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Compiled by	Reviewed by	Approved by
…….	……p.p……	…….
J de Villiers	**N Hlophe**	**M Mamoleka**
CW System Engineer	**Aux Eng. Manager**	**Engineering Manager**
Date: 18/11/2024	Date: 19/11/2024	Date: 2024-11-20

Supported by

……..

J. Varden

Generation Engineering

Chief Engineer

Date: 2024/11/21

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1. INTRODUCTION

Sulphuric acid dosing in cooling water (CW) systems is used to reduce the alkalinity of the CW. The system is an alternative and back up treatment to lime and soda ash treatment plants. Adequate m-alkalinity control is required to ensure that carbonate-based scale does not precipitate on various surfaces within the CW system.

Scale formed in the CW system affects the efficiency of the main turbine condensers, cooling towers, turbine auxiliary -, boiler auxiliary and generator auxiliary coolers. This scale has caused units to run with poor main turbine condenser backpressure (vacuum) such as Duvha unit 4. In addition, scale build up has decreased the efficiency of lube oil coolers such as those of the boiler electric feed pumps resulting in unit trips at Duvha power station. The lack of treatment of the CW system will continue to cause scaling on heat exchange equipment which reduces the heat transfer effectiveness and results in a continued increase in partial load losses (PLL).

The sulphuric acid bulk storage tank on the North cooling water plant was installed and commissioned in 1979 and it is currently out of service due to critical material corrosion as indicated in Figure **1** below. The tank was design according to the BS1515 part 1- 1965 which covers the corrosion and erosion protection for the acid tank, as well as the mechanical design. Due to aging of the tank the corrosion protection deteriorated resulting in the severe degradation of the tank hence there is a need to procure a new tank.

Figure 1**:** North Sulphuric Acid storage tank

The tank and plant are equipped with an offloading area where sulphuric acid is transferred to the bulk storage tank by means of isolation valves. From the tank plug valves are used to regulate the flow from the tank to the reciprocating pumps. The tank is equipped with two manhole access covers, an overflow or vent point, drain point as well as the inlet and outlet flanges. In addition, the tank makes provision for earthing lugs to avoid the build-up of static electricity. The tank discharge is fed to reciprocating pumps that discharges into the Northern recarbonation launder through the use of a stainless-steel pipeline.

The tank deteriorated over the years that resulted in numerous acid spillages to the bund area. The degradation of the tank affected the reinforced concrete bund around the storage tank. This bund is designed to contain spillages due to acid leakages from the tank and pipework and prevent any soil or ground contamination. The bund drainage system consists of a catch pit that connects to a manhole outside of the bund with a drainage pipe underneath the concrete floor slab (from offloading area to the

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sludge launder). There are two manholes within the drainage system, one located outside of the bund area the other located downstream towards the discharge point at the sludge launder. The corrosion protection system of the bund has been compromised over the years, namely the bund walls and mostly the floor slab. The corrosion is also evident on the catch pit, manholes and the sludge launder. There is also corrosion evident on the offloading area concrete floor slab as well as the drainage system which also require remedial works.

2. SUPPORTING CLAUSES

2.1 SCOPE

This document covers the technical requirements, works boundaries, standards and specifications for the North cooling water treatment plant sulphuric acid tank system with associated pipework and valves as well as Civil repairs.

2.1.1 PURPOSE

The intent of this document is to ensure that the technical requirements, *works* boundaries, standards and specifications for the are clear to that of the *Contractor* and the *Employer*. In addition, the document is to be used to establish an NEC contract and to ensure that the technical requirements are clearly and fully captured for the execution of the works.

2.1.2 Applicability

This document applies to Duvha Power Station Northern Cooling Water Treatment Plant.

2.2 NORMATIVE/INFORMATIVE REFERENCES

Parties using this document shall apply the most recent edition of the documents listed in the following paragraphs.

2.2.1 Normative

[1] 32-727 - Eskom Safety, Health, Environment and Quality (SHEQ) Policy

[2] Occupational Health and Safety Act No. 85 of 1993,

[3] Republic of South Africa, Pressure Equipment Regulations (PER), Government Notice No. R. 734, Government Gazette No. 32395, 15 July 2009. Promulgated under the Occupational Health and Safety Act, No. 85 of 1993. Available: https://www.saflii.org/za/legis/consol_reg/per354.pdf

[4] SANS 347:2024 Categorization and conformity assessment criteria for all pressure equipment

[5] 240-105658000 (QM58) - Supplier Quality Management: Specification

[6] 240-106628253 - Standard for Welding Requirements on Eskom Plant

[7] PD 5500 – Specification for unfired fusion welded pressure vessels240-83539994 –Standard for Non-Destructive Testing (NDT) on Eskom Plant

[8] 240-101712128 Standard for the Internal Corrosion Protection of Water Systems, Chemical Tanks and Vessels and Associated Piping with linings

[9] 240-106365693 - Standard for External Corrosion Protection of Plant Equipment and Associated Piping with Coatings

[10] 34-1168- COLOUR CODING, SYMBOLIC SAFETY SIGNS AND DEMARCATION

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[11] 240-145581571 Standard for the Identification of the Contents of Pipelines and Vessels

[12] GE/MAT/24/088 – Duvha P/S Corrosion Specification for Acid Proofing of Sulphuric Acid Bund.
[13] GE/MAT/24/089 – Duvha P/S Corrosion Specification of Acid Bund Structural Steel Elements.

[14] 240-105020315 Standard for Low Pressure Valves

[15] 240-123801640 Standard for Low Pressure Pipelines

[16] SANS 310:2021 Storage tank facilities for hazardous chemicals — Above-ground storage tank facilities for flammable, combustible and non-flammable chemicals

[17] 240-53114002 Engineering Change Management Procedure

[18] 240-109607332 Eskom Plant Labelling Abbreviation Standard

[19] 240-71432150 Plant Labelling Standard

[20] 240-53113685 Generation Design Review Procedure

[21] 240-86973501 Engineering Drawing Standard

[22] 32-6 Document and Records Management Procedure

[23] 240-54179170 Technical Documentation Classification and Designation Standard

[24] 240-65459834 Project Documentation Deliverable Requirement Specification

[25] 240-53114026 Project Engineering Change Management Procedure

[26] 240-49230111 Hazard and Operability Analysis Guideline

These documents are indispensable for the application of this document, i.e. documents to be used together with this document.

2.2.2 Informative

n/a

2.2.3 DISCLOSURE CLASSIFICATION

Controlled disclosure: controlled disclosure to external parties (either enforced by law, or discretionary).

2.3 DEFINITIONS

- **Quality Assurance (QA):** The systematic process by which the specified quality requirements are met through planned and documented activities. QA ensures that all project components meet the established standards and specifications outlined in QM 58 (240-105658000 - Supplier's Contract Quality Requirements Specification).
- **Corrosion Protection**: The process and standards applied to prevent corrosion of structural components, particularly in sulphuric acid environments. For this project, all structural steel elements must comply with the GE/MAT/24/089 Duvha P/S Corrosion Specification, ensuring durability and safety.
- **Project Boundary:** The defined scope and physical limits within which all project activities, including fabrication, installation, and commissioning, will occur. For this document, the project boundary is as indicated in Figure 2 of 0.57/47052 Rev 1 Sulphuric Acid Storage North (P&ID).
- **Bund Wall:** A containment structure designed to capture any accidental spills or leaks of hazardous materials, such as sulfuric acid, thus preventing soil and environmental contamination.

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It includes drainage features, such as catch pits and manholes, essential for safe handling and disposal.

- **Neutralization Process**: The procedure used to safely reduce the acidity of residual sulfuric acid in the tank and bund area. It involves the application of a diluted base solution, as specified in the safety guidelines, to reach a neutral pH, ensuring safe dismantling and disposal of the old tank.

2.4 ABBREVIATIONS

Abbreviation	Description
SANS	South African National Standards
SABS	South African Bureau Standards
SE	System Engineer
SHEQ	Eskom Safety, Health, Environment and Quality
QA	Quality Assurance
QM	Quality Manual
QC	Quality Control
SDS	Safety Data Sheet
PD	Published Document
NDT	Non-destructive test
NEC	New Engineering Contract
IWE	International Welding Engineer registered with IIW
IIW	International Institute of Welding
IWP	International Welding Practitioner registered with IIW
IWS	International Welding Specialist registered with IIW
IWT	International Welding Technologist registered with IIW

2.5 ROLES AND RESPONSIBILITIES

Appointed *Contractor* – Execute the scope of work as per the *Employer's* specification captured in this document. To ensure quality assurance is done as per QM 58 [5] and Eskom Safety, Health, Environment and Quality (SHEQ) Policy is adhered to. The Contractor must be ISO 3834-2 certified.

***Employer's* Project manager** – To ensure that the Tenderer executes the works within the required schedule and with the correct quality. Ensures that the scope of work is converted into a NEC contract format and liaise with the *Employers'* engineering department for any ambiguity.

***Employer's* System Engineer** – The *Employers'* System Engineer will review all works which is being executed and ensure that quality assurance is adhered to. Compile the scope of works with support of the *Employer's* senior and GX engineers. Draft a technical evaluation strategy for the proposed scope of works.

***Employer's* Buyer –** Takes the scope of works, technical evaluation strategy and NEC contract to draft a procurement strategy and takes the project to the market in adherence to the procurement procedures of the *Employer*.

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2.6 PROCESS FOR MONITORING

The works quality will be monitored in accordance with the *Employer's* quality requirements as outlined in QM 58 [5].

2.7 RELATED/SUPPORTING DOCUMENTS

Drawings:

- 0.57/ 21873 Sulphuric Acid Storage Vessel Rev. 1
- 0.57 02649 REV 5
- 0.57/02649 Rev 5 Sulphuric Acid Bulk Storage Vessel
- 0.57/16479 Rev 1 Details of M.S. Plug Cock for Unlined Bulk Storage Tanks
- 0.57/19885 Rev 1 Deck Plan of Sulphuric Acid Storage & Off-loading area
- 0.57/19886 Rev 1 Platforms at Sulphuric Acid Storage Tank & Off-loading area
- 0.57/21813 Rev 1 Sulphuric Acid Bulk Storage Vessel Assembly and Details
- 0.57/21815 Rev 0 Manway Davit Details 500 N/B (Vertical)
- 0.57/21816 Rev 0 500 N/B Manway Davit Details (Horizontal)
- 0.57/21817 Rev 0 Details of Platform Clips
- 0.57/29291 Rev 0 North Clarification Plant Sulphuric Acid Offloading area concrete details
- 0.57/29294 Rev 1 North Clarification Plant Storm Water & Dirty Drain System
- 0.57/47052 Rev 1 Sulphuric Acid Storage North (P&ID)

3. SCOPE OF WORKS

3.1 DESCRIPTION OF THE WORKS

The scope involves:

- Design, fabricating, installing, and commissioning a new sulphuric acid bulk tank for Duvha Power Station in line with PD 5500, SANS 347 [4], and the PER [3] (Section 3.1.2).
- The sulphuric tank should be inclusive of
    - Supply of the plug valves and overflow valve (Section 3.1.2 and Section 3.1.3)
    - Supply, sizing and installation of the desiccant drier and breather (3.1.4)
    - Supply and installation of a level probe with local display (Section 3.1.5).
    - Supply and installation of the pipe work (pipework to EN 13480) as marked by the battery limits of Figure 2 and listed in Section 3.1.2.
    - Supply and installation of all mechanical components including valves as demarcated inside Figure 2 of the battery limits and listed in Section 3.1.2.

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- Neutralizing the current acid tank system (Section 3.1) the dismantling and safe disposal of the old bulk acid tank (Section 3.1.1.5).
- The project also encompasses civil and structural work that includes reinforced concrete repairs, and corrosion protection of the works and concrete lining (Sections 3.2, 3.3, 3.4, 3.5, 3.6, 3.7 and 3.8).
- The integration of the above-mentioned scope into the sulphuric acid offloading system. The discharge from the new tank will connect to the reciprocating sulfuric acid pumps, enabling sulfuric acid dosing into the CW system.
- The labelling of all newly installed equipment as per Section 3.13 requirements.
- Method statements and design reports as per Section 3.11 in accordance with the requirements of Section 3.12
- The *Contractor* must submit the deliverables for tender phase as outline in Section 3.15 in accordance with the requirements of Section 3.12.
- The *Contractor* shall submit the deliverables for design phase as outline in Section 3.15 in accordance with the requirements of Section 3.12.
-

The scope of the project will be restricted to the red box in Figure 2 as indicated below as well as the level and local display requirement as outlined in Section 3.1.5:

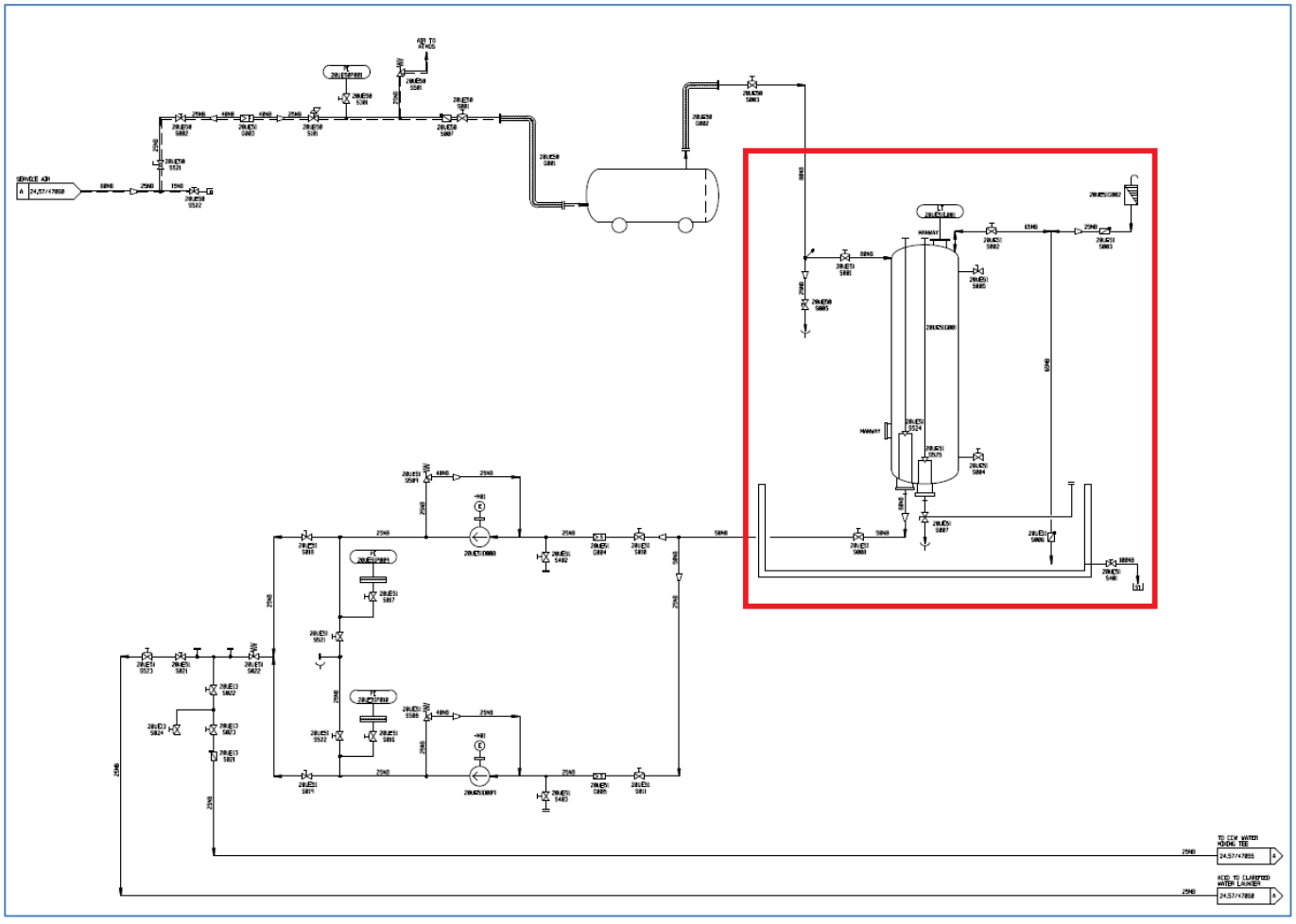

Figure 2 Project boundary as indicated by the red box on 0.57/47052 Rev 1 Sulphuric Acid Storage North (P&ID)

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The *Contractor* is responsible for supplying all the cranages, scaffolding or equipment that will be required to execute the works as outlined in this document. The *Contractor* is responsible to ensure that there is access to the area where the e works will be installed and if any plant is in the way, then the *Contractor* is to safely dismantle and preserve the plant and replace it in the original area with full capabilities in place. The *Contractor* is to safely dismantle and preserve the safety showers currently in place and put them back into place at the conclusion of the project. The *Contractor* is to remove all existing labels and is to supply and install new labels as per P&ID (0.57/47052) and in accordance with Section 3.13 and [19].

All work will be conducted in accordance with the standards and guidelines prescribed in this document. The detailed scope of the North acid dosing plant to be performed by the *Contractor* is as follows:

3.1.1 Preparation works.

The Northern acid dosing plant has not been in operation for many years. However, the tank will have to be neutralized of any possible remaining acid to ensure that the tank can safely be dismantled and disposed of. The safety shower currently in place is to be safely removed and reinstated in its current working condition before the end of the project to ease access.

3.1.1.1 Preliminary Preparation and Safety Measures

- **Safety Planning**: Conduct a safety briefing with all personnel involved in the operation. Review the Safety Data Sheet (SDS) for 98% sulphuric acid and the neutralizing agent to understand potential hazards.
- **PPE**: Ensure that all personnel are equipped with the appropriate personal protective equipment (PPE), including acid-resistant clothing, gloves, boots, goggles, and face shields. Respiratory protection may also be needed depending on ventilation and potential vapor exposure.
- **Limited access register (LAR):** Ensure that the *Contractor* signs the LAR at the beginning of work as well as the end of work as in accordance with the *Employers'* operating procedures.
- **Permit to work:** The *Contractor* is to ensure that a permit to work is taken in place in accordance with the *Employers'* procedures.
- ***Employers'* Life Savings Rules:** Adhere to the following rules:
    - Open, isolate, test, earth, bond/or insulate before touching any equipment.
    - Hook up at heights
    - Buckle up when driving in any vehicle
    - Be sober at all times during work
    - Permit to work before any work is started
- **Site Preparation**: Establish a secure perimeter around the work area to prevent unauthorized access. Set up emergency response equipment, including neutralizing agents, spill kits, eyewash stations, and showers.
- **Inform water treatment plant**: Ensure that the site water treatment plant is fully aware when activities are to take place to neutralize the tank as the run-off will go to the sludge sump system from where water treatment plant has to activate the sludge pumps.

3.1.1.2 Neutralization Process

- **Selection of Neutralizing Agent**: Use a base such as Calcium Hydroxide, diluted to an appropriate concentration to safely neutralize sulphuric acid without causing excessive heat generation. *Contractor* to provide a method statement how this will be done and incorporate some of the aspects as below:
- **Application of Neutralizing Agent**:
    - Prepare a diluted solution of the base in water in a separate container.

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- Using a high-pressure (HP) gun or sprayer, carefully apply the neutralizing solution to the internal surfaces of the tank. Begin from the bottom and work upwards to ensure even coverage and avoid splashing.
- Continuously monitor the reaction. Be cautious of any exothermic reactions that may occur, which can cause splattering or release vapours.

- **Neutralization of Bund Wall Area**:
  - Please refer to normative reference [12] this reference and methods must be incorporated in the *Contractor's* method statement. .

3.1.1.3 Verification of Neutralization

- **pH Testing**: Collect samples of the liquid residue from inside the tank and the bund wall area. Use pH test strips or a digital pH meter to measure the pH.
  - A neutral pH (around 7) indicates complete neutralization.
  - If the pH is still acidic, continue applying the neutralizing solution until the desired pH is achieved.

3.1.1.4 Rinsing and Drainage

- **Removal:** After confirming neutralization use a pump or vacuum to remove the neutralized acid and dispose of as per the environmental regulations.
- **Rinsing**: Rinse the tank with clean water to remove any remaining residues of neutralized acid and base. Collect and properly dispose of all rinse water, following environmental regulations. For the bund wall area ensure that the standards of [12] and [13] are adhered to.
- **Drainage**: Ensure all neutralized liquids and rinse water are properly drained from the tank and bund wall.

3.1.1.5 Tank Dismantling

- **Inspection**: Conduct a final inspection to ensure all areas are neutralized and safe for dismantling.
- **Dismantling Process**:
  - Begin dismantling the tank using appropriate tools and cutting equipment, ensuring all workers maintain safe distances and use PPE.
  - Start from the top of the tank and work downward in sections to prevent collapse or instability.

3.1.2 Sulphuric Acid Tank

- Remove and dispose of the existing damaged tank from its position including all the supports.
- Design and manufacture the Sulphuric acid bulk tank in accordance with the drawing number 057/21873 Rev1 and 0.57 02649 Rev 5 using the PD5500 standard.
- Transport the new Sulphuric acid bulk tank to Duvha power station.
- Supply all the relevant pipes (to EN13480) that will be installed with the tank.
- Install the Sulphuric tank (20UE51G001) including all the accessories as indicated from drawing number 057/21873 Rev1 that will include:
  - The emergency drain and outlet plug valves:
    - Drain stop plug valves (20UE51S525)
    - Outlet stop plug valves (20UE51S524)
  - Earthing lug
  - Tank insulation and cladding

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- Desiccant breather and vent line (20UE51G002).
- Storage tank breather NRV 25NB (20UE51S003)
- Breather isolation valve 65NB (20UE51S002)
- Level transmitter (20UE51L001)
- Drain line connecting to the drainage system leading to the sludge system.
- Bund wall drain valve 100NB (20UE51S401)
- Storage tank vent drain NRV (20UE51S006)
- Storage tank inlet acid top op valve 80NB (20UE51S001)
- Supply line drain valve 25NB (20UE50S005)
- Storage tank drain valve (20UE51S007)
- Storage tank to reciprocating pumps isolation valve 50NB (20UE51S008)
- Storage tank to reciprocating pump line (20UE51S008)
- Barometric pressure isolation valve (20UE51S004)
- Top overflow valve (20UE51S005)

- Install all the pipe work required for the North acid dosing plant. The boundaries will be the suction of the reciprocating pumps for the acid tank discharge. All of the suction piping including the offloading area will be included.
- Inspect and test for any defect and leaks in accordance with PD 5500.
- Ensure that all valves that are installed have extended spindles to allow the operator to control the valve outside of the bund wall area.
- Commission the new North acid dosing plant. Acid will be provided by the *Employer* for the commissioning to take place.

To manufacture a new tank as per the drawing provided in Appendix A. All work will be conducted in accordance with the standards and guidelines prescribed in this document as well as on the supplied drawing.

Note: The design code for this tank was BS1515 part 1- 1965 new tank will be designed in accordance with PD 5500 and will be designed and manufactured in accordance with SANS 347 and the PER ([3] and [4]) as per *Employer's* design Requirements.

The fabrication includes all the tank's accessories as depicted in the Figure 3 below.

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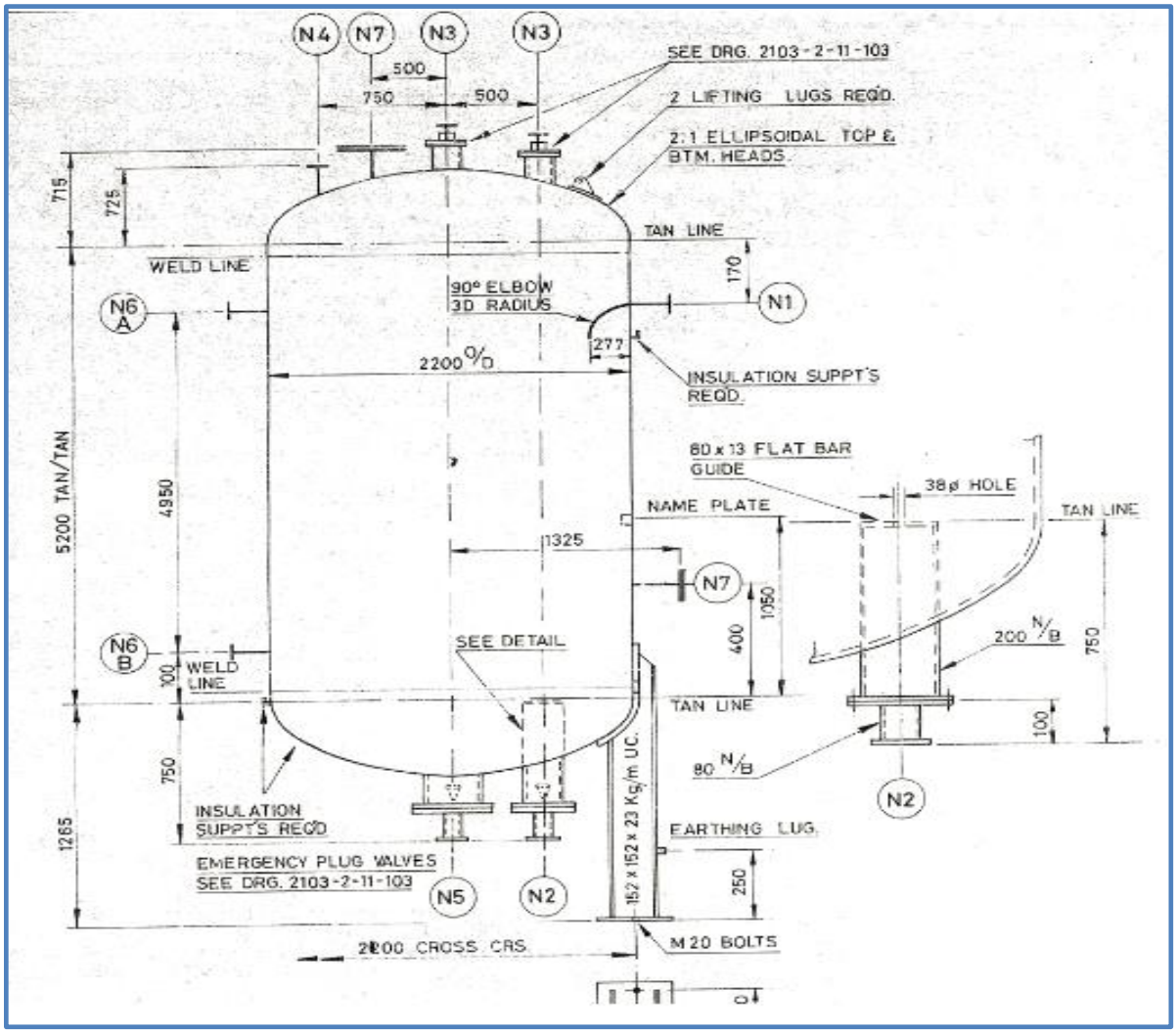

Figure 3 Sulphuric Acid Bulk storage tank

Table 1 Sulphuric acid storage tank design specification as per the drawing any discrepancies picked up by the *Contractor* can be clarified by the *Employer*.

Parameter	Value	Unit
Height (inclusive of supports and top flanges)	7180	mm
Diameter	2220	mm
Design pressure	258	kPa
Test hydraulic pressure	As determined by code	kPa
Test water temperature	>12	°C
Working temperature	ATM	°C
Volume	22	m^3
Design Temperature	50	°C
Design Code	PD 5500	
SANS 347 Hazard category	CAT 1	

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Media	Sulphuric acid 98%

In addition, the following requirements will have to be met for the scope of works:

- The design should assume a specific gravity of the operating liquid at 1.88.
- All non-manhole gaskets should be suitable for exposure to 96 – 98 % sulphuric acid and the *Contractor* is to provide the safety data sheet (SDS).
- Manhole gaskets to be Hypaloned with PTFE.
- The cold formed heads of the tank greater in size than 3/8 thick are to be stress relieved before they are to be welded to the shell.
- All couplings socket welds that are to be attached to the tank will have to make use of full penetration welds.
- All flanges are to make use of EN 1092.
- All manholes are to be provided with a davit.
- One transit gasket for each flange is to be provided with at minimum three gaskets supplied in addition for spares.
- The tank is to be tested with a hydraulic test in accordance with PD5500 standard.
- The *Contractor* will be responsible for removing and scrapping away the old storage tank in accordance with the Duvha Waste management procedure.
- An overflow pipe will be connected to the breather connection that will discharge into the bund wall area.
- All structural steel elements shall adhere to GE/MAT/24/089 Duvha P/S Corrosion Specification of Acid Bund Structural Steel Elements.
- A desiccant dryer and breather will be made available on the tank design to slow down corrosion on the sulphuric acid tank in accordance with the requirements of Section 3.1.4.

The tank should be manufactured with the following corrosion allowance:

- **Shell**: 3 mm
- **Head**: 3 mm
- **Internals**: 6 mm

The materials to be used with the tank are to be as follows:

- **Shell:** EN 10028 P265GH or similar approved
- **Heads:** EN 10028 P265GH or similar approved
- **Forgings:** EN 10222 P245GH
- **Piping:** EN 10216
- **Gaskets:** No material is to be used that makes use of asbestos.
- **Internals:** BEN10028 P265GH or EN10216 P265GH as applicable to product form
- **Corrosion protection:** All structural steel elements shall adhere to GE/MAT/24/089 Duvha P/S Corrosion Specification of Acid Bund Structural Steel Elements.

Additional vessel requirements:

- The tank should be painted with an applicable corrosion protection on the outside of the vessel to ensure that no corrosion from the outside is to take place. This will be in line with GE/MAT/24/089 Duvha P/S Corrosion Specification of Acid Bund Structural Steel Elements.
- Ensure that the colour coding on all of the pipes should adhere to 240-145581571 Standard for the Identification of the Contents of Pipelines and Vessels. Earthing lug is to be added to the supports and properly grounded.
- Ellipsoidal lifting lugs should be made available on the top and bottom vessel heads.
- Vessel will comply to PER and SANS 347 requirements. Minimum a Module B as per Table 2 in SANS347.

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- *Contractor* will have ISO 3834-part 2 certification.
- All welds are to be 100% X-ray inspected.

The name plate will have the following information and should be at a convenient level to ease reading and in compliance to Regulation 9 of the PER [3] and the Employer's standard [19].

3.1.3 Sulphuric acid tank plug valves

The tank will require both an outlet plug valve for the tanks as well as an emergency drain plug valve. The plug valves should be fit for sulphuric acid tank service and the plug be selected suitable for Sulphuric acid service – safety data sheet (SDS) and data sheets to be supplied. The leak test that will be conducted on the tank will be done with all of the plug valves in the closed position. The plug valve handwheel should be removable from the driving spindle to allow maintenance to take place. The plug valve at the top should have a housing with gland packing. This will allow the handle of the plug valve spindle that is covered with acid to not be released to the environment. In addition, the plug valves spindles will be lockable. No lead is to be used for any of the works.

3.1.4 Desiccant dryer and breather

Sulphuric acid is hydroscopic and as such it will absorb moisture from the air that can dilute the concentration of the sulphuric acid. Once it is diluted the ionization potential of the acid increases which increases the corrosiveness of the fluid. Hence a desiccant dryer needs to be added to the top of the tank's vent line to absorb any moisture that is present in the tank as well as to absorb moisture of any air that enters the tank. The proposed desiccant dryer should consider:

- The desiccant chamber and associated piping must be made from materials resistant to sulphuric acid vapours.
- The housing should be such that the removal of spent desiccant should not risk the operator directly to the sulphuric acid.
- An air release valve to equalize pressure build up will be made available on the top of the desiccant dryer.
- The desiccant bed inside of the dryer should make use of perforated trays to ensure that airflow is not restricted once the desiccant material starts absorbing moisture and consequently moves.
- The desiccant chamber should make use of an isolation valves to ensure that when desiccant is changed out air ingress into the tank is minimized and the operator is not exposed to acid tank fumes.
- An inlet and outlet flange leading to the desiccant dryer will be made available on the top of the tank.

3.1.5 Level indication

The hydrostatic level measurement system will be used to measure the level of sulphuric acid in the bulk storage tank by detecting the pressure exerted by the liquid column. The system will include pressure transmitters installed at the lower flange to measure the hydrostatic pressure.

Alarm or light that indicates to the operator that when the level reach 100% during topping up of the tank or when the level is reduced to below 15%.

3.1.5.1 Pressure Transmitter Specifications

The currently installed pressure transmitter is a Hartman & Braun AMD220 pressure transmitter. ABB. acquired Hartman & Braun. For standardisation purposes, a like for like replacement pressure transmitter

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must be supplied, installed and commissioned. Below are the minimum specifications of the pressure transmitter:

- **Type**: Hydrostatic Pressure Transmitter
- **Range**: 0-1.6 bar
- **Output**: 4-20 mA analog signal.
- **Interface with the WTP DCS**: The pressure transmitter must be interface with the WTP via the remote I/O cubicle 20KP01. There is existing cable that interfaces the currently installed pressure transmitter. The *Contractor* must assess the condition of the currently installed cable and if it in good condition it shall be used otherwise, a new cable must be supplied and installed to interface the new pressure transmitter with the DCS via 20KP01 remote I/O cubicle. A new cable must comply with the Eskom Standard: Requirements for control and power cables for power station 240-56227443.
- **Accuracy**: ±0.1% of full scale.
- **Materials**: All wetted parts of the pressure transmitter must be made of corrosion-resistant materials, such as Hastelloy C, Tantalum, or PTFE-lined components, to withstand exposure to 98% sulphuric acid.
- **Ingress Protection**: Minimum IP65, with higher levels (e.g., IP67 or IP68) recommended for outdoor installations or in harsh environments.
- **Temperature Range**: -40°C to +85°C operating range to account for potential temperature variations at the tank location.

3.1.5.2 Flange Connections

The lower and upper pressure transmitter connection flanges should make use of EN 1092. The gasket material should be made of PTFE, Viton, or EPDM to ensure chemical compatibility with sulphuric acid.

3.1.5.3 Signal Transmission

- **Wiring**: Shielded cables rated for hazardous environments (chemical-resistant insulation). The cable length should account for the distance between the sensor and the control system.
- **Conduit**: Use of acid-resistant conduit to protect cables is recommended.

3.1.5.4 Display and Control Unit

It will be required that a local display panel be available outside of the bund area to assist the local operator in receiving a level indication on the sulphuric acid within the tank. The following will be required from the local display unit:

- **Type:** Electronic display unit capable of receiving a 4-20 mA signal from the hydrostatic pressure sensor
- Display**:** LCD or LED display showing the tank level in meters, litres, or percentage of full capacity. The display should be configurable to show the level based on the liquid height (converted from the pressure signal).
- **Resolution:** At least 0.01 meters (1 cm) or 0.1% of tank volume.
- **Power Supply**: 24 VDC or 230 VAC, depending on what is locally available at the installation point.
- **Enclosure:**
  - **Material**: Corrosion-resistant housing, preferably stainless steel or polycarbonate.
  - **Ingress Protection**: Minimum IP65 for outdoor use or in environments where moisture and dust may be present.

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  - **Mounting**: Wall or panel mounted near the tank but outside of the bund wall area so that it is convenient for operators to access.
- **Alarm Indication**: Built-in high and low-level alarms that trigger visual indicators or a buzzer when critical tank levels are reached (when the tank is full or approaching empty).
- **Backlighting**: Adjustable backlight for clear visibility in low-light conditions.
- **User Calibration**: The display should allow for easy calibration based on the tank's maximum and minimum levels. Calibration should be adjustable via front-panel buttons or a simple menu interface.
- **Zero and Span Adjustment**: The unit should allow for zero and span calibration based on the minimum and maximum pressure signals from the sensor (setting 4 mA to 0% level and 20 mA to 100% level).
- **Operating Temperature Range**: -20°C to +60°C to accommodate various site conditions.
- **Humidity Tolerance**: Suitable for environments with up to 95% relative humidity, non-condensing
- **Surge Protection**: Protection against electrical surges or transients that could damage the display or sensor input.
- **EMI/RFI Protection**: Shielding to prevent interference from external electromagnetic or radio frequency sources.
- **Signal Type**: The electronic display will receive a 4-20 mA analog signal from the hydrostatic pressure sensor.
- **Wiring**: Shielded cable between the hydrostatic sensor and the display unit to prevent electrical noise. Wiring should be run in acid-resistant conduit for protection in environments exposed to sulphuric acid fumes.
- **Connector**: Ensure compatible connectors between the pressure sensor and the local display, with IP-rated junction boxes for protection if needed.
- **Battery Backup**: If the site is prone to power outages, consider a display with battery backup for uninterrupted level monitoring.

3.1.6 4. Calibration and Setup

It will be the responsibility of the *Contractor* to ensure that the calibration of the level transmitters is done correctly, and it will be required that the *Contractor* test the accuracy of the transmitters during the commissioning phase of the contract:

- **Initial Setup:** Before installation, ensure the pressure transmitter is calibrated to the correct density of the liquid. For 98% sulphuric acid, the density should be set to around 1830 kg/m³.
- **Zero Calibration:** Once installed at the lower flange, perform a zero-point calibration by ensuring the transmitter is reading 0 m when the tank is empty (or as close to empty as possible).
- **Span Calibration:** Use a known liquid level or manual measurement of the sulphuric acid to set the full span for the height of the tank.
- **Pressure-to-Level Conversion:** Program the control system or the transmitter to convert pressure readings into level readings based on the density of sulphuric acid.

3.1.7 Bund wall valves

All valves that are to be situated in the bund wall area should be resistant to sulphuric acid. All valves will have an extended handwheel spindle supported by a bearing attached to the bund wall to allow the operator to operate the valve from outside the bund wall without compromising the safety of the operator. Specification sheets to be provided with tender indicating suitability of valve for applications involving Sulphuric acids (on concentrations lower than 98%). The requirement is posed due to the potential for dilution of Sulphuric acid in the bund wall area.

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3.2 CIVIL AND STRUCTURES SCOPE OF WORK

The access platforms for the tank and bund access as well as the offloading access platform requires refurbishment for the structural steel frame and replacement of gratings. Concrete repair, structural steel and corrosion protection works shall be carried out to reinstate the plant to good conditions. Care should be taken to adhere to GE/MAT/24/088 and GE/MAT/24/089 standards (references [12] and [13]).

3.2.1 Steel structures works (Access Platforms)

Refer to Drawing 0.57/19886 for access platforms:

- Remove the access platforms structure from position.
- Prepare and sandblast the steel structures.
- Comply to the specification as outlined in GE/MAT/24/089 standard for Structural Steel Elements.
- All fasteners shall be replaced with new ones of the same specification.
- Conduct NDTs (Magnetic Particle testing) on the welds connections and repair any defect found.
- NDTs shall be conducted as per 240-83539994 - Standard for Non-Destructive Testing (NDT) on Eskom Plant
- Welding shall be conducted as per 240-106628253 Standard for Welding Requirements on Eskom Plant
- Supply, assemble, erect, and install the refurbished structural steel.
- Installation shall be done after the tank new tank has been installed in position.
- Supply and installed new gratings of the same specification.

3.2.2 Reinforced concrete Bund (including Concrete plinths, catch pit, offloading bay and concrete manholes)

Refer to drawings 0.57/32568, 0.57/19885 and 0.57/32569 for reinforced concrete bund:

- Remove all attachments from the bund.
- Break and remove the tank concrete plinths rubble.
- Conduct rebound hammer test on the entire area and mark out all areas for repair.
- Saw cut the damaged concrete slab of (estimated depth of 440mm). Break and remove all concrete rubbles from the area including catch pit and concrete manhole outside the bund.
- Repair concrete with fresh concrete of compressive strength of 30MPa/19mm aggregate.
- Should it be found the contamination goes beyond the concrete floor to the layer works underneath the following activities shall be done:
    - Entirely remove the concrete floor slab
    - Remove reinforcement steel
    - Ensure the linking reinforcement steel bars between the bund wall and the floor are exposed and removed carefully during the removal of the floor slab
    - Clean the linking reinforcement bars with wire brush, ensure all dirt is removed
    - Excavate the contaminated soil inside the bund

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- Clean and remove the old acid lining on the concrete bund walls
- The rubble to be disposed into a designated skip. Due to waste being hazardous, the hazardous waste disposal process shall be followed.
- Supply gravel material (G5) and compact it in layers of 150mm to 98% Mod AASTHO at 2% moisture content to complete terrace.
- Supply and cast blinding of 50mm thick using 15mpa concrete.
- Supply and lay one layer of 500 µm (0,5 mm) polyolefin waterproof sheeting that complies with SANS 952 type C.. The water proofing sheeting shall be placed between the blinding and the topsoil layer work
- Supply and install reinforcement steel bars as well as mesh wire for the tank foundation slab, bund slab, collecting sump and for tank plinths, see reinforcement details on the drawings mentioned in this section.
- The new reinforcement steel shall be spliced with the existing reinforced steel on the bund walls
- Supply and apply a cement-based epoxy anti-corrosion bonding agent to the affected surface to ensure proper adhesion between the old and new concrete (see specification on section 3.8).
- Supply and cast fresh concrete for the tank foundation, floor slab, collecting sump as well as the tank plinths.

- Concrete of compressive strength of 30MPa/19mm aggregate.
- Concrete cover shall be 50mm
- Supply and apply a cement-based epoxy anti-corrosion bonding agent to the affected surface to ensure proper adhesion between the old and new concrete (see specification on section 3.8).
- Repair all damaged surface area using polymer modified cement mortar. Patch the area, layer of up to 40mm-70mm should be applied to match the existing level (see specification on section 3.7)
- The walls shall be thoroughly cleaned before repairs are conducted
- Supply and install a lining system as per GE/MAT/24/088: Duvha P/S Corrosion Specification for Acid Proofing of Sulphuric Acid Bund
- Supply and install catchpit covers as per grating specification on section 3.6

3.2.3 Drainage pipeline

The drainage pipe collects spillage from the acid offloading bay and the acid tank bund area. The pipe is buried beneath the concrete floor slab at for the offloading and the concrete bund floor slab. The depth of the invert level varies along the long section of the pipe as shown in drawing 0.57/19885. The pipeline is a 100mm diameter (durapipe) high-density, heat-treated polyethylene pipe, The following activities shall be executed for the drainage pipeline.

- Pressure clean to remove dirt, mud and other debris. The flushing of the pipeline shall be conducted from the offloading bay up to the discharge point at sludge launder.
- Conduct a camera inspection for the full length of the pipeline to determine the condition and integrity of the pipe. Provide a report together with the video to the client
- Camera inspection shall be carried out before the repairs of the bund concrete slab is carried out
- Should the pipe be found to be damaged the following works shall be carried out.

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- Scan the area for underground services detection present within the pipe route
- Remove the pavement bricks on the pipe route
- Excavate the damage section of the pipe for manhole to manhole or connection point.
- Remove the damaged section of the drainage pipe
- Supply bedding from commercial sources and lay as per SANS 1200
- Supply and install a new pipe section, the fall for pipe slope shall be maintained as per invert levels shown on the drawing mentioned in this section.
- The new pipe shall be of the same material or with similar properties.
- Backfill material using stockpiled material, compact to 95% Mod AASTHO at 2% moisture content to complete terrace
- Reinstate the pavement bricks and make good.

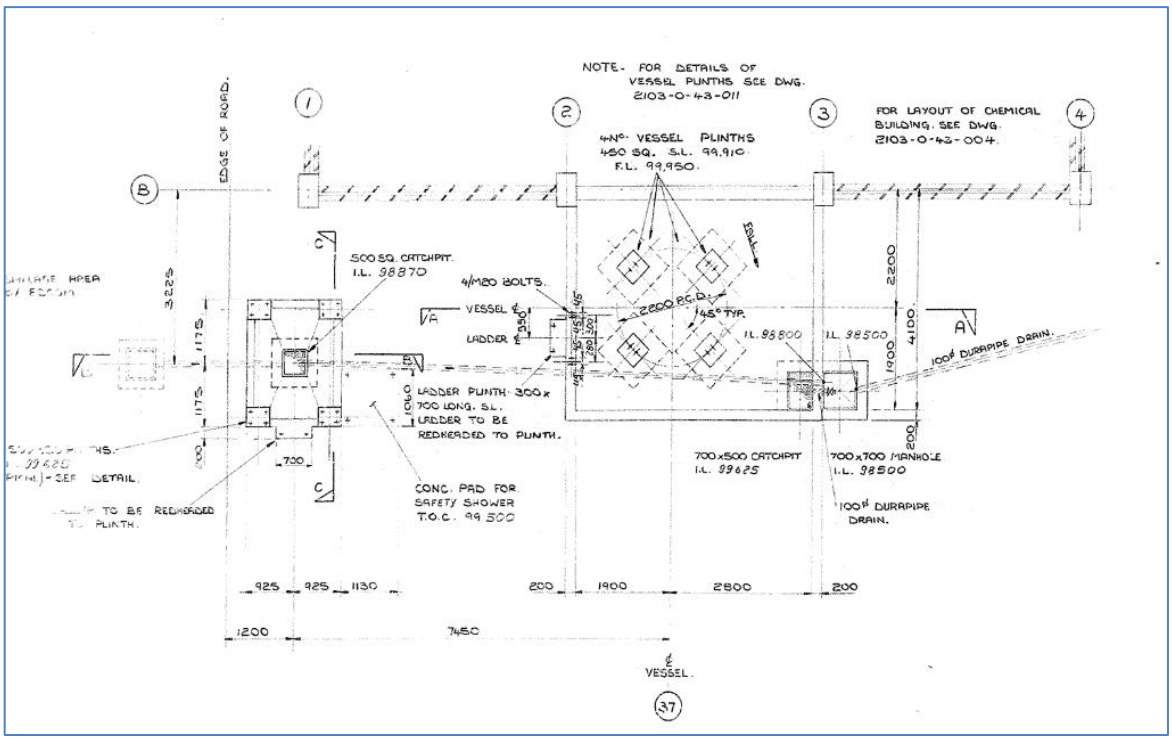

Figure 4: Showing the layout of the North WTP offloading area as well as the bund area. The height of the bund wall is 1575 mm.

3.2.4 Sludge Launder repair works

- Open the trench covers to gain access to the launder
- Conduct rebound hammer test on the entire area and mark out all areas for repair
- Saw cut, break and remove damaged section of approximately 40mm to 70mm of the identified areas on the concrete wall and floor to expose reinforcement steel
- Remove all loose aggregate and concrete particles, all rubbles to be dumped on a designated skip which will be provided through the PM
- Clean the concrete surface area using pressure wet cleaning method.

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- Supply and apply a cement-based epoxy anti-corrosion bonding agent to the affected surface to ensure proper adhesion between the old and new concrete (see specification on section 3.8).
- Repair all damaged surface area using polymer modified cement mortar. Patch the area, layer of up to 40mm-70mm should be applied to match the existing level (see specification on section 3.7)
- Reinstate a channel semi-circular floor using 30 MPa with 19mm stone aggregate concrete in the all-launder channel. Formwork will be required for proper shaping of channel benching.
- Remove all damaged sealing joint identified during the inspection and reinstate sealing joint (see sealing joint specification on section 3.9)
- Supply and install Sulphuric resistant Portland cement with acid resistant protective coating on the concrete floors as well as the walls.

3.3 CONCRETE SPECIFICATION

Concrete should have adequate flexural strength and good dimensional stability. The concrete should be placed, compacted, and finished to acceptable dimensional tolerances and surface texture.

General requirements

Materials for the concrete are covered by SANS 10100-2,

- Cement shall comply with the requirements of SANS 50197-1 of cement 42,5N or 52,5N. Superplasticiser type CHRYSO Fluid L or similar shall be used to improve workability of the concrete ONLY if necessary. Superplasticiser shall be the chloride free type.
- Aggregates shall comply with the requirements of SANS 1083.

NOTE: In certain conditions, additional tests might be necessary to determine the suitability of aggregates (see SANS 1083)

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Admixtures

- Please Note: Admixtures shall ONLY be used with the approval of the Engineer.
- Admixtures shall be chloride free.

Concrete mix proportioning

General

Ready mix concrete 15Mpa for blinding and 30Mpa shall be used for this application. The *Contractor* shall provide a mix design to the Engineer. No placing of concrete shall commence without the prior approval of the mix design.

Proportioning

The concrete mix should be proportioned to try and provide a smooth and as continuous an overall grading as possible. Where more than one size of coarse aggregate is used, the sizes should be chosen to avoid particle interference between the two sizes.

Fresh concrete

- The concrete should be designed to ensure adequate consistence as measured by the slump test (see SANS 5862-1). Suitable slumps are in the range of 75 mm to 120 mm depending on the equipment to be used.

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- The concrete should be cohesive enough to ensure complete compaction and to avoid segregation. This can be assessed by tapping the base plate in the slump test after the slump has been determined. A cohesive mix should settle gradually without the concrete falling apart.
- The bleeding of the fresh concrete should be minimized as excessive bleeding can result in zones of weakness when trapped below aggregate particles and reinforcing steel and also interfere with finishing operations. Care shall be taken not to reduce bleeding too much as this will significantly increase the risk of plastic shrinkage cracking.
- The effect of admixtures, when used, on setting and bleeding should be assessed.
- The amount of paste on the surface after compaction should be assessed in the laboratory. Too little paste could result in difficulty in finishing the surface and disturbance of the coarse aggregate near the surface. Too much paste could result in durability problems such as dusting and crazing of the surface area.
- Concrete should be thoroughly compacted in terms of SANS 10100 /2 by using suitable concrete vibrators.
- Damp curing of the topping should start immediately after surface finishing by covering the patch with polyurethane or damp hessian. Damp curing should be maintained for at least 3 days
- The construction area is to be barricaded for at least 3 days.

Finishes:
Finishes shall be a smooth finish.

Hardened concrete
The 28-d compressive strength for concrete should be as specified on section 6.1 of the scope of work.

Quality Control
All work is carried out under the supervision of an experienced supervisor. The *Contractor* complies with the *Employer's* Supplier Quality Management: Specification as specified in Eskom Generation Standard QM58 (240-105658000 - Supplier's contract quality requirements specification Supplier Quality Management: Specification). All quality control documentation is submitted to the Project Manager within 7 days of Contract date. Quality Control:

- The *Contractor* to provide a Quality Control Plan to Eskom Duvha for approval prior to construction. The *Contractor* shall also assure that the following quality control documentation are available during construction and are submitted to the *Employer* on completion.
- Ready Mix Concrete delivery note (if ready mix concrete will be used)
- QCP plan with signed off witness and hold points by the *Employer's* Engineer.
- Slump test to be done in terms of SANS 5862-1
- Cube Testing in terms of SANS 5860, SANS 5860 – 2&3:
- Cube test samples to be taken and tested by an approved laboratory which will be agreed upon prior to execution of work
- Testing of cubes shall be done on 7 and 14 as well as 28 days.

Formwork
All formwork to be provided with a smooth finish

3.4 CORROSION PROTECTION REQUIREMENT FOR STRUCTURAL STEEL WORK

The *Contractor* is to follow Eskom's GE/MAT/24/089 – Duvha P/S Corrosion Specification of Acid Bund Structural Steel Elements standard.

3.4.1 Steel structures material specification

- All structural steelwork is manufactured using grade S355JR steel

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- Structural fasteners are of the following grades and types:
  - "All structural bolts and holding down bolts are of class 8.8 and nuts are of class 8
- The chemical composition and mechanical properties of all steel incorporated into structures is stated in the mill test certificates and submitted to the *Project Manager* for acceptance
- Where required and prior to fabrication, test certificates or cast analysis certificates, or both, pertaining to the steel to be used, are supplied to the *Supervisor* by the *Contractor*
- Fabrication drawings are prepared by the *Contractor*. The drawings are issued to the *Project Manager* for acceptance in the form of two paper prints and in "PDF" electronic format and in Native Format (dgn or dwg). The *Contractor* does not commence with fabrication until written acceptance from the *Project Manager* is received
- The *Contractor* is to have sufficient capacity and equipment for handling of the steelwork so that it can be placed in its final position without distortion or undue stressing of members.
- Welds to comply with 240-106628253: Standard for Welding Requirements on Eskom Plant

3.5 GRATING SPECIFICATIONS

- Grating sizes to be RS40: 25 x 4.5
- Gratings to be hot dipped galvanised for corrosion protection
- Gratings to be secured to the platform structure using galvanised clips
- Fabrication shall be in accordance with SANS 1200H

3.5.1 Handrails specifications

- Stanchions to be fixed on the kick plates by means of bolts or welding depending on the existing connection onsite
- Handrail height to be 1000mm from the floor level
- Knee rail to be 500mm from the floor level
- Spacing from centre to centre for stanchions shall maintain existing on site
- Colour Specification for Handrails and Structural Steel:
  - **Handrails and Horizontal Posts:** All horizontal posts and handrails on the sulfuric acid tank platform must be painted in safety yellow to enhance visibility and comply with safety standards.
  - **Remaining Structural Steel:** All other structural steel components, excluding the yellow-painted handrails and posts, must be painted in matte black to create a distinct contrast and maintain uniformity in appearance.

3.6 POLYMER MODIFIED CEMENT MORTAR

Product Description

The product shall be a high strength, shrinkage compensated, fibre reinforced, rapid set structural repair mortar that includes corrosion inhibitors

Characteristics and Mechanical / Physical Properties

- Easy to use pre-blended product (just add clean water) with superb placing and finishing characteristics.
- Very low permeability protects steel and resists carbonation and chloride attack.
- Excellent high early and initial strengths, with high build allows for efficient application.
- Very good placement and finishing characteristics.

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- Shrinkage compensated – Minimises tendency of repairs to cracks and allow ingress of water and chlorides, especially in harsh environments.
- Protects steel from corrosion with migrating corrosion inhibitors
- Compressive Strengths: ≥75Mp after 28 days (must comply to SANS 50196 – 1)
- E-Modulus: ≥20MPa after 28 days
- Adhesion: ≥2Mpa after 28 days
- Capillary absorption: ≤0.6kg/m²h0.5

3.7 CEMENT-BASED EPOXY ANTI-CORROSION BONDING AGENT

Product Description

Use whenever new concrete or plaster is to be placed over existing concrete or plaster surfaces to ensure a complete bond between the two materials

Characteristics and Mechanical / Physical Properties

- Tensile Adhesion Strength ≥ 1.5 N/mm2 (MPa) (after 28 days)
- Contains corrosion inhibitor
- Certified for application under dynamic load conditions
- Good resistance to water and chloride penetration
- Suitable in concrete repair as corrosion protection for reinforcement.
- Suitable as a bonding primer on concrete and mortar

3.8 SEALING JOINTS

Product Description

Elastic sealant for joints exposed to chemicals

Characteristics and Mechanical / Physical Properties as per GE/MAT/24/088

- Secant Tensile Modulus: 0.60 N/mm2 approx. at 100% elongation (23 °C) (ISO 8339) and 1.10 N/mm2 approx. at 100% elongation (−20 °C)
- Tear Propagation Resistance; ≥ 5.0 N/mm approx.
- Chemical Base: Polyurethane
- The joint width must be designed to suit the joint movement required and the movement capability of the sealant. The joint width shall be > 10 mm and < 35 mm. A width to depth ratio of 1:0.8 must be maintained (for exceptions, see table below)

3.9 WELDING REQUIREMENTS

- All welding activities shall be in-line with the *Standard for Welding Requirements on Eskom Plant*, doc. no.: 240-106628253.
- Welding procedure qualification for welds shall be in accordance with the appropriate welding standard incorporated into the relevant design and construction code. Combination or mixing of different codes shall not be permitted.

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- A WPS supported by a valid WPQR/PQR, approved by a registered IWE or IWT, shall be submitted to Eskom for review.
- Welders and welding operators shall be qualified in accordance with the requirements of the latest applicable construction code or engineering specification relevant to the plant.
- NDT on welds shall be performed according to the requirements of the relevant design and construction codes, applicable (additional) engineering or product specifications and Eskom standard 240-83539994.
- Company to perform welding shall have accreditation to ISO 3834 Part 2 as minimum (for Eskom Level 1 plant). The ISO 3834-2 Certificate shall have as a minimum accreditation to the following codes: BS EN ISO 13445, PD5500 and ASME 8 applicable to pressure vessels.
- Records pertaining to the repairs or modifications shall be compiled as per the requirements of QM 58 (240-105658000 - Supplier Quality Management: Specification).
- 240-56241933 – Control of Plant Construction, Repair and Maintenance Welding Activities
- 240-83539994 - Eskom NDT Personnel Approval (NPA) for Quality Related Special Processes on Eskom Plant Standard

- All welding taking place off site is witnessed and approved by the *Contractor's* Approved Inspection Authority (AIA) and communicated to the *Employer's* AIA for approval.

- All welds are to be 100% X-ray inspected.

3.10 QUALITY CONTROL

All work is carried out under the supervision of an experienced supervisor. The *Contractor* complies with the *Employer's* Quality Requirements as specified in Eskom Generation Standard QM-58 ([5]). All quality control documentation is to be submitted and should adhere the Level 2 plant equipment as per the QM-58 standard. In addition the standard the *Contractor* is required to:

- The *Contractor* to provide a Quality Control Plan to the *Employer's* Duvha Engineering department for approval prior to commencement with the works. The *Contractor* shall also assure that the following quality control documentation are available during the work and are submitted to the *Employer* on completion:
    - The QCP must align with key required point from PD 5500 standard including
        - NDT inspection reports done during manufacturing
        - Material certificates for the plates, flanges, consumables,
        - Welder qualifications, WPQR and WPS
    - Report indicating design in accordance with PD5500 and referencing drawings.
    - QCP plan with signed off witness and hold points by the *Employers'* Engineer and Eskom's AIA.

All Welding in accordance with ISO 3834 Part 2

3.10.1.1 HAZARD AND OPERABILITY STUDY (HAZOP)

The *Contractor* shall carry out formal HAZOP studies for the purpose of identifying potential hazards and operability problems. The HAZOP analysis shall be used to evaluate the design for possible flaws or undesirable effects and interactions within the *Contractors* designs. These studies shall be done in accordance with HAZOP Guideline [26].

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3.11 CONTRACTOR'S DESIGN

The *Contractor* to design and manufacture the sulphuric acid bulk tank in accordance with the drawing number 057/21873 Rev1 and 0.57 02649 Rev 5 unless otherwise specified in the document as the PD5500, PER and SANS requirements. No asbestos and lead are to be used in the execution of the works.

The *Contractor* to provide the method statement for:

- The design, manufacturing, transporting, installation of the new sulphuric acid storage tank.
- The calculation report detailing the assumptions and calculations in line with PD 5500 for the tank design.
- The civil repairs to be conducted based on the assessment done and accepted by the *Employer's* civil engineers.
- The *Contractor* is also to provide a method statement for the neutralization and disposal of the old sulphuric acid tank.
- The *Contractor* is to provide a commissioning method statement prior to the planned date of commissioning to the *Employer* for review and acceptance. The method statement will be submitted to the *Employer* with sufficient time prior to the planned commissioning date to allow the *Employer's* engineers adequate time to review.
    - The *Contractor* is required to provide a new mechanical drawing for the tank, valves, piping and structures including all plant specifications. The *Contractor* is to provide a list of critical spares for the works and as well as the first set of critical spares.

3.12 DOCUMENT MANAGEMENT

All documents supplied by the *Contractor* shall be subject to *Employer's* approval. The language of all documentation shall be in English. All documentation shall be controlled and managed in accordance with Document and Records Management Procedure (32-6).

3.12.1 Document Identification

The *Contractor* is required to submit the Vendor Document Submission Schedule (VDSS) as per agreed dates to the delegated *Employer's* Representative. The *Employer* will pre-allocate document numbers on the VDSS and send back to the *Contractor* through the delegated *Employer* Representative. The VDSS is revisable, and changes must be discussed and agreed upon by all parties. Changes in the VDSS can be additional documentation to be submitted, changes in submission dates or corrections in documentation descriptions, document numbers, etc. The *Contractor's* VDSS shall indicate the format of documents to be submitted.

3.12.2 Document Submission

All project documents must be submitted to the delegated *Employer* Representative with transmittal note. In order to portray a consistent image, it is important that all documents used within the project follow the same standards of layout, style and formatting as described in the Work Instruction. The *Contractor* is required to submit documents as electronic and hard copies and both copies must be delivered to the *Employer* Representative with a transmittal note.

In addition, the *Contractor* shall be provided with the following standards which must be adhered to:

- Project Plant Specific Technical Documents - Handover Works Instruction 240-124341168
- Technical Documentation Classification and Designation Standard 240-54179170 [7.].
- Project/ Plant Specific Technical Documents and Records Management Work Instruction 240-76992014

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3.12.2.1 Electronic Submission

Electronic submissions shall be done using the ZendTo Larger File Transmittal Site functionality and route. The submission we use the following link can be used https://zendto.eskom.co.za/

3.12.2.2 Emails and other submission methods

Where applicable and contractually agreed, e-mail submissions can be used, as well as other submission methods employed in the relevant project e.g. Box; Norman Secure, etc.

3.12.3 Project Engineering Change Management

All Design change management shall be performed in accordance with the latest revision of the Eskom Project Engineering Change Management Procedure (240-53114026) and the *Employer* shall ensure that Contractor is provided with latest revisions of this procedure. Any uncertainty regarding this procedure should be clarified with the *Employer*. All design reviews will be conducted according to the Design Review Procedure (240-53113685).

3.12.4 DRAWINGS FORMAT AND LAYOUT

The creation, issuing and control of all Engineering Drawings will be in accordance with the latest revision of engineering drawing Standard 240-86973501. Drawings issued to the *Employer* will be a minimum of one hardcopy, a PDF file and an electronic editable copy (.DGN). All Contractors are required to submit electronic drawings in Micro Station (DGN) format, and scanned drawings in pdf format. No drawings in TIFF, AUTOCAD or any other electronic format will be accepted. Drawings issued to the *Employer* may not be “Right Protected” or encrypted. The *Employer* reserves the right to use these drawings to meet other contractual obligations. The Contractor shall include the *Employer’s* drawing number in the drawing title block. Drawing numbers will be assigned by the *Employer* as drawings are developed.

3.13 PLANT CODING AND LABELLING

3.13.1 Plant Coding

Coding of the design shall be based on the latest revision of Station AKZ Coding Standard and the *Employer* shall undertake the coding in line with its standards. The AKZ coding shall be applied during the design review stage(s) and cross referenced to all arrangement drawings, schematics, instructions and manuals and where practical to spare parts list/manuals. The *Contractor* shall be required to include allocated coding to the electronic design drawings.

Plant Coding shall be undertaken by the *Employer* and as such the *Contractor* shall make available the following documentation to code:

1 **Mechanical**

- Piping and Instrumentation Diagrams (P&IDs)
- interface list
- process flow diagrams (PFDs)

2 **Electrical**

- single line diagrams
- electrical board general arrangements (GA)
- cable schedule

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3 C&I

- C&I architecture drawings
- C&I Cubicle GA
- cable block diagrams
- remote control station lists
- cable schedules

4 Civil

- site layouts
- building layouts
- building sectional layouts
- building floor plans per level
- underground services layouts
- cable rack & support
- building lists (including room equipment lists)

Employer will only code the AKZ code defining Documentation listed above. The *Employer* will assign a coding technician who will interact with the *Contractor* in coding the plant as listed above. The *Contractor* will then be required to include allocated codes to all other designs and related documentation. It is also the responsibility of the *Contractor* to consistently apply the AKZ codes throughout the rest of the technical documentation which shall include, but not limited to:

- load schedules
- board parts lists
- cable block diagram
- termination diagram
- drive & actuator schedules
- instrument schedules
- alarm lists, loop diagrams
- signal lists
- schematic diagrams
- termination diagrams
- logic diagrams, etc.

The *Contractor* shall ensure that all documentation is coded (as per the codes assigned by the technician) prior submission to *Employer* for review.

3.13.2 Plant Labelling

The Contractor shall also manufacture and install AKZ labels to the new installed system. Labels shall be manufactured and installed according to the *Employer's* Plant Labelling Standard 240-71432150. The

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labelling standard shall be supplied as part of the enquiry documents. Contractor shall provide a label sample to be inspected and provided prior to bulk manufacturing of labels.

3.14 CONFIRGURATION MANAGEMENT STANDARDS

[1.] 240-53114002 Engineering Change Management Procedure
[2.] 240-109607332 Eskom Plant Labelling Abbreviation Standard
[3.] 240-71432150 Plant Labelling Standard
[4.] 240-53113685 Design Review Procedure
[5.] 240-86973501 Engineering Drawing Standard
[6.] 32-6 Document and Records Management Procedure
[7.] 240-54179170 Technical Documentation Classification and Designation Standard
[8.] 240-65459834 Project Documentation Deliverable Requirement Specification
[9.] 240-53114026 Project Engineering Change Management Procedure
[10.] 240-76992014 Project/Plant Specific Technical Documents and Records Management Work Instruction

3.15 DELIVERABLES

3.15.1 Tender phase deliverables:

- **Project Execution Plan:**
  - A detailed methodology for the project, covering steps from decommissioning and dismantling of the existing tank to installation and commissioning of the new tank. This includes safe disposal of the old tank in compliance with environmental and safety regulations.
- **Personnel and Experience Documentation:**
  - CVs for key personnel, especially the lead Mechanical Design Engineer, demonstrating their qualifications, certifications (such as ECSA registration), and relevant experience with pressure vessel design and PD 5500 compliance.
  - Organizational chart with roles for project management, engineering, welding personnel, and subcontractors.
- **Compliance Documentation:**
  - Evidence of valid ISO 3834 certification for welding standards.
  - Quality assurance/quality control (QA/QC) plans aligned with PD 5500 standards, including welding and inspection standards.
- **Previous Project References:**
  - Completion certificates or reference letters for similar projects, including details such as project scope, client name, description, duration, and contact person. These should specifically reference prior experience with sulphuric acid or similar corrosive environments and compliance with PD 5500 standards.
- **Preliminary Method Statements**
  - Dismantling and safe disposal of the existing tank, with specific safety and environmental controls.
  - Civil works, including bund wall repairs and floor resurfacing.

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- Structural assembly, welding, and installation of the new tank.

3.15.2 Design phase deliverables

- Detailed Design Drawings
  - General arrangement (GA) and fabrication drawings for the tank, bund walls, access platforms, and drainage system.
  - Weld maps specifying weld types, locations, and welding processes.
  - Nozzle schedule, valve locations, and instrumentation layout.
- Design Calculations and Information
  - Complete design calculations in accordance with PD 5500, covering pressure, stress, and support for the tank and associated structures.
  - All plant and material specifications including valves, piping, instrumentation, cabling etc.
- Construction and Assembly Method Statements
  - Installation and welding of the tank and piping.
  - Civil repairs to the bund and surrounding structures.
  - Corrosion protection and painting procedures in compliance with acid-resistant specifications.
- Welding Procedure Specifications (WPS)
  - Detailed WPS for each weld type, including joint preparation, welding processes, filler materials, and pre/post-weld heat treatment as required by PD 5500.
  - Approval of WPS by a certified authority in compliance with PD 5500 and ISO 3834-2.
- Welder Qualifications (WPQR)
  - Qualification records for welders performing the work, verifying they meet PD 5500 and ISO 3834-2 standards.
  - Documentation for welder certifications specific to project materials and welding processes.
- Non-Destructive Testing (NDT) Plan and Reports
  - NDT plan specifying required testing methods for each weld (e.g., radiographic, ultrasonic, magnetic particle).
  - Inspection reports for each weld, confirming quality and integrity as per PD 5500.
- Quality Control and Inspection Plan
  - Final QA/QC plan covering hold points, welding inspection requirements, and testing, including hydrostatic testing.
  - Collection of welding records, NDT results, material certificates, and final inspection reports.
- Final Bill of Quantities and Material List
  - Updated BoQ, including detailed materials, labour costs, and specific welding materials.
  - Material certificates for acid-resistant materials, welding consumables, and structural elements.
- Testing and Commissioning Plan

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- Detailed plan for testing and commissioning, including acceptance criteria for hydrostatic tests, NDT inspections, and instrumentation calibration.
- Calibration documentation for level indication systems.

- HAZOP Study Report
  - Comprehensive HAZOP analysis covering design, installation, and operational hazards identified during the detailed design phase.
- Documentation and Submission for Approval
  - Finalized VDSS and detailed engineering documentation submission plan.
  - As-built drawings and detailed engineering calculations for final approval.
- Operating and Maintenance Manuals
  - Complete manuals for the tank, valves, and other installed equipment, including maintenance schedules and spare parts lists.
- Handover Package
  - As-built drawings, final inspection certificates, and quality documentation.
  - Complete documentation and training records for the Employer’s operating personnel.

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4. AUTHORISATION

This document has been seen and accepted by:

Name & Surname	Designation
Dheneshree Lalla	Corporate Specialist Chemistry/Process
Justin Varden	Chief Engineer GX Engineering: Chemistry/Process
Sumayyah Sulliman	Chief Engineer GX Engineering: Chemistry/Process
Lethukuthula Ndwandwe	System Engineer: C&I Systems water treatment plant.
Fred Mashiane	Senior Maintenance: C&I Systems outside plant
Vusi Chirwa	Civil Engineer
Herman van Niekerk	Senior Consultant GX Engineering – Mechanical
Keith Northcott	Senior Consultant GX Engineering – Corrosion Protection
Devilliers Moll	Senior Engineer Prof Engineering - Welding sections

5. REVISIONS

Date	Rev.	Compiler	Remarks
November 2022	0	Thabiso Masethe	Draft Document
June 2023	0.1	Thabiso Masethe	Revised to incorporate Civil Scope of work
July 2023	1	Thabiso Masethe	Final document for authorisation
November 2024	2	Jean-Pierre de Villiers	Revise the scope after deficiencies were identified in terms of the acid tank auxiliaries and the requirements of the tank.

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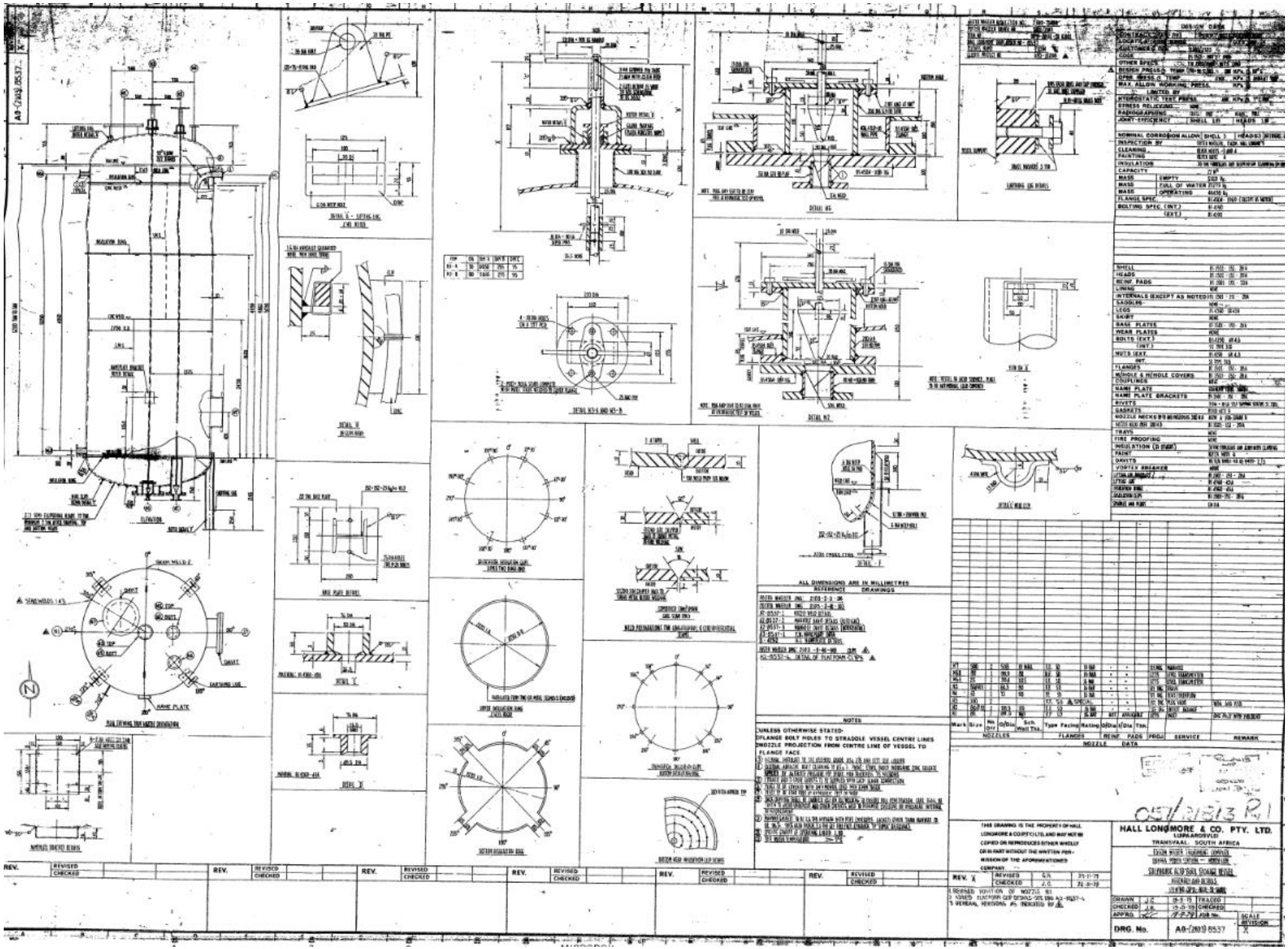
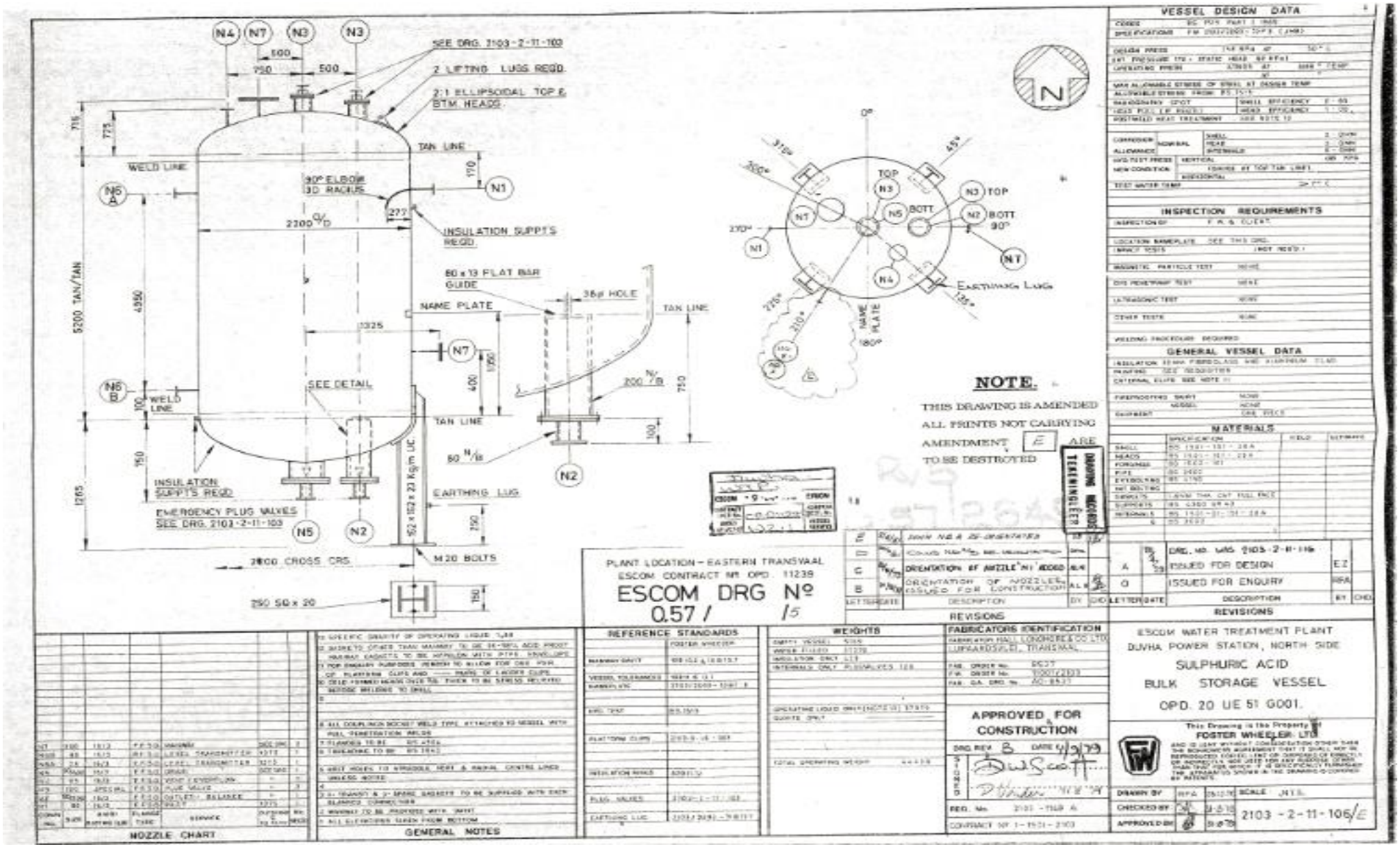
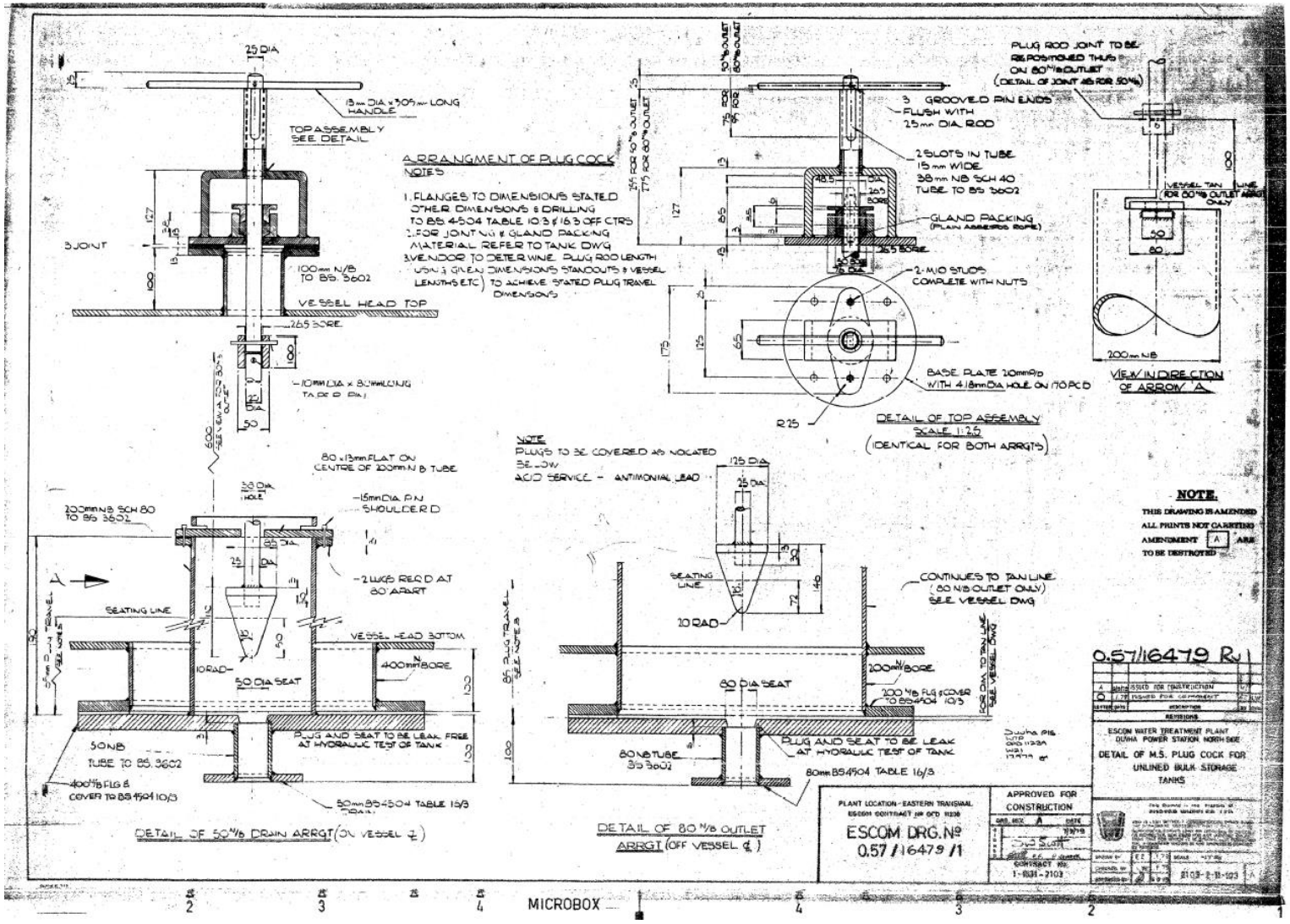
APPENDIX A: SULPHURIC ACID BATCH TANK DRAWIINGS

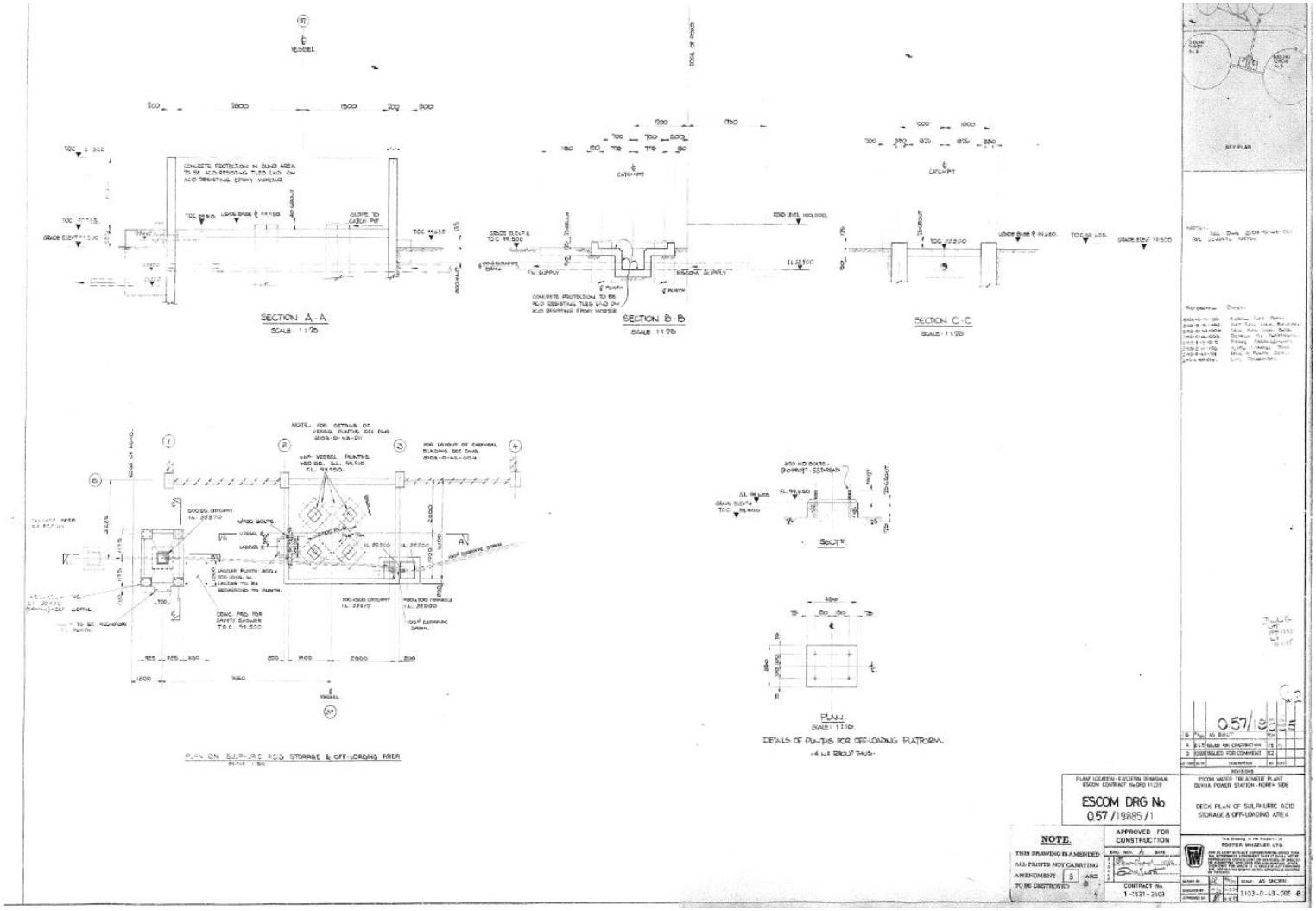

HALL LONGMORE & CO. PTY. LTD.
LUPA-ARDSVLEI
TRANSVAAL, SOUTH AFRICA
DRG. No.
A0-(203) 8537


VESSEL DESIGN DATA
INSPECTION REQUIREMENTS
GENERAL VESSEL DATA
MATERIALS
NOTE.
THIS DRAWING IS AMENDED
ALL PRINTS NOT CARRYING
AMENDMENT E ARE
TO BE DESTROYED
PLANT LOCATION – EASTERN TRANSVAAL
ESCOM CONTRACT Nº OPD. 11239
ESCOM DRG Nº
0.57 / 15
REVISIONS
ESCOM WATER TREATMENT PLANT
DUVHA POWER STATION, NORTH SIDE
SULPHURIC ACID
BULK STORAGE VESSEL
OPD. 20 UE 51 G001.
APPROVED FOR CONSTRUCTION
FOSTER WHEELER LTD
2103 - 2 - 11 - 106/E
NOZZLE CHART
GENERAL NOTES
REFERENCE STANDARDS
WEIGHTS
FABRICATORS IDENTIFICATION

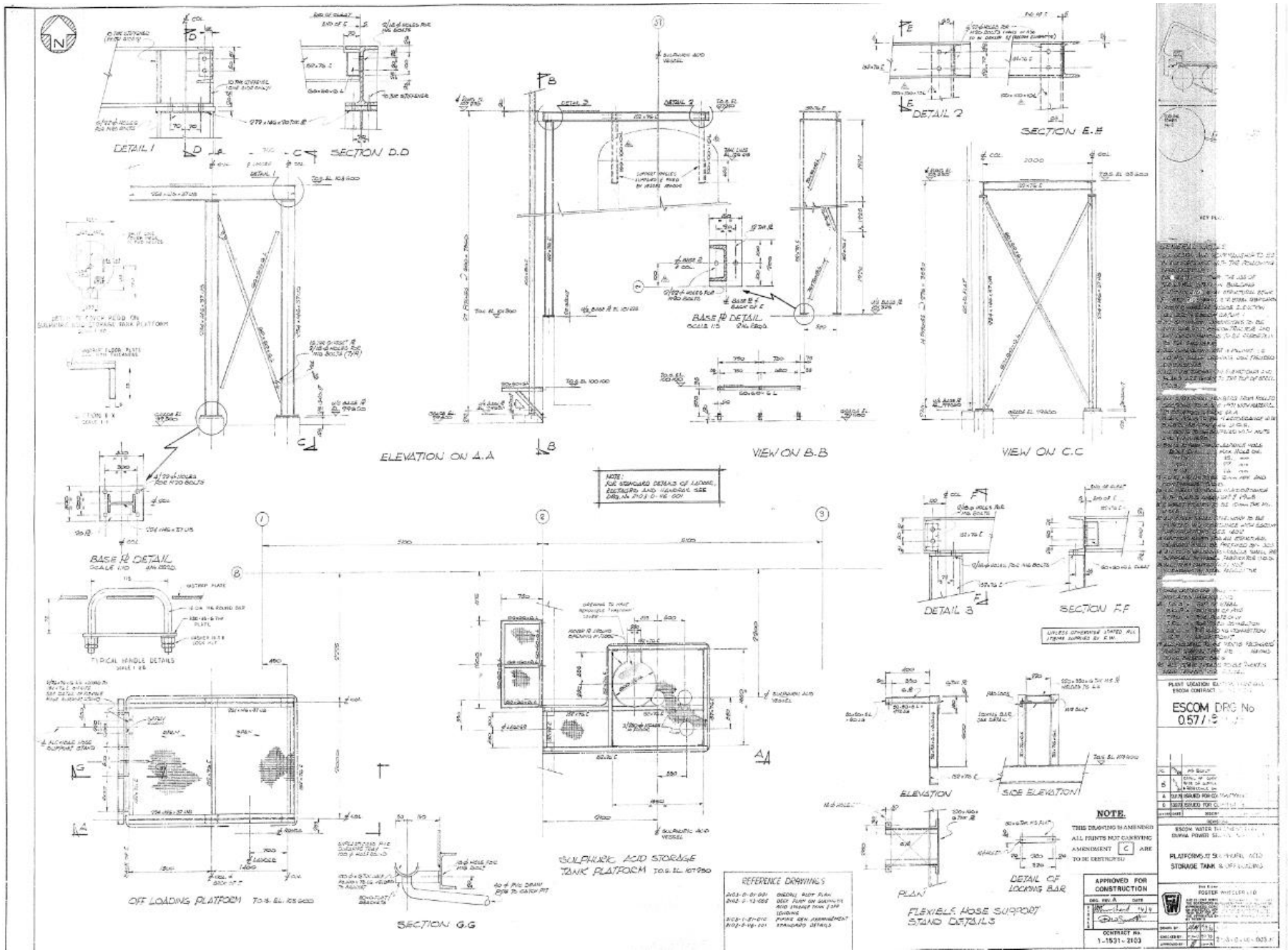
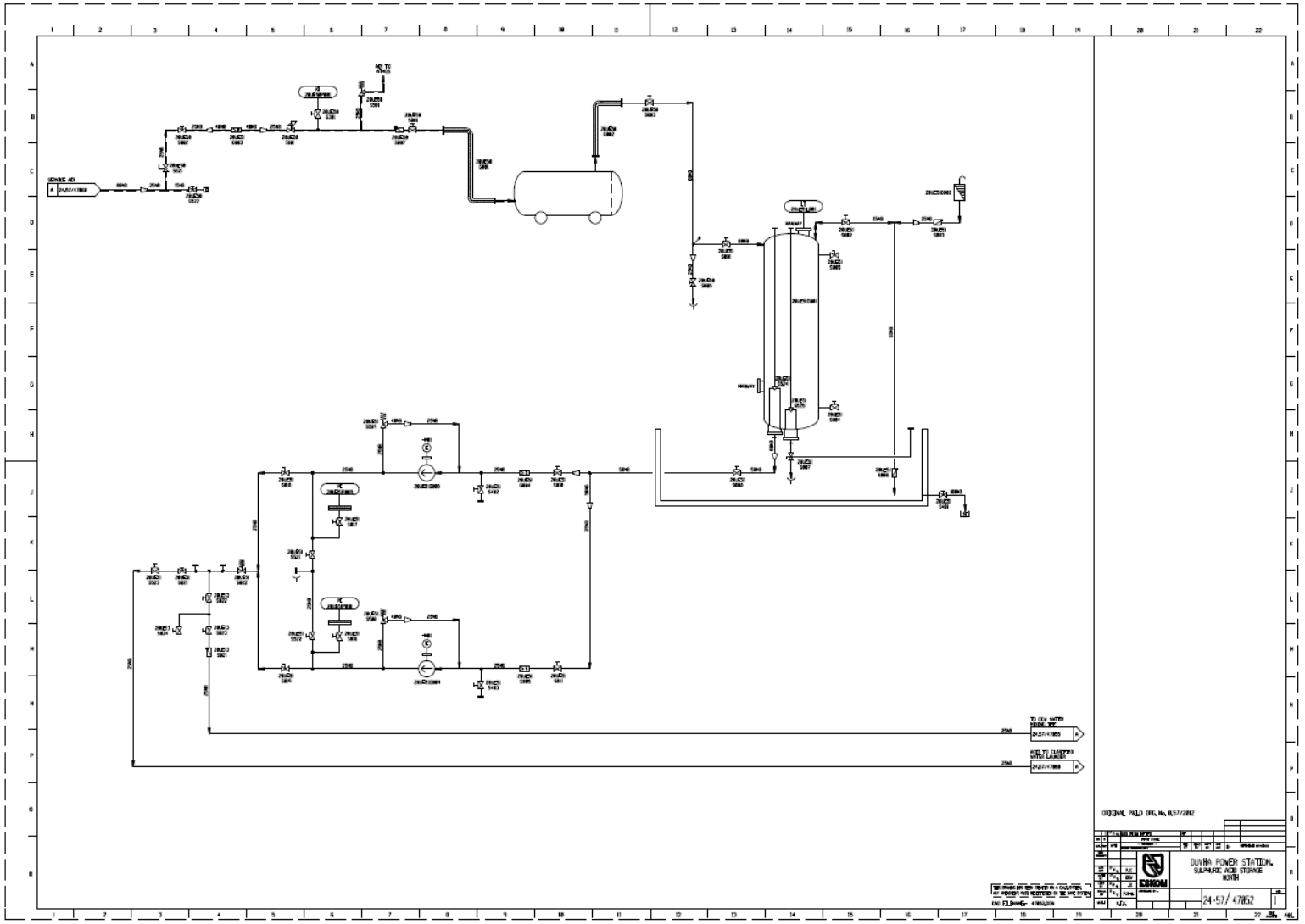
APPENDIX B: SULPHURIC ACID TANK PLUG VALVE DRAWIINGS



APPENDIX C: BUND WALL AREA DRAWINGS



APPENDIX D: ACCESS PLATFORM


DETAIL 1
SECTION D.D
DETAIL 2
SECTION E.E
ELEVATION ON A.A
VIEW ON B.B
VIEW ON C.C
BASE PL DETAIL
DETAIL 3
SECTION F.F
TYPICAL HANDLE DETAILS
OFF LOADING PLATFORM
SECTION G.G
SULPHURIC ACID STORAGE TANK PLATFORM
ELEVATION
SIDE ELEVATION
PLAN
DETAIL OF LOCKING BAR
FLEXIBLE HOSE SUPPORT STAND DETAILS
REFERENCE DRAWINGS
NOTE.
APPROVED FOR CONSTRUCTION
ESCOM DRG No
CONTRACT No.
1-1531-2103

APPENDIX E: ACID TANK P&ID DIAGRAM