliance with SANS 10400-S.
- The width of a stairway that forms part of an emergency route shall be not less than that 1500mm and will not be more than 1,8 m. The handrail may project into such width by not more than 100 mm.
- The distance between any change in floor level and the center line of a doorway in an emergency route or between two changes of floor levels in such route will not be less than 1,5 m (See the Figure below).



Position of doors in relation to change in level

4.1.1.3.18 Ventilation of stairways and emergency routes

The building does not exceed 30m in height; thus, natural ventilation can be provided utilizing a roof ventilator with an effective area of not less than 25 % of the plan area of the stairwell (SANS 10400-T, Section 4.24). The ventilator must be permanently open. Equal effective areas of inlet air vents must be provided at the bottom of the stairway.

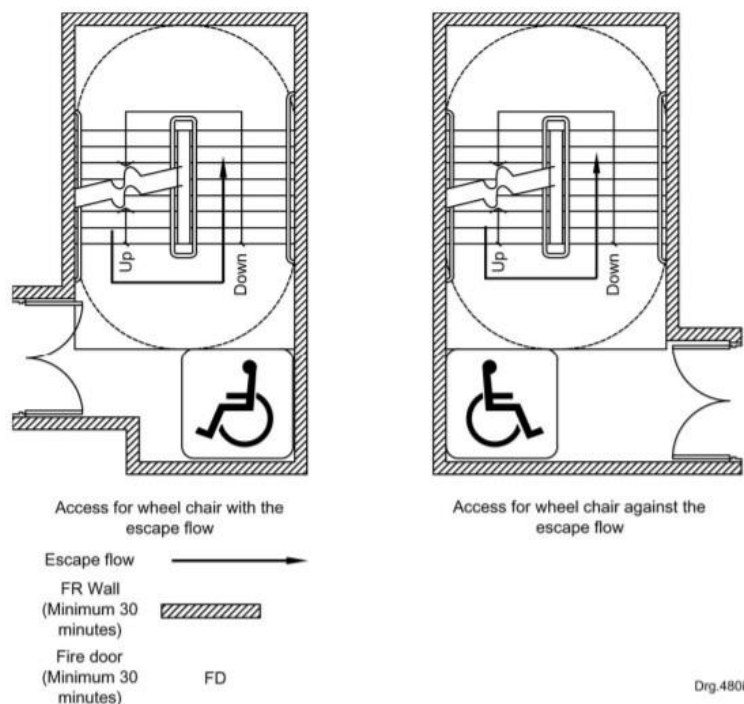
4.1.1.3.19 Refuge areas

Refuge areas must be placed on each floor at the entrance to the emergency staircase as per SANS 10400-T, Section 4.16.8.

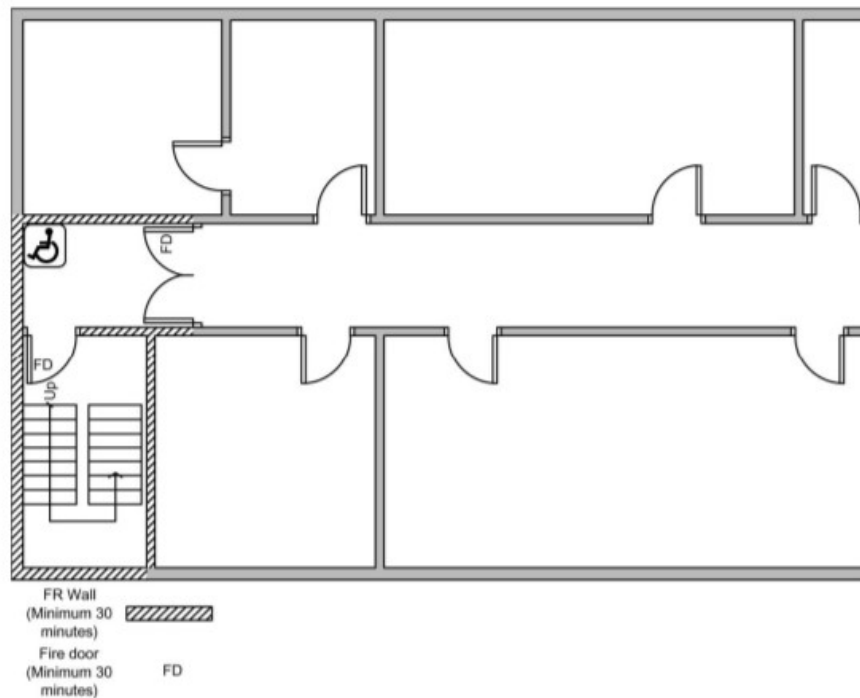
The refuges must:

- Be provided at not less than one for each stairway on each floor;
- Have a fire resistance of not less than 30 min,
- Be of sufficient size and manoeuvring potential to accommodate a wheelchair user and a companion. The space provided for a wheelchair in a refuge should not be less than 0.9m x 1.4m to allow for manoeuvring (SANS 10400-T, Section 4.16.24).
- Be located such that they do not adversely affect routes or means of escape.

When it is not possible to place the refuge at the head of the stairs, the refuge can be placed in a protected lobby or corridor. The wheelchair space should not reduce the width of the escape route. See the Figures below for suggested layouts of the refuge.



Refuge area option 1.



Refuge area option 2.

4.1.1.3.20 Emergency lighting

As per SANS 10400-T, Section 4.30, any escape routes must be provided with artificial lighting and, at any time, when the building containing such route is occupied. A minimum average illuminance of 50 lux on a horizontal plane 100 mm above the floor is required. The lighting will also be provided above the exit door where such a door is at the discharge of an emergency stairway or leads to stairs outside the building.

- The light sources must be connected to an emergency power supply, that is,
- independent of the mains supply.
- capable of providing power supply to emergency light sources for not less than the periods given in Table 5. 4.30.3

Emergency light sources, the minimum emergency lighting levels on the escape routes and the emergency lighting design shall comply with the relevant requirements of SANS 10114-2 and SANS 1464-22.

4.1.1.3.21 Lifts

As per SANS 10400-T, Section 4.43.3, The lift shaft openings must be provided with a lobby that has a stability and integrity rating of not less than 30 min and shall be arranged to prevent the exit of smoke into the lift shaft(s) for a minimum of 30 min. The doors of the lobbies must have self-closing mechanisms to automatically close the doors after being opened. If double doors are used, a selector mechanism must be installed to ensure the correct meshing of any rebate on the meeting styles.

The lift shaft must have a fire resistance of not less than the structural stability requirement of 60 minutes as per SANS 10400-T, Table 5. No more than four lifts can be accommodated in a lift shaft as per SANS 10400-T, Section 4.44.4.

No decorative finish or floor covering of lifts will have a fire index of more than 2 when tested in accordance with SANS 10177-3 or SANS 10177-4. 4.45.2.

In the event of a fire, the lift must be brought automatically to the main entrance storey without stopping and must remain there with its doors open (SANS 10400-T, Section 4.45.2). In addition, any non-enclosed stair lifting or vertical lifting platform provided for the use of mobility-impaired persons must return the platform to the closest floor served and remain in such position until their controls are reset.

4.1.1.3.21.1 *Firemen's lift*

No Firemen's lift is required in a building that does not exceed 30 m in height or less than 12,5 m below the level of escape (SANS 10400-T, section 4.61.1).

4.1.1.3.21.2 *Protection of Courtyard Lift*

The outer glass finishes of the courtyard lift must be sprinkler protected. The TYCO Model WS specific application window sprinklers are fast response, glass bulb-type spray sprinklers available in the horizontal sidewall and pendent vertical sidewall models.

4.1.1.3.22 Installation of Liquid Fuel in the Basement

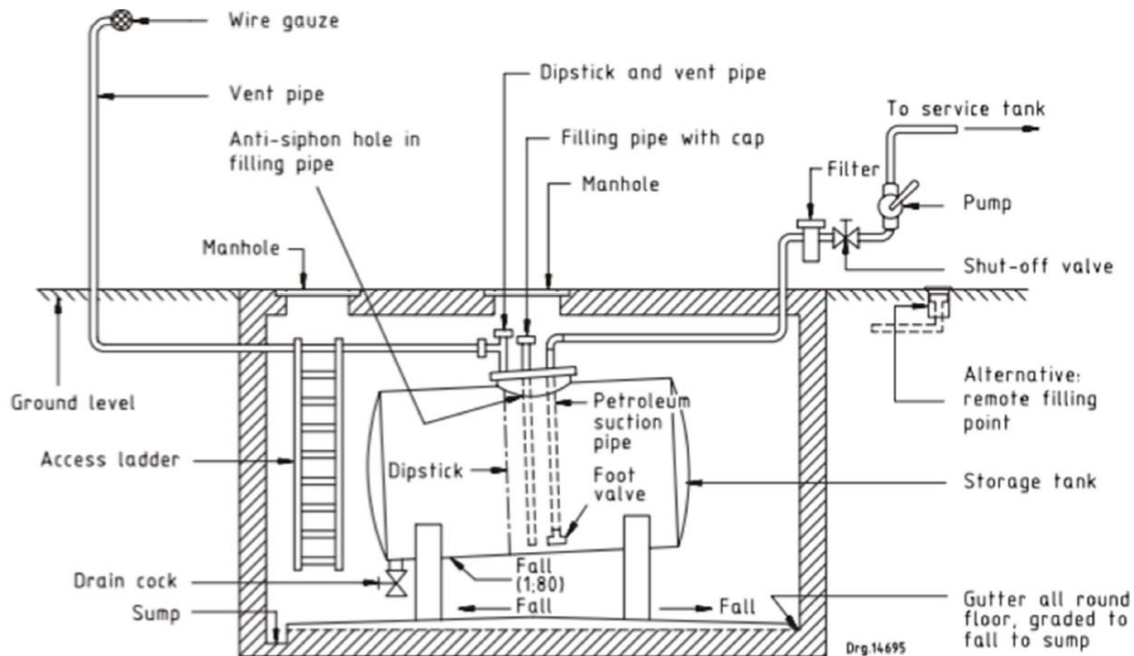
Diesel is a Class II liquid. Only Class II and III liquids can be stored in basements. Where tanks are installed in a basement, the tank must be installed in a chamber and fully enclosed by walls with a fire resistance rating of 4 hours.

Only a single tank or a service tank shall be allowed in a chamber, and the tank shall not exceed a capacity of 25 m³.

The following is required for Diesel stored in a chamber as per SANS 10131, Section 4.1.5:

- The roof of the chamber shall be of concrete of thickness at least 150 mm and the floor of brickwork, stone, reinforced concrete, or other material of equivalent strength. The floor shall not be constructed of earth or of an asphaltic material.
- A clear space of width at least 1 m shall be provided between the tank and the walls and between the tank and the roof of the chamber.
- Each doorway in the walls of the chamber shall be protected with two fire-doors of class D rating (see SANS 1253). To fulfil their function, both fire-doors should be kept closed at all times when the chamber is not occupied. Raise the sill of each doorway to form a bund wall that will entrap spillage. Ensure that the bund has a net capacity at least equal to that of the tank plus 10 % of the tank capacity.
- Vent the chamber to the open air in a safe location. Protect any metal ventilating duct inside the building over its entire length.
- Electrical equipment used in chambers shall comply with SANS 10089-2.
- Heat Detection must be installed in the chamber.

The Figure below is the recommended layout for the Diesel tank in the chamber.



Typical tank installation in a chamber (SANS 10131, Figure 2).

4.1.1.3.23 Heritage Museum Protection

For the preservation of the historical content of the library a gas suppression system is recommended. More specifically, the FM 200 Gas suppression cylinders. FM-200, also commonly known as HFC-227ea, is a clean agent fire suppressant for Class A, B, and C fires and meets NFPA Standard 2001 Clean Agent Fire Extinguishing Systems. Clean agents are fast and effective in suppressing fires, are safe in occupied spaces, and do not leave residue. FM-200 Clean Agent is a colorless, odorless, non-contaminating gaseous fire protection agent. Electrically non-conductive, FM-200 works by removing heat from a fire so that combustion cannot be sustained.

The outer walls and doors of the library must be 60 min Firewalls and Class A fire doors. Each separate room in the library should also have 60 min firewalls and Class A fire doors for sufficient protection.

Smoke detection must be connected to the fire doors to close in the event of a fire.

4.1.1.3.24 Battery Room Protection

Fire can start due to the rupture of Li-ion cells, resulting in the ejection of electrolyte, a class B flammable or combustible liquid. The other most likely start of a fire would be an electrical or Class C fire. Novec 1230 gas suppression cylinders are effective against Lithium-ion and Lithium-metal fires.

4.1.1.3.25 Server Room Protection

The same system used in the library (FM 200 Gas suppression cylinders) will sufficiently protect the server room.

4.1.1.3.26 Generator and Transformer Room Protection

The generator and transformer rooms must have fire-rated walls of 120 min and Class B fire doors.

Heat detection is required in both rooms.

For the automatic sprinkler system, a design density of 12.2 mm/min over an area of 230 m² is required (NFPA 37, Chapter 11, Section 11.4.5.1). Sprinkler and water spray system coverage must be provided to all areas within the enclosure located within 6 m of the following:

- The engine
- The lubricating oil system.
- The fuel system

Sprinklers and water spray nozzles must not be directed at engine components that are susceptible to thermal shock or deformation.

An additional fire hose allowance of 1900 l/min for 90 minutes is required for an Extra Hazard Group 1 (NFPA 13, Table 19.2.3.1.2).

4.1.1.3.27 Basement Office Sprinkler Protection

NFPA 13 is suggested for the design of the sprinkler systems within the basement due to the smaller water demand requirement when compared to ASIB.

ASIB requires sprinkler protection of 5.0 mm/min over an area of 216 m² for a duration of 60 minutes and with an additional fire hose allowance of 1200 l/min for an hour.

NFPA 13 requires that the basement office area be sprinklered with protection of 4.1 mm/min over an area of 140 m² (NFPA 13, Table 19.2.3.1.1) for a duration of 30min. An additional water allowance for fire hoses of 380 L/min is required for 30 minutes (NFPA 13, Table 19.2.3.1.2).

4.1.1.3.28 Fire-Water Requirements

Based on the most extreme condition for the simultaneous operation of sprinklers and hydrants, the adequate tank capacity is 428 Kl. This can only be established once the size of the transformer and generator room is set.

4.1.1.4 LIFTS

4.1.1.4.1 Lift Shaft

The facility shall be furnished with two lift shafts. a new lift shaft shall be constructed in the courtyard area and one existing lift shaft shall be retained. The new courtyard shaft structure shall be constructed from glass and galvanized steel members. The shaft shall house four 1000kg box-type passenger lifts that will service all levels of this facility.

The new steel shaft shall be constructed as per the structural engineer's specifications. The overall internal dimensions of the lift shaft are 9772mm wide x 1800mm deep and 28500mm high. The shaft shall have a pit and headroom of 1600mm and 4200mm respectively.

The existing lift concrete lift shaft shall be reinstated and house a passenger-cargo lift which can also be used as a scratcher lift. Modifications should be made on this lift shaft to bring it to compliance with requirements of 4.47 of SANS 10400-T. The shaft shall have a pit and headroom of 1600mm and 4600mm respectively. The lift *Contractor* will be responsible for the complete design of steelwork and other dimensions necessary for the complete lift installations.

The power mains distribution board (DB) shall be located by others as per the lift specialist. The electrical *Contractor* will provide a 3-phase powerpoint at the top of each lift shaft for the lift motor.

Suitably rated single phase plug socket outlets are to be provided at the top and bottom of the shaft respectively and are to be protected by a separate earth leakage device.

The existing concrete shaft lights shall be operable by means of two-way switching, one switch mounted at the bottom, and the other at the top of the shaft.

4.1.1.4.2 Car Landing Doors and Door Frames

The landing doors and the car doors for the passenger lifts shall be hairline stainless steel and glass with an aluminum sill finish. The thickness of the glass should meet the minimum required SANS standard.

The landing doors and the car doors for the passenger-cargo lift shall be hairline stainless steel with a suitable fire rating and an aluminum sill finish.

All panels of the landing and car doors shall comply with SANS 1545, and certification of proof shall be furnished by the elevator Vendor.

All Landing architrave frames shall be new hairline stainless steel with a fire rating complying with SANS 1545 part 9. The elevators Vendor shall furnish a test report as required in terms of EN 1363-1.

Detailed drawings of the proposed frames must be submitted to the Engineer for approval before manufacturing commences.

4.1.1.4.3 Landing details

An infrared curtain door protection system shall be provided at each landing door that an invisible safety net of beams across the elevator entrance. At the lift entrances on each landing, a flush-mounted alpha-numeric digital car position display unit shall be provided in an operating panel comprising of natural colored brushed stainless steel finish with micro-touch buttons. The design of the panel shall cater to visually impaired users.

Each button shall be marked with its corresponding direction of travel. The demarcation shall either comprise a raised or recessed approved symbol, with Braille markings, that shall not fade over time.

The location of centerline of each landing's micro push-button fixture shall be located at 1050mm above the floor to suit operation from a wheelchair.

4.1.1.4.4 Landing operating panels

Landing operating panels shall have the following:

- Stylish, hairline finish stainless steel panel with touch-sensitive buttons
- Call acceptance (visual)
- Up & down buttons on each floor (one button only for ground and top/roof floor)
- Braille
- Car position indicator on each floor
- Car full indicator - Pre-announcing arrows on each floor
- Key switch on ground floor landing

4.1.1.4.5 Lift Car

- The passenger car panel finishes shall be hairline stainless steel and glass. The cargo-passenger car panel finishes shall be hairline stainless steel.
- Emergency lighting shall be fitted in the car either in self-contained luminaries or a centrally supplied luminaire. The duration of operation of the emergency lighting shall be at least 3 hours.
- A ventilation fan must be fitted to the lift car.
- A safety balustrade shall be fitted around the top of the lift car.
- Appropriate safety control shall be provided for servicemen working on the top of the lift car.
- The passenger-cargo lift shall be provided with hangers and canvas cover to protect the car wall from damage during office furniture transport.

4.1.1.4.6 Door protection devices

- A non-retractable electronic infra-red/ultra-sonic protective leading edge shall be provided and shall extend at least 2100-mm above the platform and its active surface/area shall project beyond the front edges of each leading car door panel. Should this device come nearby, or touch a person or object whilst the car doors are closing, the car and shaft doors shall return to their open position. Manual reversal of the doors while the lift is on automatic operation shall be accomplished by pressing a door open button in a car-operating panel. Should this device be activated while the car doors are closing, the car and shaft doors shall return to their open position.
- Without exception, the *Contractor* shall demonstrate on the day of Completion that the door closing pressures comply in full with the SABS 1545 Part 1 and Part 2 under normal and forced closing conditions.

- The door protection device shall have the capabilities of detecting metal/plastic wheelchairs.

4.1.1.4.7 Nameplates

The nameplate accommodates names and other information as well as floor assignments.

4.1.1.4.8 Lift Drive

The lift machine shall be of the variable voltage variable frequency gearless traction drive type, with regeneration technology mounted in the top of the new lift shaft. Where regenerative technology is not provided, the tenderer will need to prove the lift drive system has a similar energy-saving and efficiency to that of a regenerative drive system and that the total harmonic distortion is equal to or below 5%.

Where hoist belts are provided in place of ropes/cables these shall be monitored by a resistance monitor with lift cut-out protection.

4.1.1.4.9 Lift Operation

Lift operation shall be full collective with microprocessor control with backup as per the Vendors standard, which shall be submitted to the Engineer for approval before manufacturing commences.

A full-length, flush-mounted operating panel shall be provided in the sidewall of the car and shall be furnished with a digital floor position and direction of travel indicators.

The panel shall be paraplegic friendly and shall be located so that all operating and emergency buttons that incorporate Braille markings are located between 900 and 1500mm above the car platform.

The emergency buttons and switches shall be mounted at the bottom and the call buttons in numerical order starting above the emergency button.

The alarm button shall operate a bell on top of the car and a buzzer with a flashing LED unit at the duty room on the ground floor, which serves as an emergency signal. The alarm may, however, be combined with the BMS and intercom system. Once it is activated the unit at the duty room on the ground floor shall remain active until it is manually reset.

4.1.1.4.10 Car operating panels

Car operating panel shall have or meet the following minimum requirements:

- Stylish, stainless steel – telephone style with touch-sensitive glass, button keypad (built to standard EN 81-70).
- Door open/close and alarm buttons.
- Braille.
- Visual and audible confirmation of the call
- Position indicator and number of the current level.

- Direction arrows for memory push-button control.
- Pre-announcing arrows for collective controls.
- Destination floor display for collective selective control.
- Additional, horizontal car operating panel for handicapped.
- Second, vertical car operating panel in car opposite to main car operating panel.
- Voice floor announcement (English and Zulu languages).
- Intercom and BMS facility

4.1.1.4.11 Lift Intercom System and Security system

An intercommunication system, complete with talk-back speakers with all required auxiliary equipment, wiring, and a two (2) hour minimum backup power supply, shall be provided.

The voice link shall constantly produce a sound/speech quality comparable to that of the normal telephone network. All provisions to adequately address interference in the lines shall be included. The intercom master stations, one at the lift controller and the other at the duty room on the ground floor shall include a visual and audible indicator system/panel to indicate the lift car initiating the emergency call. Once activated, the warning system shall remain active until it is manually reset.

Wiring from the lift master station to the ground floor duty room shall be undertaken by the electrical *Contractor*; however, the supply of the remote intercom station forms part of this contract.

Elevators/Lift traveling cables shall contain two (2) shielded pairs of conductors for the car for the intercommunication system.

All wires in the wiring system shall be shielded without exception.

Wiring between all master stations in the building shall comply with Vendor's recommended standards.

There shall be an activated or programmable voice in English and Zulu languages notifying the passenger of the opening floor level. An announcement of lift overload shall also be provided. This function shall be activated on all elevators.

4.1.1.4.12 Lifts Specifications

1000kg Passenger Elevator	
Main Detail	
Type of elevator	Gearless MRL
Quantity	4
Capacity	1000kg
Rated Speed	1,00 m/s
Travel	24000mm
Stops/Doors/Floors	6/6/6
Openings	In Line
Basic station	G
Floor marks	LG, UG, 1,2,3,4,
Shaft	
Shaft dimensions ID	9772 (w) mm x 1800 (d) mm
Headroom	4200mm
Pit	1600mm
Shaft material	Galvanize Steel Members and Glass
Car	
Car dimensions ID	1400 (w) mm x 1600 (d) mm x 2250 mm (h)
Car Panel Finish	Hairline stainless steel & glass
Car Flooring	Black studded rubber
Car Handrail	Round stainless steel on 3 sides
Car Skirting	None
Car Mirror	½ on rear
Car Canvas Blanket	None
Signalization - Car (COP)	

COP Type	Left front standing inside the car facing out
Content	Call buttons, alarm, door open, door close, emergency light, overload indicator, floor indicator
COP Finish	Hairline stainless steel
Display Type	LCD
Display Content	Numeric floor indicator, directional arrows
Display Colour	Blue background and white text
Button Type	Round
Button Backlight Colour	Blue
Button with Braille	With
Disabled COP	With
Voice Annunciator	With
Arrival Gong on Car	With
Signalization - Landing (LOP)	
LOP Type	Surface-mounted
LOP Finish	Hairline stainless steel
Display Type	LCD
Display Content	Numeric floor indicator, directional arrows
Display Colour	Blue background and white text
Button Type	Round
Button Backlight Colour	Blue
Button with Braille	With
Arrival Gong on Landing	Without
Car Door Details	
Car Door Opening Size	900 (w) mm x 2100 (h) mm

Car Door Type	2 panel centre opening
Car Door Finish	Hairline stainless steel & glass
Car Door Sill Finish	Aluminium
Car Door Details	
Landing Door Opening Size	900 (w) mm x 2100 (h) mm
Landing Door Type	2 panel centre opening
Landing Door Finish	Hairline stainless steel
Landing Door Sill Finish	Aluminium
Landing Door Fire Rating	2 hour fire rated n/a
Landing Door Frame Type	Standard small architraves
Landing Door Frame Finish	Hairline stainless steel
Drive System	
Drive Type	Gearless traction machine
Power Required	400V
Drive Location	Within shaft
Drive System	
Control Type	Full collective
Inverter Type	Integrated
Group Control	Simplex
MAP Location	Top floor next to landing door
MAP Finish	Hairline stainless steel
Rescue Device	With
Rescue Communication	GSM device

Unit Detail:2250kg Cargo unit**Main Detail**

Type of elevator	Gearless MR
Quantity	1
Capacity	2250kg
Rated Speed	1,00 m/s
Travel	24000mm
Stops/Doors/Floors	6/6/6
Openings	In Line
Basic station	UG
Floor marks	LG, UG, 1,2,3,4,5
Shaft	
Shaft dimensions ID	5330 (w) mm x 1955 (d) mm
Headroom	4500mm Machine room height = 2500mm
Pit	1600mm
Shaft material	Concrete
Car	
Car dimensions ID	5330 (w) mm x 2 (d) mm x 2250 mm (h)
Car Panel Finish	Hairline stainless steel
Car Flooring	Black studded rubber
Car Handrail	Round stainless steel on 3 sides
Car Skirting	None
Car Mirror	½ on rear
Car Canvas Blanket	None
Signalization - Car (COP)	
COP Type	Left front standing inside the car facing out
Content	Call buttons, alarm, door open, door close, emergency light, overload indicator, floor indicator

COP Finish	Hairline stainless steel
Display Type	LCD
Display Content	Numeric floor indicator, directional arrows
Display Colour	Blue background and white text
Button Type	Round
Button Backlight Colour	Blue
Button with Braille	With
Disabled COP	With
Voice Annunciator	With
Arrival Gong on Car	With
Signalization - Car (COP)	
COP Type	Left front standing inside the car facing out
Content	Call buttons, alarm, door open, door close, emergency light, overload indicator, floor indicator
COP Finish	Hairline stainless steel
Display Type	LCD
Display Content	Numeric floor indicator, directional arrows
Display Colour	Blue background and white text
Button Type	Round
Button Backlight Colour	Blue
Button with Braille	With
Disabled COP	With
Voice Annunciator	With
Arrival Gong on Car	With
Signalization - Landing (LOP)	
LOP Type	Surface-mounted

LOP Finish	Hairline stainless steel
Display Type	LCD
Display Content	Numeric floor indicator, directional arrows
Display Colour	Blue background and white text
Button Type	Round
Button Backlight Colour	Blue
Button with Braille	With
Arrival Gong on Landing	Without
Car Door Details	
Car Door Opening Size	1800 (w) mm x 2100 (h) mm
Car Door Type	4 panel centre opening
Car Door Finish	Hairline stainless steel & glass
Car Door Sill Finish	Aluminium
Car Door Details	
Landing Door Opening Size	1800 (w) mm x 2100 (h) mm
Landing Door Type	4 panel centre opening
Landing Door Finish	Hairline stainless steel
Landing Door Sill Finish	Aluminium
Landing Door Fire Rating	2 hour fire rated n/a
Landing Door Frame Type	Standard small architraves
Landing Door Frame Finish	Hairline stainless steel
Drive System	
Drive Type	Gearless traction machine
Power Required	400V
Drive Location	Within shaft
Drive System	

Control Type	Full collective
Inverter Type	Integrated
Group Control	Simplex
MAP Location	Top floor next to landing door
MAP Finish	Hairline stainless steel
Rescue Device	With
Rescue Communication	GSM device