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Project Name	HW FIRE	**Checked By**	B Jones
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FIREFIGHTING SCENARIO PRELIMINARY CALCULATION

SUMMARY OF ALL CREDIBLE EVENTS

Foam Concentrate Dosing Ratio 3%

Scenario	**Flow Rate (L/min)**		
	Total	**Fire Water**	**Foam Concentrate**
Scenario A: DWP Manifold on fire	3420	3316	104
Scenario B: Spill Basin on fire	1810	1755	55
Max Scenario Flow Rate	**3420**	**3316**	**104**

Scenario	**Volume Required (L)**	
	Fire Water	**Foam Concentrate**
Scenario A: DWP Manifold on fire	198960	6240
Scenario B: Spill Basin on fire	139500	4326
Max Scenario Volume Required	**198960**	**6240**

SUMMARY OF DESIGN CREDIBLE EVENT

Service	Scenario	Flow Rate
Fire Water	Scenario A	3316 L/min
Foam Concentrate	Scenario A	104 L/min

Service	Scenario	Volume Required
Fire Water	Scenario A	198960 L
Foam Concentrate	Scenario A	6240 L

Service	Scenario	Flow Rate
Foam Pre-mix	Max. Flow Rate	3420 L/min
	Min. Flow Rate	1810 L/min

Individual Equipment		Flow Rate
Foam Pre-mix	Max. Flow Rate	1140 L/min
	Min. Flow Rate	450 L/min

Revision History

A	Issued for Acceptance
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C	Fire Hydrants Removed

Comments

In the event of a spill basin fire, the protection systems for the manifold will be active. To ensure the spill basin has sufficient firefighting volume (water and foam concentrate volume), the operator has a maximum of 10 minutes to close the isolation valves of the three monitors.

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FIREFIGHTING SCENARIO PRELIMINARY CALCULATION

Scenario A: DWP Manifold on fire

Scenario	Scenario A
Foam Concentrate Dosing Ratio	3%
Area(s) of Fire	DWP Manifold on fire
Assest (s) Requiring Protection	Adjacent Areas using Foam Premix from Hydrants

Equipment Used During Scenario	**Incl. Scenario (Yes/No)**	**Foam Pre-mix (Yes/No)**	**Flow Rate (L/min)**		
			Total	**Fire Water**	**Foam Concentrate**
Foam Hydrants	No	No	0	0	0
DWP Manifold Monitor					
West	Yes	Yes	2280	2211	69
East	Yes	Yes	1140	1105	35
Spill basin	No	Yes	0	0	0
Total			**3420**	**3316**	**104**

Equipment Used During Scenario	**Incl. Scenario (Yes/No)**	**Foam Pre-mix (Yes/No)**	**Duration (mins)**	**Volume Required (L)**	
				Fire Water	**Foam Concentrate**
Foam Hydrants	No	No	60	0	0
DWP Manifold Monitor					
West	Yes	Yes	60	132660	4140
East	Yes	Yes	60	66300	2100
Spill basin	No	Yes	60	0	0
Total				**198960**	**6240**

Revision History

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FIREFIGHTING SCENARIO PRELIMINARY CALCULATION

Scenario B: Spill Basin on fire

Scenario	Scenario B
Foam Concentrate Dosing Ratio	3%
Area(s) of Fire	Spill Basin on fire
Assest (s) Requiring Protection	Adjacent Areas using Foam Premix from Hydrants

Equipment Used During Scenario	Incl. Scenario (Yes/No)	Foam Pre-mix (Yes/No)	Flow Rate (L/min)		
			Total	Fire Water	Foam Concentrate
Foam Hydrants	Yes	Yes	450	436	14
DWP Manifold Monitor					
West	No	Yes	0	0	0
East	No	Yes	0	0	0
Spill basin	Yes	Yes	1360	1319	41
Total			**1810**	**1755**	**55**

Equipment Used During Scenario	Incl. Scenario (Yes/No)	Foam Pre-mix (Yes/No)	Duration (mins)	Volume Required (L)	
				Fire Water	Foam Concentrate
Foam Hydrants	Yes	Yes	60	26160	840
DWP Manifold Monitor					
West	Yes	Yes	10	22800	684
East	Yes	Yes	10	11400	342
Spill basin	Yes	Yes	60	79140	2460
Total				**139500**	**4326**

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B	Update in firefighting duration
C	Fire Hydrants Removed

Notes :

Although the monitors do not provide any protection to the spill basin, it should be noted that in event of a spill basin fire, the manifold monitors will be in operation for 10 minutes until the isolation valve to the spill basin is opened and the monitor valves are closed. Hence the volume in this scenario accounts for the volume discharged from the monitors and as a result provides the overall volume used in this scenario.

TRANSNET PIPELINES

11364

HW FIRE

HOWICK SPILL CONTAINMENT CAPACITY REPORT

11364-A1146-Rev A

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TRANSNET PIPELINES

11364

HW FIRE

HOWICK SPILL CONTAINMENT CAPACITY REPORT

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1 EXECUTIVE SUMMARY

This report presents a spill containment capacity assessment for the Howick Depot, undertaken as part of the Transnet Pipelines fire protection system upgrade. It establishes the calculation basis for assessing the adequacy of the site spill basin to manage both product loss and firefighting discharge during credible fire and rupture scenarios.

Data obtained from the survey were used to calculate spill basin volume. The nett operational capacity for firefighting volume of the existing spill basin volume is 299.9 m³. It has been assumed that the existing DWP manifold oil separator will be used as a flashback chamber (i.e. the volume of the primary chamber of the spill basin has been included in the overall containment volume of the spill basin) and that previous risk assessments by the *Employer* have confirmed that a dedicated flashback chamber between the spill basin and the DWP Crude Oil manifold is not required.

Considering maximum product inflow rates in accordance with the TPL Standard for Spill Basin Design, a 5-minute spill adds 72.5 m³, giving a total required containment volume of 277.7 m³. A surplus containment volume of 22.2 m³ was identified.

2 INTRODUCTION

This calculation-based report has been prepared by GreyJones (PTY) Ltd. for the Howick TPL Depot Foam-Based Fixed Fire Protection System Project.

GreyJones (the *Consultant*) has been formally appointed as part of the *Employer*'s team to provide EPCM services in support of this critical infrastructure upgrade.

This document details the calculation and capacity of the Howick Depot spill basin, evaluating its ability to contain product, firefighting foam-premix, and water under various fire scenarios.

3 REFERENCED DOCUMENTS AND SPECIFICATIONS

The content of this report is not only subjected to the mentioned documents below but is instead used as a direct reference where necessary for further information and/or elaboration on a particular subject.

Document Number	Document Name
TPL-TECH-STD-002-Revision 00	Standard for Spill Basin Design
TPL-HWR-CI-DE-170424_A	Howick Spill Basin Drawing
11364-A1021 - Rev C	Fire Scenario Calculations
Transnet Howick Wg31_Survey_Howick July 2025	Howick Survey Drawing
TPL Fire Design Standard	Transnet Pipelines Fire Design Standard
H354086-00008-270-276-0001 Rev 3	Howick Pump Station Manifold P&ID

4 SPILL CONTAINMENT PHILOSOPHY

The firefighting volume for the spill basin was identified using the credible scenario. The following volumes will be excluded from the spill basin containment capacity:

4.1 Fire water and/or foam pre-mix volumes discharged from firefighting hoses during a fire at the Manifold (Scenario A), and Spill Basin (Scenario B)

4.2 Increases in volume occupied by the foam due to the aspiration of foam pre-mix.

5 DATA COLLECTION

Information on the existing spill basin parameters, were obtained from an as-built drawing from the *Employer* and from a recent survey.

The site survey and as built drawing for Howick was consulted for the spill basin, floor invert levels, and overall areas. Based on the results obtained and the containment area classification, the following dictating levels, and areas, as indicated by the black bold lines in the figure below, were obtained.

Spill Basin: (As Built Drawing)

- Top of wall level = 298.41 m
- Floor level = 296.228 m
- Height = 2.182 m
- Containment Area = 195.5 m²

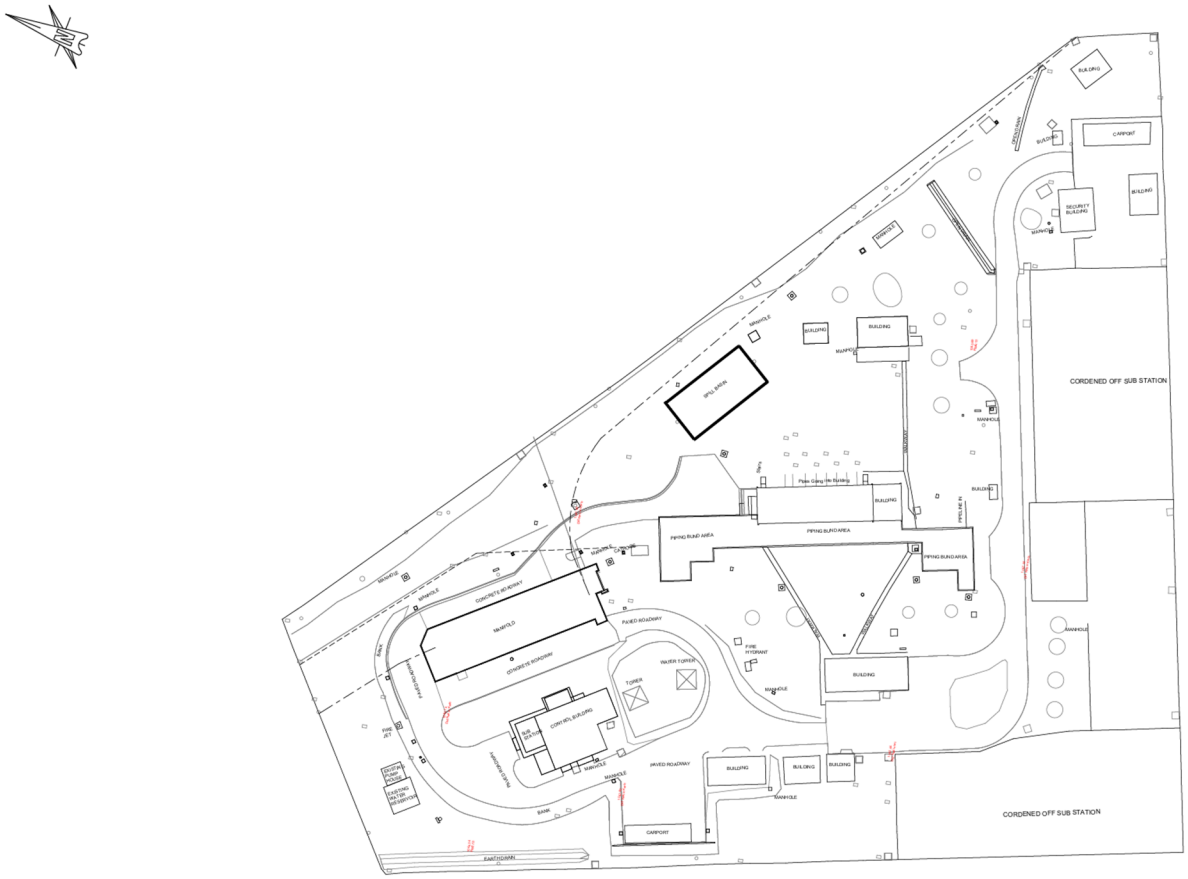


Figure 1: Spill Containment areas at the Howick depot.

Based on the analysis of the available drawings and site survey, there is no indication of a flashback chamber for the DWP manifold.

6 FIRE FIGHTING VOLUMES

The fire water and foam pre-mix volumes for the fire scenarios are included in the table below.

Scenario	Total Fire Water and/or Foam Pre-mix Volume (m^3)	Fire Water and/or Foam Pre-mix Volume Directed to Spill Basin (m^3)
Scenario A: Manifold Fire	205.2	205.2
Scenario B: Spill Basin Fire	143.8	143.8

The largest firefighting volume directed to the spill basin occurs in Scenario A: Manifold, with a volume of 205.2 m^3.

7 SPILL BASIN VOLUME

The DWP manifold has an oil separator and no flashback chamber. It is assumed that the oil separator will be utilised as a flashback chamber, however this is discouraged as an oil separator is not designed or certified to act as a flashback chamber.

It is assumed that previous risk assessments have previously determined that the absence of a flashback chamber between the spill basin and the DWP manifold is acceptable, given that only crude oil—a product with a low flashpoint—is used. If the DWP manifold is used for high flashpoint products in the future, the construction of a flashback chamber should be reconsidered.

The spill basin volume analysis was conducted where product and firefighting volumes are directed for containment in the event of a fire.

7.1 Existing Spill Basin Volume

With reference to drawing TPL-HWR-CI-DE-170424_A, the spill basin has internal dimensions of:

- Length = 19.6m
- Breadth = 10m
- Floor level (average) = 296.20
- Top of intermediate wall level = 297.73
- Height = 1.53 m

Nett spill basin volume = 299.9m^3

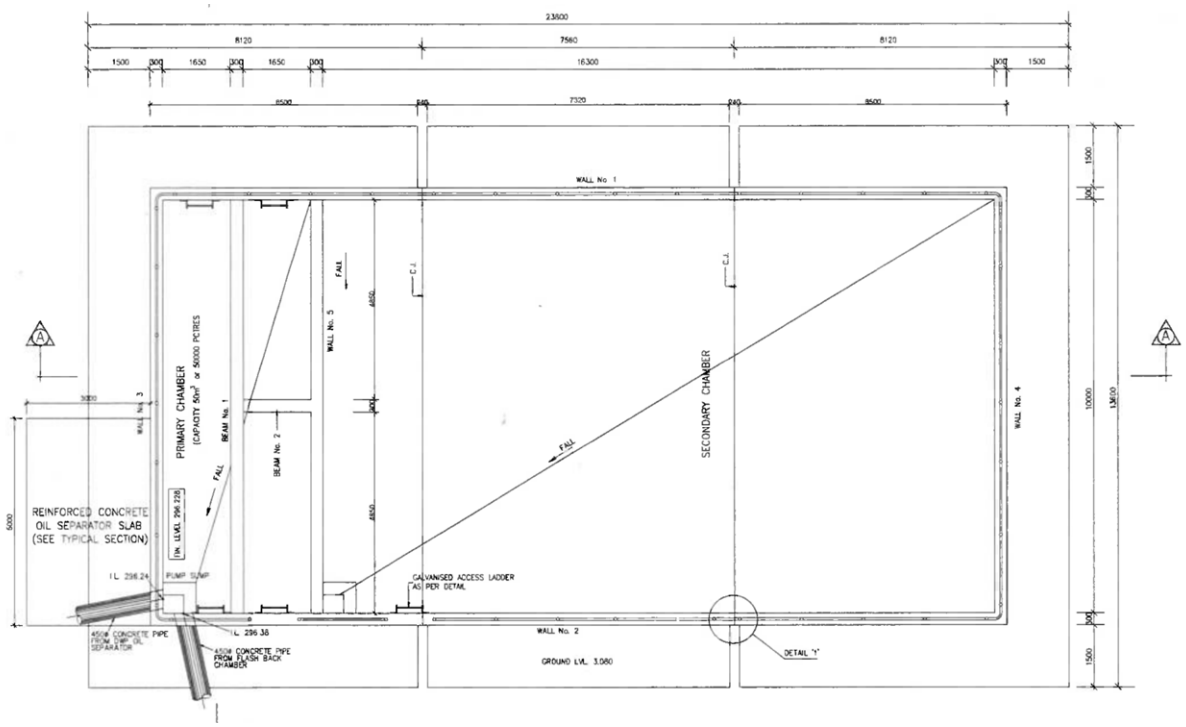


Figure 2: Spill Basin As-Built.

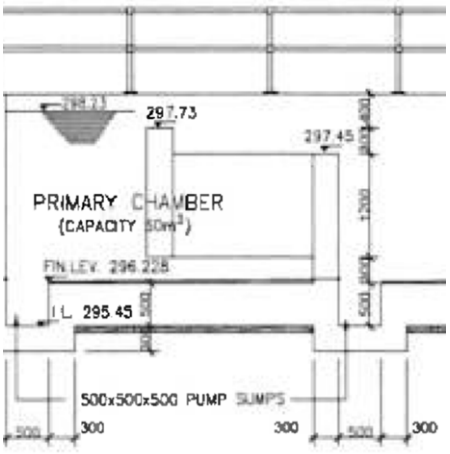


Figure 3: Internal dividing wall.

7.2 Required Spill Basin Volume

The TPL Standard for Spill Basin Design requires the spill basin capacity to contain the following:

- Product spill at the maximum product flow rate for 5 minutes.
- Fire-fighting water/foam for 60 minutes at the application rates for the largest credible event.

The largest credible event is Scenario A – Manifold with a firefighting volume of 205.2 m^3 to be contained.

The referenced product P&ID shows the product inflow rate to the Howick manifold as 870 m^3/h (14,500 L/min). At 5 minutes flow, the volume is 72.5 m^3.

In accordance with the TPL Standard for Spill Basin Design and requirements, the spill containment volume is given as;

Required spill containment volume is thus 205.2 m^3 + 72.5 m^3 = 277.7 m^3.

Spill containment surplus volume is 299.9 m^3 – 277.7 m^3 = 22.2m

The spill basin volume shall be considered sufficient in containing the firefighting volume and product spill at a maximum flow with a surplus containment volume of 22.2 m^3.

8 MANIFOLD SPILL CONTAINMENT

The drainage line from the manifold to spill basin is a Ø450 concrete pipe running between the separator chamber at the manifold and the primary chamber of the spill basin. The ground level variance between these two points is 500mm, assuming consistent cover over the pipe this provides a fall of approximately 1-100.

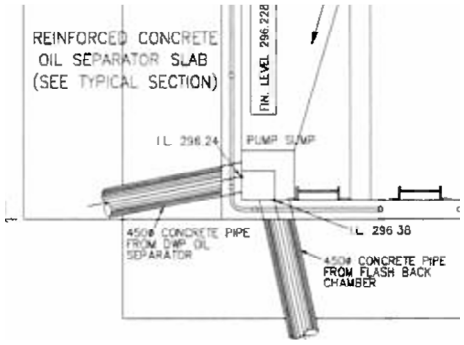


Figure 4 : Discharge pipe from manifold separator.

The table below provides flow rates for varying depths of the discharge pipe. At 60% full, the flow rate is 13600L/min. A five-minute period would allow for 68 m³ of water discharge. The pipe is adequately sized to drain the 5-minute manifold product release of 72.5 m^3 and the Manifold fire scenario pre-mix flow rate of 3420 L/min. It is important to note that the following flow calculations are predicated on the viscosity of water rather than that of crude oil.

Pipe Diameter			450 mm					
Gradient Pipe, 1 in			100					
Manning constant , n			0.011					
% full	**depth mm**	**V (m/s)**		**flow (l/s)**	**flow (m³/s)**	**flow (l/min)**	**flow (m³/min)**	**flow (m³/hr)**
0.1	45	0.85		7	0.007	422	0.42	25.32
0.2	90	1.3		29.5	0.03	1770	1.77	106.22
0.3	135	1.64		66	0.066	3959	3.96	237.54
0.4	180	1.91		113.5	0.114	6813	6.81	408.77
0.5	225	2.12		168.5	0.168	10108	10.11	606.5
0.6	270	2.27		226.4	0.226	13582	13.58	814.94
0.7	315	2.37		282.1	0.282	16926	16.93	1015.57
0.8	360	2.41		329.4	0.329	19761	19.76	1185.66
0.9	405	2.38		359.1	0.359	21547	21.55	1292.81
1	450	2.12		336.9	0.337	20217	20.22	1213

9 CONCLUSION

The existing spill containment capacity was considered against the existing product process conditions, and the firefighting volumes that will be discharged onto the spill containment area.

It has been assumed that the DWP manifold oil separator can be used as a flashback chamber until there is a change in product at the depot. The spill basin containment volume is 299.9 m^3 and the required containment volume is 277.7 m^3, there is a surplus of 22.2 m^3, hence the containment volume of the existing spill basin is sufficient.

TRANSNET PIPELINES

11364

HW FIRE

HOWICK FIRE SYSTEM DEMOLITION SCOPE OF WORK

11364-A1147-Rev B

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TRANSNET PIPELINES
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HW FIRE
HOWICK FIRE SYSTEM DEMOLITION SCOPE OF WORK

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1 EXECUTIVE SUMMARY

The demolition work for the Howick depot has been outlined in this document. It discusses the scrapping, disposal, and removal of the existing fire protection system and equipment. This includes the disconnection and abandonment of underground piping, demolition of structural work, disposal of redundant equipment and relocation of a selection of equipment, and the complete demolition of the fire pump house.

Additionally, electrical and instrumentation (E&I) systems will be decommissioned, with the removal of electrical panels, cabling, and hydraulic activation systems.

Key fire equipment, such as water tanks, diesel engines, and foam systems, will also be demolished or removed as part of the process.

2 ABBREVIATIONS

Abbreviation	Term
E&I	Electrical and Instrumentation
EPC	Engineering, Procurement and Construction
EPCM	Engineering, Procurement and Construction Management
GA	General Arrangement
IBC	Intermediate Bulk Container
NGL	Natural Ground Level
TPL	Transnet Pipelines

3 DEFINITIONS

Term	Definition
Transnet Pipelines	The *Employer*
Responsible Engineer	An engineer who is registered in terms of the Engineering Protection Act, 2000 (Act. No 46 of 2000) and is viewed as competent as prescribed in the National Building Regulations A19.
Zone	A defined area on site which bounds a possible fire event occurring due to a rupture or spill within the area or which drains to the area.
System	Part of the fire protection dedicated to the protection of one of the areas on site and supplied with water or premix through a single pressure regulating deluge valve. The bund pourers for the spill basin would be such a system.

4 REFERENCED DOCUMENTS

The content of this report is not only subjected to the mentioned documents below but is instead used as a direct reference where necessary for further information and/or elaboration on a particular subject.

Document Number	Document Name
ISO 14001: 2015	Environmental Management System
ISO 31000: 2018	Risk Management Guideline
TG/GFIN5/1/2P	Contract Management Policy
TRN-IMS-GRP-005	Compliance Obligations Procedure
TRN-IMS-GRP-PROC-014	Transnet Contractor Management Procedure
Act 107 of 1998	The National Environmental Management Act 107 of 1998
Act 36 of 1998	National Water Act 36 of 1998
Act 59 of 2008	National Environmental Management: Waste Act 59 of 2008
11364-A1047	Typical Details - Piping Demolition Capping details
11364-A1048	Typical Details - Pipe Support
G159	G159 – Scrapping Form
G160	G160 – Transfer Form
PL 912	Piping Supply and Installation
11364-A1176	Equipment Relocation and Scrapping List
11364-A1177	Demolition Bill of Materials
PL SK No. 0712-A	Normal Valve Setting for Howick Fire Protection
WS0000	Howick Pump Station
PL 112878	Howick Site Layout

5 INTRODUCTION

This Demolition Scope of Work document has been prepared by GreyJones (PTY) Ltd. following the award of the contract under Tender Number: TPL/2024/09/0008/77334/RFP – Appointment of an EPCM *Consultant* to form part of Owner's Team: to Develop Scope of Works and Support Transnet Pipelines (TPL) in Management of EPC *Contractors* during the Design, Procurement and Construction Phases of Witbank & Howick TPL Depots Foam-Based Fixed Fire Protection System Project.

GreyJones (the *Consultant*) has been formally appointed as part of the *Employer*'s team to provide EPCM services in support of the critical infrastructure upgrade at the Howick depot.

The intent of this document is to outline the site-specific demolition scope of work that discusses how the demolition process shall occur, and the necessary requirements and steps to be taken for the various equipment/ facilities in the existing system.

Where the term 'equipment' is used in this specification, it shall be interpreted to mean Plant and Materials as defined in NEC3 Clause 11.2(12).

6 EXISTING FIRE PROTECTION SYSTEM

The existing fire protection system consists of the following fire protection equipment with regards to the different fire risk areas.

Fire Risk Area	Fire Protection Equipment/ System
DWP Manifold	• 2 off Foam Monitors
DJP Pump House	• 2 off Foam Monitors
Spill Basin	• 2 off Bund Pourers
Foam Ring Main	• 4 off Single Header Foam Premix Hydrants
Fire Water Ring Main	• 2 off Single Header Foam Premix Hydrants

The fire protection system also includes:

- The pump house
- The existing control system
- Fire water, foam concentrate and foam pre-mix reticulation within the pump house.
- Fire water and foam concentrate tanks.

The mentioned parts of the fire system as described above shall be demolished/relocated to facilitate the installation of the upgraded fire protection design system.

7 NOTIFICATION AND DECOMMISSIONING WORK

A formal request notification period, of 10 working days, must be provided by the *Contractor* to the *Employer* for decommissioning and related *works.* The request shall be made with relevant documentation and include a description of what demolition or equipment removal is to be conducted.

All requests made by the *Contractor* must be submitted in writing and acknowledged by the *Employer*.

The documentation required to be completed for the scrapping and transfer of equipment includes the G159 – Scrapping form and the G160 – Transfer form. The internal process of populating the mentioned documents is to be done by the *Employer* or the depot manager as instructed by the *Employer* and shall be completed prior to the removal of the relevant equipment.

The completion of these documents by the *Employer* is required to be done within the 10-working day notice submitted by the *Contractor.*

8 COMPLIANCE REQUIREMENTS

The *Employer* and the *Contractor* must comply with permitted disposal requirements or recycling facilities in accordance with the National Environmental Acts, and with the respective *Employer* policies.

It is the responsibility of the *Contractor* to obtain a water disposal permit. The handling of the water tank with its contents is further discussed in section 9.5.3.

The *Contractor* must make provision to deal with potential contamination of the water within the existing fire water tank prior to disposal.

The risk register should include permits that may cause delays, such as the water disposal permit and any other.

The *Contractor* is required to include municipal certificates, fire system drawings, demolition drawings, and necessary applications as part of their demolition scope of work.

The *Contractor* shall issue revised / updated electrical certificates of compliance (COC's) for each of the existing electrical installations which are being altered due to the demolition scope of works of which all revised / updated electrical certificates of compliance (COC's) must be submitted to the *Employer* for record and safe keeping purposes.

The *Contractor* shall liaise with the *Employer* to obtain the respective existing electrical certificates of compliance (COC) to be revised / updated as well as arrange all the necessary electrical power outages and / or electrical switching arrangements as required to successfully perform the demolition scope of works.

9 DEMOLITION SCOPE OF WORK

The content in this section outlines the various aspects that shall require the demolition or removal of the existing fire protection system. The demolition/removal process is described in two phases, however below it is detailed with intermediate steps, in accordance with the compliance requirements stated in section 8.

At all times during the fire system upgrade, a fire protection system must be fully functional. During the installation of the new equipment, temporary connections need to be tied into the existing system.

The demolition and installation process of the respective equipment can be described as follows:

1. The *Contractor* shall begin the installation of the new equipment, adjacent to the existing equipment.
2. Upon the completion of new water tank, the *Contractor* shall create a temporary water supply connection between one of the new water tanks and the existing fire water pump suction line, to ensure there is continuation of a functional fire protection system. This temporary connection complete with new fire piping shall be commissioned before it can be used.
3. The existing water tank will then be demolished to make way for construction of the second fire water storage tank
4. Upon successful commissioning of the new fire system, the *Contractor* shall then remove the temporary connection between the new water tank and the existing fire pump, and commence with demolition of the remainder of the existing fire system.

The phases of demolition of the existing system can be described in the points below:

1. Phase 1: Demolition and removal of existing equipment and systems, focuses on the careful decommissioning and removal of all existing equipment and systems within its designated area. It includes the physical dismantling and safe disposal of redundant infrastructure and the relocation of specified equipment as stated in section 6 and section 9.5.
2. Phase 2: Site levelling, is followed by the completion of Phase 1 ensuring the site is cleared, levelled, and made safe for final operation and use of the new system and other parts of the depot.

9.1 Bill of Materials and Equipment Inventory for Demolition

The equipment of the existing fire system that is to be removed or relocated is provided in Appendix A: Equipment Relocation and Scrapping List, and Appendix B: Existing Fire System Bill of Materials.

The existing fire protection system is described in the flow diagrams and site layouts as seen in Appendix C: Existing Fire System Flow Diagram and Site Layout. The bill of materials and equipment list of the existing system has been generated using the information in Appendix C: Existing Fire System Flow Diagram and Site Layout and survey data collected upon site visits.

It should be noted that that the equipment provided in the Appendix A: Equipment Relocation and Scrapping List and Appendix B: Existing Fire System Bill of Materials is an approximate value based on the existing equipment in Appendix C: Existing Fire System Flow Diagram and Site Layout and survey data.

9.2 Scrapping and Disposal

The scrapping and disposal process must be done in accordance with the *Employers* approval.

Various equipment on site is tagged with an asset number. The *Employer* shall be responsible for the internal scrapping process for equipment with asset numbers. The equipment provided on the asset register must be accounted for by the *Employer*, followed by the notification and decommissioning *works* by the *Contractor.*

The *Employer* shall verify and provide details of the equipment for removal to ensure proper handling is conducted by the *Contractor*. The *Contractor* is responsible for the scrapping and disposal process of all identified equipment that is confirmed with the facility owner at the depot.

The *Contractor* shall be responsible for all costs incurred with the demolition, removal, transportation, disposal and scrapping of the identified equipment.

9.3 Above-ground Piping

The existing fire protection system was designed with above and below ground piping. All above-ground piping of the existing fire system will be demolished. The following decommissioning/ demolition process shall apply based on the respective ground penetration areas;

1. All above-ground piping in hardstand areas that penetrates below ground shall be cut below NGL and filled with concrete. This includes the casting of concrete blocks for decommissioned pipes and the floor sealing of new concrete joints. This will also apply to pipes that penetrate the bund walls.
2. All above-ground piping in unsurfaced areas that penetrates below ground shall be cut below NGL and backfilled. Concrete capping of pipe is not required.

All piping demolished below ground level shall be done in accordance with concrete specifications and civil drawings 11364-A1047 and 11364-A1048.

9.4 Structural work

All structural work shall be done as per the *Employer's* specifications.

All existing fire system civil/structural structures that will become redundant once the new fire system is commissioned, shall be demolished. The *Contractor* must note that all structural facilities that are being demolished must be graded to avoid the pooling of water during rainfall and to allow safe operational access.

9.4.1 Fire Pump House and Fire Shelter Demolition

The existing pump house and fire shelter is to be demolished to the natural ground level and graded.

All piping within the existing pump house and adjacent to the fire shelter shall be cut and sealed as mentioned in section 9.3 and electrical cables shall be decommissioned as per the requirements in section 9.6.

9.4.2 Existing Water Tank Demolition

The existing water tank must be demolished. The existing concrete plinths must be demolished to the natural ground level and graded.

9.4.3 Foam Tank

The concrete plinths of the existing foam tank are to be demolished to the natural ground level and graded.

9.5 Equipment Demolition and Removal

All redundant fire protection equipment such as bund pourers, valves, hydrants, above ground piping etc. shall be demolished or removed to be assessed and refurbished. The equipment listed below shall be removed and relocated:

- Hydrant heads
- Diesel engine
- Fire water pump.
- Foam pump
- Control Panels
- Selected valves
- Monitors
- Foam Concentrate

Further information on the relocated equipment shall be provided in section 0.

9.5.1 Pump House Equipment

According to section 10, the equipment from the current pump house will be moved to its assigned depot workshops. All other equipment, including the foam pump's electric motor, will be demolished and managed following proper scrapping and disposal procedures.

The diesel engine is to be removed from the base plate with its related components as mentioned in section 0.

9.5.2 Existing Foam Generating Equipment

The existing fire protection equipment as mentioned in section 6, shall be removed and scrapped. This shall be done with an exception to the hydrant heads and monitors. The hydrant heads are to be removed and relocated as stated in section 0 and the risers are to be scrapped.

All related above ground piping shall be removed and below ground penetrations shall be sealed accordingly.

9.5.3 Existing Water Tank

The water in the existing water tank can be managed at the *Contractor's* discretion, including testing, disposal with a permit, or filling commissioned tanks, in compliance with the Environmental Act, and provided there is always the equivalent of the existing water storage capacity available for use by the existing fire system.

The existing tank holds an estimated volume of 65,000 litres. The *Contractor* shall not receive reimbursement for 65,000 Litres of water contained in the new water tank, if it can be demonstrated that the water from the existing water tank may be transferred to the new fire water tank.

The *Contractor* is responsible for assessing the viability of the water (i.e. pH) in the water tank if it is to be released into municipal system with the use of a permit.

The *Contractor* shall demolish the water tank to NGL for the construction of the new pump house and second water tank.

All associated costs for handling of water in the existing water tank is for the *Contractors* account.

9.5.4 Foam Concentrate and Foam Tank

The *Contractor* shall decant the foam concentrate in the existing foam tank into IBC’s and relocated. It should be noted that the existing foam concentrate, in the foam concentrate tank is approximately 5000 litres. Thereafter the foam tank shall be disposed of at a registered waste site.

9.6 E&I System Demolition and Removal

The *Employers* electrical department shall only be responsible for the electrical disconnection, making electrically safe and removal of electrical and instrumentation infrastructure at the point of supply / control.

The *Contractor* shall however be responsible for the electrical disconnection, making electrically safe and removal from site all electrical and instrumentation infrastructure from the electrical or control load point onwards and only within the specific areas / buildings / installations where the demolition scope of works is to be executed.

9.6.1 Electrical and Instrumentation Infrastructure

All existing fire system electrical and instrumentation infrastructure shall be properly managed where asset numbers are verified. The *Contractor* shall disconnect, make electrically safe and remove from site the following electrical and instrumentation infrastructure but not limited to;

- Electrical distribution boards and control panels.
- Electrical and instrumentation cables and wiring.
- Electrical and instrumentation cable and wiring routing infrastructure (i.e. conduits, distribution boxes, cable sleeves, cable ladders, cable trays, wire mesh baskets, pedestals and supports, etc.).
- Electrical building fit-out infrastructure (i.e. light switches, light fittings, socket outlets, electrical isolators, etc.).
- Instrumentation infrastructure (i.e. control valves, control switches, control sensors, start / stop stations, etc.).
- Earthing, bonding and lightning protection infrastructure (i.e. aluminium roof conductor, aluminium down conductor, test points, copper conductor, earth spikes, earthing busbars, etc.).

9.6.2 Cable Decommissioning

The *Employers* electrical department shall only be responsible for the disconnection and making electrically safe the existing fire system electrical and instrumentation cables at the point of supply / control.

The *Contractor* shall be responsible for the disconnection and making electrically safe all of the existing fire system electrical and instrumentation cables at the electrical or control point onwards.

The *Contractor* shall cut all the primary electrical supply cables and primary instrumentation feed cables as close as possible to the respective cable sleeve and install end-caps at both ends of all such electrical and instrumentation cables.

All decommissioned electrical and instrumentation cables must be fitted with clear and unambiguous labels at the respective end caps stating either “REDUNDANT ELECTRICAL CABLE” or “REDUNDANT INSTRUMENTATION CABLE”.

10 EQUIPMENT AND FACILITY RELOCATION

The list of equipment that shall be removed as mentioned in section 9.5 shall be relocated to various TPL depot workshops and storage facilities.

The *Contractor* shall use their own equipment for the relocation process.

All hose boxes around the depot are to be removed and scrapped.

The following equipment shall be relocated to the Pinetown stores:

- The foam concentrate in the tank shall be decanted into IBC's that are provided by the *Contractor.*
- The diesel engine, fire water pump, foam pump and control panel
- The monitors
- The deluge and pressure control valves (INBAL)
- Both the pressure relief valves
- Hydrant heads

APPENDIX A: EQUIPMENT RELOCATION AND SCRAPPING LIST

TRANSNET pipelines

GREYJONES (PTY) LTD.

DOCUMENT DETAILS	
Document Number	11364-A1176
Revision No	A
Revision Date	2026/02/11
Revision Description	Issued for Information
Prepared By	N Perumal
Checked By	B Jones
Approved By	B Jones

PROJECT DETAILS		REVISION HISTORY		REFERENCE P&IDs / DRAWINGS
Client	TRANSNET PIPELINES	A	ISSUED FOR COMMENT	PL SK No. 0712-A
Project Name	TPL HW FIRE			WS 0000
Project Number	11364			Survey Data

EQUIPMENT RELOCATION AND SCRAPPING LIST

DEMOLISH/ RELOCATE	DESCRIPTION	SIZE	ACTUATOR	P&ID/SKETCH REF.	MATERIALS OF CONSTRUCTION	PROCESS FLUID
RELOCATE	FOAM CONCENTRATE	5000 L	N/A	PL SK No. 0712-A	GRP	FOAM CONCENTRATE
DEMOLISH	BUTTERFLY VALVE	100NB	HAND WHEEL	PL SK No. 0712-A	CARBON STEEL	FOAM PREMIX
DEMOLISH	BUTTERFLY VALVE	100NB	HAND WHEEL	PL SK No. 0712-A	CARBON STEEL	FOAM PREMIX
RELOCATE	CONTROL VALVE	100NB	N/A	Survey Data	CARBON STEEL	FOAM PREMIX
RELOCATE	CONTROL VALVE	100NB	N/A	Survey Data	CARBON STEEL	FOAM PREMIX
RELOCATE	OSCILLATING MONITOR	100NB	N/A	WS 0000	CARBON STEEL	FOAM PREMIX
RELOCATE	OSCILLATING MONITOR	100NB	N/A	WS 0000	CARBON STEEL	FOAM PREMIX
RELOCATE	OSCILLATING MONITOR	100NB	N/A	WS 0000	CARBON STEEL	FOAM PREMIX
RELOCATE	OSCILLATING MONITOR	100NB	N/A	WS 0000	CARBON STEEL	FOAM PREMIX
DEMOLISH	PRESSURE INDICATOR	15NB	N/A	PL SK No. 0712-A	CARBON STEEL	FIRE WATER
DEMOLISH	PRESSURE INDICATOR	15NB	N/A	PL SK No. 0712-A	CARBON STEEL	FOAM CONCENTRATE
DEMOLISH	GATE VALVE	200NB	HAND WHEEL	PL SK No. 0712-A	CARBON STEEL	FIRE WATER
DEMOLISH	BALL VALVE	25NB	HAND WHEEL	PL SK No. 0712-A	STAINLESS STEEL 316	FOAM CONCENTRATE
DEMOLISH	BALL VALVE	25NB	HAND WHEEL	PL SK No. 0712-A	STAINLESS STEEL 316	FOAM CONCENTRATE
DEMOLISH	BALL VALVE	25NB	HAND WHEEL	PL SK No. 0712-A	STAINLESS STEEL 316	FOAM CONCENTRATE
DEMOLISH	BALL VALVE	25NB	HAND WHEEL	PL SK No. 0712-A	STAINLESS STEEL 316	FOAM CONCENTRATE
DEMOLISH	BALL VALVE	25NB	HAND LEVER	PL SK No. 0712-A	STAINLESS STEEL 316	FOAM CONCENTRATE
DEMOLISH	BALL VALVE	25NB	HAND WHEEL	PL SK No. 0712-A	STAINLESS STEEL 316	FOAM CONCENTRATE
DEMOLISH	BALL VALVE	25NB	HAND LEVER	PL SK No. 0712-A	STAINLESS STEEL 316	FOAM CONCENTRATE
DEMOLISH	BALL VALVE	25NB	HAND LEVER	PL SK No. 0712-A	CARBON STEEL	FOAM PREMIX
DEMOLISH	CHECK VALVE	25NB	N/A	PL SK No. 0712-A	STAINLESS STEEL 316	FOAM CONCENTRATE
DEMOLISH	PESSURE INDICATOR	25NB	N/A	Survey Data	STAINLESS STEEL 316	FOAM CONCENTRATE
RELOCATE	PRESSURE RELIEF VALVE	25NB	N/A	PL SK No. 0712-A	STAINLESS STEEL 316	FOAM CONCENTRATE
DEMOLISH	STRAINER	25NB	N/A	PL SK No. 0712-A	STAINLESS STEEL 316	FOAM CONCENTRATE
DEMOLISH	FIRE WATER TANK	50m³	N/A	PL SK No. 0712-A	SUPPLIER STANDARD	FIRE WATER
DEMOLISH	BALL VALVE	50NB	HAND LEVER	PL SK No. 0712-A	CARBON STEEL	FIRE WATER
DEMOLISH	MEX BUND POURER	50NB	N/A	WS 0000	CARBON STEEL	FOAM PREMIX
DEMOLISH	MEX BUND POURER	50NB	N/A	WS 0000	CARBON STEEL	FOAM PREMIX
DEMOLISH	FOAM CONCENTRATE TANK	5m³	N/A	PL SK No. 0712-A	SUPPLIER STANDARD	FOAM CONCENTRATE
DEMOLISH	BALANCE VALVE	80NB	N/A	PL SK No. 0712-A	SUPPLIER STANDARD	FOAM CONCENTRATE
DEMOLISH	BUTTERFLY VALVE	80NB	HAND LEVER	PL SK No. 0712-A	CARBON STEEL	FIRE WATER
DEMOLISH	BUTTERFLY VALVE	80NB	HAND LEVER	PL SK No. 0712-A	CARBON STEEL	FIRE WATER
DEMOLISH	BUTTERFLY VALVE	80NB	HAND LEVER	PL SK No. 0712-A	CARBON STEEL	FIRE WATER
DEMOLISH	BUTTERFLY VALVE	80NB	HAND LEVER	PL SK No. 0712-A	CARBON STEEL	FIRE WATER
DEMOLISH	BUTTERFLY VALVE	80NB	HAND WHEEL	PL SK No. 0712-A	CARBON STEEL	FOAM PREMIX
DEMOLISH	BUTTERFLY VALVE	80NB	HAND WHEEL	PL SK No. 0712-A	CARBON STEEL	FOAM PREMIX

TRANSNET pipelines

GREYJONES (PTY) LTD.

DOCUMENT DETAILS	
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PROJECT DETAILS		REVISION HISTORY		REFERENCE P&IDs / DRAWINGS
Client	TRANSNET PIPELINES	A	ISSUED FOR COMMENT	PL SK No. 0712-A
Project Name	TPL HW FIRE			WS 0000
Project Number	11364			Survey Data

EQUIPMENT RELOCATION AND SCRAPPING LIST

DEMOLISH/ RELOCATE	DESCRIPTION	SIZE	ACTUATOR	P&ID/SKETCH REF.	MATERIALS OF CONSTRUCTION	PROCESS FLUID
RELOCATE	CONTROL VALVE	80NB	N/A	Survey Data	CARBON STEEL	FOAM PREMIX
RELOCATE	CONTROL VALVE	80NB	N/A	Survey Data	CARBON STEEL	FOAM PREMIX
DEMOLISH	FOAM PROPORTIONER	80NB	N/A	PL SK No. 0712-A	CARBON STEEL	FOAM CONCENTRATE
RELOCATE	FP HYDRANT HEADER	80NB	N/A	PL SK No. 0712-A	CARBON STEEL	FOAM PREMIX
RELOCATE	FP HYDRANT HEADER	80NB	N/A	WS 0000	CARBON STEEL	FOAM PREMIX
RELOCATE	FP HYDRANT HEADER	80NB	N/A	WS 0000	CARBON STEEL	FOAM PREMIX
RELOCATE	FP HYDRANT HEADER	80NB	N/A	WS 0000	CARBON STEEL	FOAM PREMIX
RELOCATE	FW HYDRANT HEADER	80NB	HAND WHEEL	WS 0000	CARBON STEEL	FIRE WATER
RELOCATE	FW HYDRANT HEADER	80NB	HAND WHEEL	WS 0000	CARBON STEEL	FIRE WATER
DEMOLISH	HYDRANT VALVE	80NB	HAND WHEEL	WS 0000	CARBON STEEL	FOAM PREMIX
DEMOLISH	HYDRANT VALVE	80NB	HAND WHEEL	WS 0000	CARBON STEEL	FOAM PREMIX
DEMOLISH	HYDRANT VALVE	80NB	HAND WHEEL	WS 0000	CARBON STEEL	FOAM PREMIX
RELOCATE	POSITIVE DISPLACEMENT FOAM CONCENTRATE PUMP	80NB	N/A	PL SK No. 0712-A	CARBON STEEL	FOAM CONCENTRATE
DEMOLISH	HYDRANT VALVE	80NB	HAND WHEEL	WS 0000	CARBON STEEL	FOAM PREMIX
DEMOLISH	HYDRANT VALVE	80NB	HAND WHEEL	WS 0000	CARBON STEEL	FOAM PREMIX
DEMOLISH	HYDRANT VALVE	80NB	HAND WHEEL	WS 0000	CARBON STEEL	FOAM PREMIX
DEMOLISH	HYDRANT VALVE	80NB	HAND WHEEL	WS 0000	CARBON STEEL	FIRE WATER
DEMOLISH	HYDRANT VALVE	80NB	HAND WHEEL	WS 0000	CARBON STEEL	FIRE WATER
RELOCATE	CONTROL PANELS	N/A	N/A	Survey Data	SUPPLIER STANDARD	N/A
DEMOLISH	DIESEL TANK	N/A	N/A	Survey Data	SUPPLIER STANDARD	DIESEL
DEMOLISH	FIRE HOSE	N/A	N/A	Survey Data	SUPPLIER STANDARD	FOAM PREMIX
DEMOLISH	HYDRANT BOX	N/A	N/A	WS 0000	CARBON STEEL	N/A
DEMOLISH	HYDRANT BOX	N/A	N/A	WS 0000	CARBON STEEL	N/A
DEMOLISH	HYDRANT BOX	N/A	N/A	WS 0000	CARBON STEEL	N/A
RELOCATE	DIESEL ENGINE	TBC	N/A	PL SK No. 0712-A	CARBON STEEL	DIESEL
RELOCATE	FIRE WATER PUMP	TBC	N/A	PL SK No. 0712-A	CARBON STEEL	FIRE WATER
DEMOLISH	FOAM PREMIX HYDRANT RISER	TBC	N/A	WS 0000	CARBON STEEL	FOAM PREMIX
DEMOLISH	FOAM PREMIX HYDRANT RISER	TBC	N/A	WS 0000	CARBON STEEL	FOAM PREMIX
DEMOLISH	FOAM PREMIX HYDRANT RISER	TBC	N/A	WS 0000	CARBON STEEL	FOAM PREMIX
DEMOLISH	FOAM PREMIX HYDRANT RISER	TBC	N/A	WS 0000	CARBON STEEL	FOAM PREMIX
DEMOLISH	FIRE WATER HYDRANT RISER	TBC	N/A	WS 0000	CARBON STEEL	FIRE WATER
DEMOLISH	FIRE WATER HYDRANT RISER	TBC	N/A	WS 0000	CARBON STEEL	FIRE WATER
RELOCATE	HEAT EXCHANGER	TBC	N/A	PL SK No. 0712-A	CARBON STEEL	

APPENDIX B: EXISTING FIRE SYSTEM BILL OF MATERIALS

PROJECT DETAILS		REVISION HISTORY		DOCUMENT DETAILS	
				Document Number	11364-A1177
				Revision No	A
				Revision Date	2026/01/28
				Revision Description	Issued for Comment
Client	TRANSNET PIPELINES	A	ISSUED FOR ACCEPTANCE	Prepared By	N Perumal
Project Name	TPL HW FIRE			Checked By	B Jones
Project Number	11364			Approved By	B Jones

DEMOLITION BILL OF MATERIALS

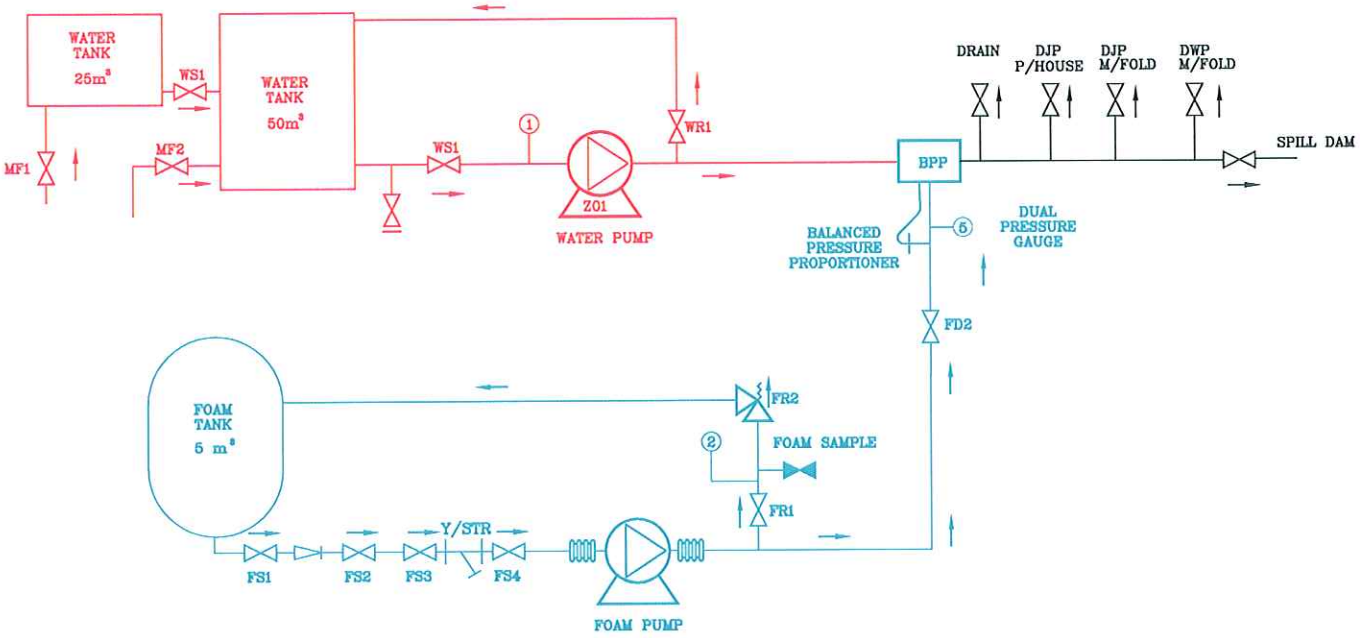
AREA	DESCRIPTION	'ERIAL OF CONSTRUCT	PROCESS FLUID	SIZE	LENGTH (m)
WATER TANK	TANK FILL INLET	CARBON STEEL	FIRE WATER	80NB	5
	RECIRCULATION LINE FROM PUMP HOUSE	CARBON STEEL	FIRE WATER	100NB	6
	WATER DISCHARGE TO PUMP HOUSE	CARBON STEEL	FIRE WATER	200NB	5
	OVERFILL LINE	CARBON STEEL	FIRE WATER	150NB	5
PUMP HOUSE	PUMP HOUSE FOAM PREMIX DISCHARGE	CARBON STEEL	FOAM PREMIX	200NB	4
	MONITOR SUPPLY	CARBON STEEL	FOAM PREMIX	100NB	5
	FOAM CONCENTRATE PIPING	STAINLESS STEEL	FOAM CONCENTRATE	80NB	20
	BUND POURER SUPLY	CARBON STEEL	FOAM PREMIX	150NB	6
	DRAIN	CARBON STEEL	FOAM PREMIX	25NB	5

Comments:

1. Orifice plates, insulation flange kits, reducers, flanges, nuts, bolts, washers and other piping accessories although not inlcuded in the list above, shall be considered a part of the bill of materials in the demolition scope of work.

APPENDIX C: EXISTING FIRE SYSTEM FLOW DIAGRAM AND SITE LAYOUT

NORMAL VALVE SETTING FOR HOWICK FIRE PROTECTION (FOAM AND WATER)



LEGEND

- PREMIX
- WATER
- FOAM
- VALVE NORMALLY OPEN
- VALVE NORMALLY CLOSED
- NON-RETURN VALVE
- CONTROL VALVE
- PRESSURE GAUGE
- PRESSURE RELIEF VALVE
- ACTUATED VALVE
- Y/STRAINER

NOTE: PREMIX COLOR CODE WHITE

FIRE FIGHTING AND POLLUTION CONTROL INSTRUCTION 1

OPERATION OF DIESEL ENGINE POWERED FIRE FIGHTING SYSTEMS ON TRANSNET PIPELINES PREMISES

THE SYSTEM MUST RUN ONCE A WEEK FOR NOT LESS THAN 45 MINUTES WITH WATER CIRCULATING. ONCE A MONTH, DURING ONE OF THESE TESTS, WATER MUST FLOW THROUGH THE RING MAIN FOR A PERIOD OF 2 MINUTES.

THE FOLLOWING MUST BE CHECKED BEFORE STARTING THE PLANT

A ENGINE

1. ENGINE OIL LEVEL.
2. ENGINE COOLANT LEVEL (WHERE APPLICABLE). USE ONLY INHIBITED WATER TO TOP UP.
3. FUEL LEVEL AND FUEL WATER TRAP. DRAIN WATER IF NECESSARY.
4. LOOSE OR DAMAGED PARTS.
5. WORN OR DAMAGED BELTS.
6. AIR INTAKE SYSTEM.
7. BATTERY ELECTROLYTE LEVEL, WASH BATTERY, CLEAN AND LIGHTLY GREASE TERMINALS 3 MONTHLY.
8. BATTERY CAPACITY TEST ANNUALLY.

B WATER CIRCULATING PUMP

1. COUPLING.
2. PIPE CONNECTIONS TO PUMP. CORRECT LEAKS OR LOOSENESS.
3. GLAND PACKINGS AND SEAL LEAKS.

C FOAM PUMP

1. COUPLING.
2. PIPE CONNECTIONS TO PUMP.
3. GLAND PACKINGS AND SEAL LEAKS.

D GEARBOX DRIVE TO FOAM PUMP

1. OIL LEVEL.
2. COUPLINGS.

E. VALVES

ACTUATE ALL VALVES FOR FREEDOM OF OPERATION.

F FOAM STORAGE

1. CHECK LEVELS OF FOAM. TOP UP FOAM TANK IF LOW
2. TEST FOAM CONCENTRATE ANNUALLY FOR POSSIBLE DILUTION. SAMPLE OF FOAM CONCENTRATE TO BE FORWARDED TO ANGUS FIRE WITH A COMPLETED APPLICATION FORM.
3. CHECK THAT RESERVE STOCKS OF FOAM IN CONTAINERS ARE NEATLY STACKED AND THAT QUANTITY IS IN ACCORDANCE WITH AGREEMENTS WITH LOCAL AUTHORITIES AND OUR OWN NEEDS DETERMINED BY THE CONTINGENCY PLAN.
4. CHECK CONDITION OF CONTAINERS AND REPLACE IF NECESSARY.

G WATER STORAGE (TIME BASIS)

1. CHECK LEVEL OF TANK. ADJUST OR REPAIR FLOAT MECHANISM IF FOUND INCORRECT.
2. CLEAN ANY DEBRIS FROM TANKS THAT MIGHT BLOCK PIPES.

H OSCILLATING MONITORS

CHECK EASE OF OPERATION MONTHLY AND GREASE 3 MONTHLY.

BEFORE ACTIVATING THE START BUTTON OPEN AND CLOSE THE RELEVANT VALVES (APPLICABLE TO PARTICULAR SYSTEM) SO THAT WATER AND FOAM SUPPLY WILL CIRCULATE BACK TO THEIR RESPECTIVE TANKS (SEE FLOW DIAGRAM FOR VALVE POSITIONS.)

ON COMPLETION OF THE TEST, THE SYSTEM IS TO BE RESET TO THE CHARGED POSITION FOR WATER AND FOAM SUPPLY AS DEPICTED ON FLOW DIAGRAM.

THE FOLLOWING MUST BE CHECKED WHILE THE SYSTEM IS OPERATING:

1. ENGINE OIL PRESSURE.
2. COOLANT TEMPERATURE (WHERE APPLICABLE)
3. PUMP DELIVERY PRESSURE. THIS MUST NOT BE LESS THAN RATED PRESSURE (AS PER DIAGRAM).
4. SYSTEM FOR LEAKS.
5. PUMP GLANDS FOR EXCESSIVE LEAKS (VERY SLIGHT LEAKS ACCEPTABLE).
6. PRESSURE READINGS TO BE RECORDED AT EVERY TEST PROCEDURE.
   a) FOAM PUMP
   b) WATER PUMP
   c) VARIABLE / BALANCE FLOW PROPORTIONER.

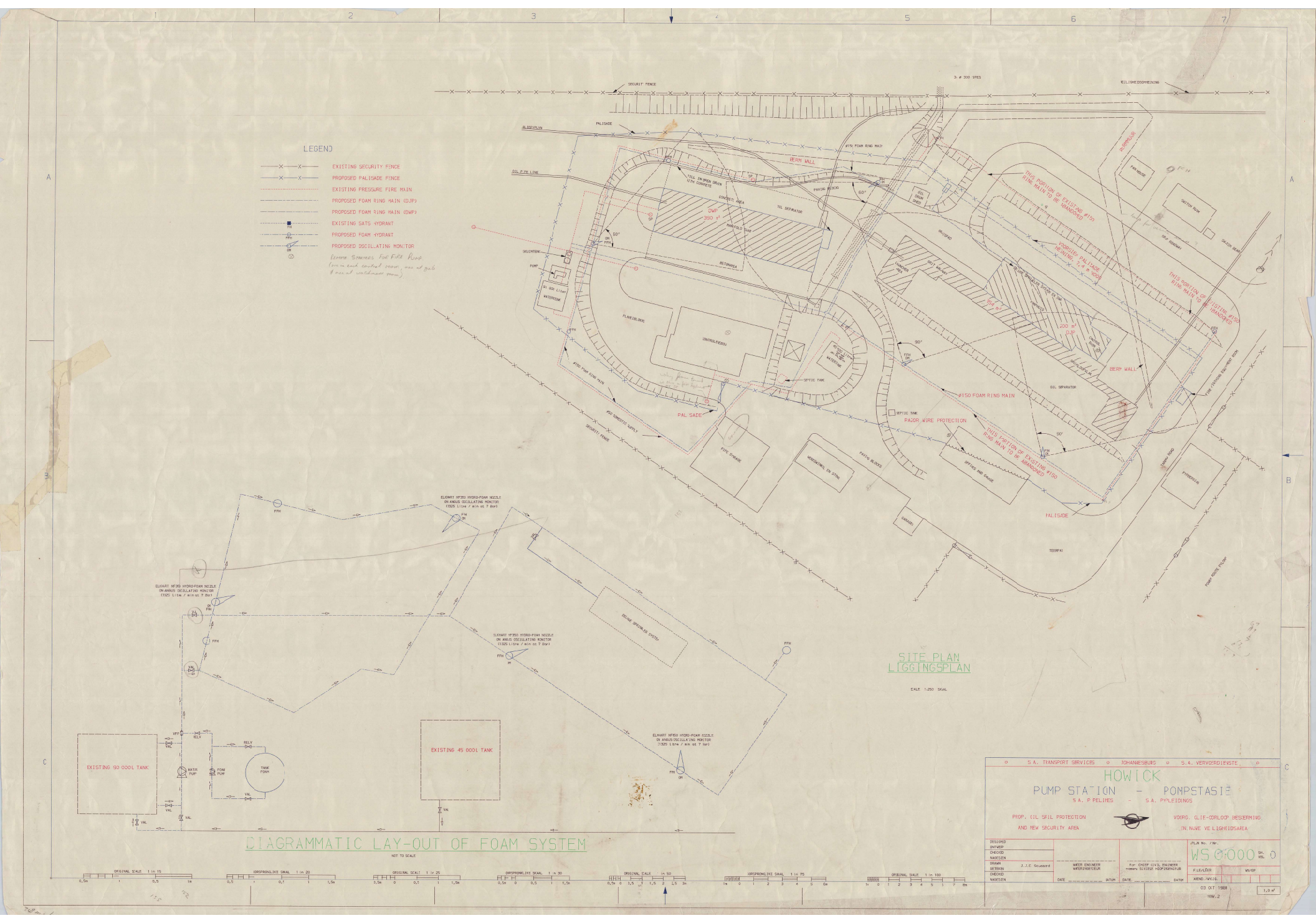
MAINTENANCE AND SERVICING OF EQUIPMENT

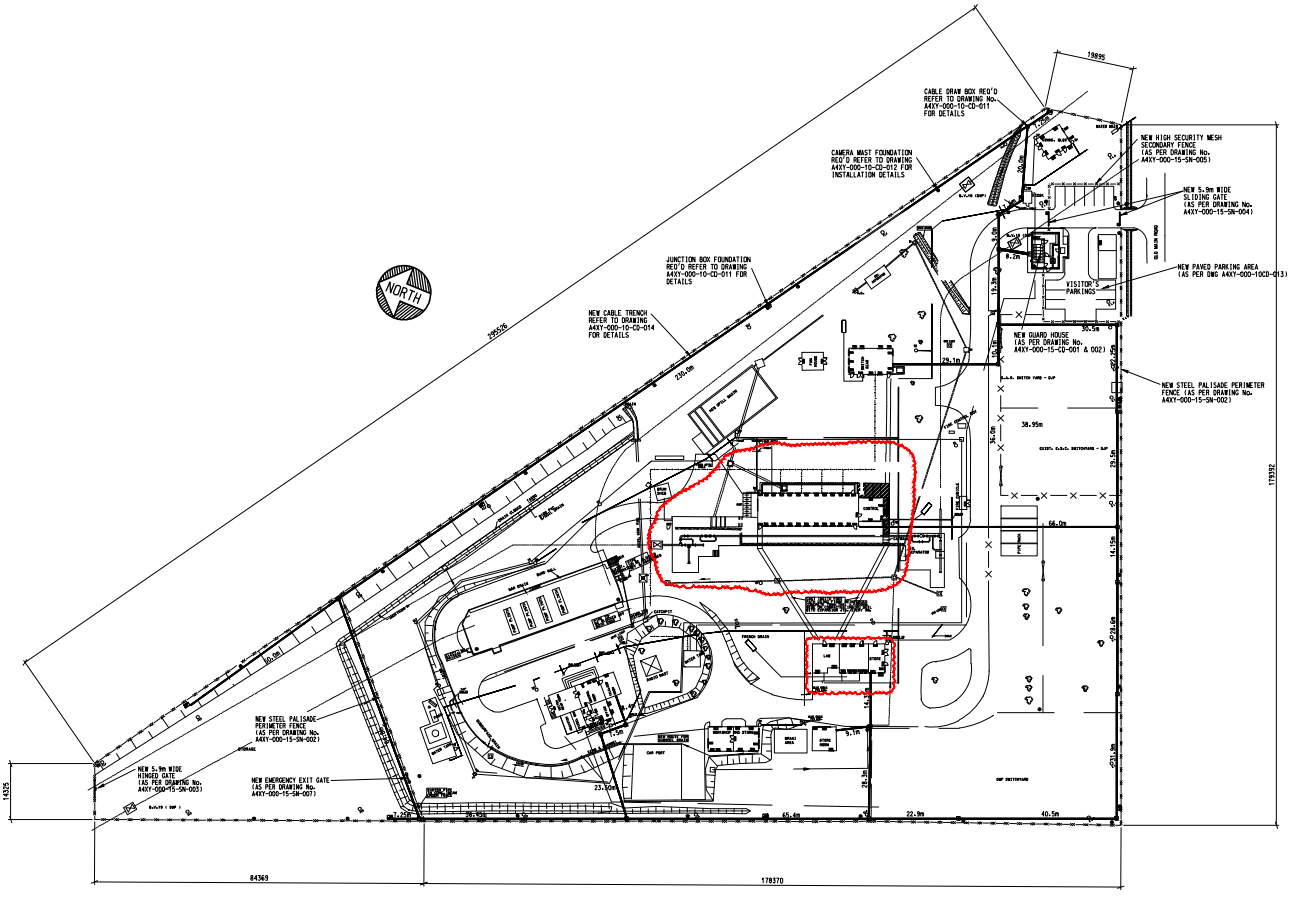
TO BE DONE AS PER TASK LIST INDICATED ON THE SAP SYSTEM OF TRANSNET PIPELINES.

COMPILED BY
H.J. NURCOMBE–THORNE

UPDATED BY BD NGCOBO
DATE: 11–11–2009

DRN. B.D.N DATE 12–11–2009
PL SK No. 0712–A


LEGEND
EXISTING SECURITY FENCE
PROPOSED PALISADE FENCE
EXISTING PRESSURE FIRE MAIN
PROPOSED FOAM RING MAIN (DJP)
PROPOSED FOAM RING MAIN (DWP)
EXISTING SATS HYDRANT
PROPOSED FOAM HYDRANT
PROPOSED OSCILLATING MONITOR
REMOTE STARTING FOR FIRE PUMP
SECURITY FENCE
PALISADE
OIL PIPE LINE
BERM WALL
#150 FOAM RING MAIN
CONCRETE AREA
OIL SEPARATOR
DWP 350 m³
PAVING BLOCKS
SKIMTANK
PUMP
50 000 Litre WATERTANK
PLANTBUNDU
CONTROLGEBOU
SEPTIC TANK
PIPE STRAMS
PALISADE
RAZOR WIRE PROTECTION
THIS PORTION OF EXISTING #150 RING MAIN TO BE ABANDONED
VOORSIEN PALISADE HEINING
OFFICES AND GARAGE
GARAGE
TEERPAD
SWITCH ROOM
SKAKEL GEAR
PYPBRUG
TOWER STARTING EQUIPMENT ROOM
DIESEL SPRINKLER SYSTEM
ELKHART HF350 HYDRO-FOAM NOZZLE ON ANGUS OSCILLATING MONITOR (1325 Litre / min at 7 Bar)
EXISTING 90 000L TANK
EXISTING 45 000L TANK
WATER PUMP
FOAM PUMP
TANK FOAM
DIAGRAMMATIC LAY-OUT OF FOAM SYSTEM
NOT TO SCALE
SITE PLAN
LIGGINGSPLAN
SCALE 1:250 SKAAL
S.A. TRANSPORT SERVICES · JOHANNESBURG · S.A. VERVOERDIENSTE
HOWICK
PUMP STATION - POMPSTASIE
S.A. PIPELINES - S.A. PYPLEIDINGS
PROP. OIL SPILL PROTECTION AND NEW SECURITY AREA
VOORS. OLIE-OORLOOP BESKERMING EN NUWE VEILIGHEIDSAREA
DESIGNED
DRAWN
CHECKED
TRACED
J.J.C Goussard
WATER ENGINEER WATERINGENIEUR
DATE
For CHIEF CIVIL ENGINEER namens SIVIELE HOOFINGENIEUR
PLAN No. / Nr.
WS 6000 SH. 0 VEL
FILE/LÊER
AMEND. / WYSIG.
03 OCT 1988
HOW. 2
ORIGINAL SCALE 1 in 15
ORIGINAL SCALE 1 in 20
ORIGINAL SCALE 1 in 25
ORIGINAL SCALE 1 in 30
ORIGINAL SCALE 1 in 50
ORIGINAL SCALE 1 in 75
ORIGINAL SCALE 1 in 100



PLAN LAYOUT ON MODIFICATIONS

KEY

	NEW PERIMETER FENCE
	NEW SECONDARY FENCE
	EXISTING FENCE LINE
	NEW MANUAL GATE
	NEW AUTOMATED GATE
	EMERGENCY EXIT GATE
	PROPOSED CABLE TRENCH
	CAMERA MAST FOUNDATION
	JUNCTION BOX FOUNDATION
	CABLE DRAW BOX

NO FIRE PROTECTION NEEDED

SENSITIVE BUILDINGS
CONTROL BUILDING
SWITCHGEAR ROOM
FAN HOUSE
WORKSHOP & STORE
PUMP HOUSE

DWG No.	DESCRIPTION
A4XY08-HWR-219C-004	WINDOW SCHEDULE
A4XY-000-10-CD-014	TYPICAL TRENCHING DETAILS
A4XY-000-10-CD-013	ROAD LAYERWORKS & KERB DETAILS
A4XY-000-15-CD-012	CAMERA MAST- INSTALLATION DETAILS
A4XY-000-10-CD-011	TYPICAL DRAW BOX CONC LAYOUT & DETAILS
A4XY-000-15-CD-001	SECURITY GUARD HOUSE DETAILS-PLANS
A4XY-000-15-CD-002	SECURITY GUARD HOUSE DETAILS -SECT.
A4XY-000-15-SN-002	STEEL PALISADE FENCE STANDARD DETAILS
A4XY-000-15-SN-003	STEEL PALISADE HINGED GATES STANDARD DETAILS
A4XY-000-15-SN-004	5.9m WIDE SLIDING GATES STANDARD DETAILS
A4XY-000-15-SN-005	HIGH SECURITY STEEL MESH FENCE STANDARD DETAILS
A4XY-000-15-SN-007	EMERGENCY EXIT GATES STANDARD DETAILS

REFERENCE DRAWINGS

REFERENCES

DWG NUMBER	DESCRIPTION

REVISIONS

REVISION	DATE	DESCRIPTION	CHK	APP
A	KN 22/07/24	SECURITY UPGRADE INCLUDED -A4XY08-HWR-10-CD-001-E		

TRANSNET pipelines

HOWICK SITE LAYOUT

PROJECT NAME	TRANSNET PIPELINES		
DRAWN		REF.	-
TRACED	CAD	DATE	02-07-2024
CHECKED		APPROVED	ZM
SCALE	N.T.S.		
DRAWING No.	PL 112878	REV	A

Specification

Thermal Relief Valve, Screwed type for Petroleum Product Service

PL 203/B

March 2014

1. SCOPE

1.1 This specification covers Transnet Pipelines' requirements for a thermal relief valve with screwed connections. (Also known externally as safety relief or pressure relief valve).

1.2 The valve is to be suitable for installation in the horizontal, vertical or inclined position.

1.3 Operating temperature will not exceed 45°C.

1.4 This specification must be read in conjunction with Transnet Pipelines Specification No. PL.2/A - General Specification - Steel valves for Petroleum Product service.

2. TECHNICAL INFORMATION REQUIRED

2.1 Tenderers shall complete the relevant questionnaire in full and shall indicate whether their offer complies with each item of the requirements.

2.1.1 Should there be insufficient space for furnishing full details, the tenderer shall provide the additional details in a covering letter. The details shall be numbered in accordance with the applicable clause specified in section 3 of this specification.

2.2 Offers will not be considered unless full particulars and sufficient literature is provided at the tendering stage to enable Transnet Pipelines to assess each offer properly.

3. SPECIFICATION

PARAGRAPH	DESCRIPTION	DETAILS OF OFFER
3.1	**Valve**	
3.1.1	Valve must be of the spring-loaded right angle type.	
3.1.2	Inlet connection to be Male NPT, 160 schedule, ½" inlet fitting for ANSI (150#, 300#, 600#) and ¾" inlet fitting for ANSI 900#: ¾"	
3.1.3	Outlet connection to be 1" Female NPT unless otherwise specified.	

3.1.4	Valve to be so designed that all trim parts are easily renewable.	
3.2	**Valve stem**.	
3.2.1	Valve stem (spindle) to be of a non-corrosive and non-erosive material (material to be specified) and mounted vertically in valve.	
3.2.2	The top of the stem is to be protected by a cap.	
3.3	**Spring**	
3.3.1	Spring to be of a non-corrosive and non-erosive material (material to be specified) and mounted within a bonnet screwed to the body.	
3.3.2	A spring adjusting screw and an adjusting screw lock nut must be provided. The valve to be provided with a lifting lever.	
3.3.3	Adjustment of the spring must be possible without having to remove the valve from the pipework.	
3.4	**Nozzle**	
3.4.1	Nozzle to be removable and fitted with an adjustable blow down regulating ring with locking stud.	
3.5	**Disc**	
3.5.1	To be of the single, self-aligning type seating drop tight on the nozzle face under all spring seating pressures below the set pressure of the valve.	
3.6	**Body**	

3.6.1	Body / bonnet to be of cast steel. (Material to conform to API SPEC 6D-Latest).	
3.7	**Settings**	
3.7.1	Unless specified, standard settings are: Low pressure manifolds ANSI 150# 1 900kPag High pressure manifolds ANSI 600# 9 900kPag ANSI 900# 12 280kPag Other ANSI 300# 4 500kPag	

I confirm that all information furnished is correct and complies with Transnet Pipelines Specification PL 203/B.

Signature: _____ Designation: _____

Name: _____ Company: _____

Date: _____

Witness 1: _____ Witness 2: _____

Specification for Painting of Manifold Piping and Ancillary Equipment

Document number	TPL-TECH-M-SPEC-PL407
Version number	2.0
Classification	Internal Usage
Revised date	06 November 2024

SUMMARY VERSION CONTROL

VERSION NO.	NATURE OF AMENDMENT	PAGE NO.	DATE REVISED
1.0	1st Revision		07 Aug 2020
2.0	Addition of Thermal Spray Aluminium (TSA) and amendment of tank clauses.		06 Nov 2024

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DOCUMENTATION SIGN-OFF SHEET

I, the undersigned hereby approve this procedure.

ROLE	CAPACITY/ FUNCTION	SIGNATURE	DATE
Revised By:	**Mechanical Specialist**		06 Nov 2024
Accepts document for adequacy and practicability. Comments By: Frans Maditse			
Approval:	**Principal Mechanical Engineer**		11/11/24
Approves document for use. Comments:			

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1. PURPOSE

This specification details requirements for the corrosion protection/painting of structural steelwork, piping and associated equipment for the above-ground-structures of Transnet Pipelines. It covers the selection and application of protective coating systems and the requirements for labour, tools, materials, equipment and quality control at the service providers workshop or on TPL site.

2. GENERAL REQUIREMENTS

The requirements of ISO 12944:1998 shall apply as a minimum to all coating application activities. Supplementary requirements are given in this document. In the event of conflict between this document and the ISO standard, the requirements of this document will prevail.

The application contractor shall be responsible for ensuring that he is fully conversant with the requirements of this specification and the relevant coating systems.

Only skilled blasters, painters, thermal sprayers shall be used, and they shall be trained in accordance with NACE and ASTM 4228-99 for new Projects. All supervisors involved with any coating activity shall be suitably certified and skilled. An appropriately trained foreman shall supervise the blasters and applicators. Certifying bodies shall comply with ISO/IEC 17024. All Inspection, Quality Control and Quality Assurance personnel shall be individually certified by a recognized Body, e.g., NACE, SAQCC and agreed by Transnet.

2.1 Design Considerations

2.1.1 Steel components should be designed to be accessible for the purposes of applying, inspecting and maintaining the protective coating system.

2.1.2 The guidelines to ensure accessibility and suitability for painting shall be drawn from ISO 129443:1998 'Paint and varnishes – Corrosion protection of steel structures by protective paint systems' Part 3 – 'Design considerations'.

2.1.3 Steel components that are to be hot dip galvanised shall be designed in accordance with the ISO 14713 'Protection against corrosion of iron and steel structures – Zinc and aluminium coatings – Guidelines' and the 'Design for Hot Dip Galvanizing' guidelines from the Hot-Dip Galvanizers Association Southern Africa.

2.2 Qualified Staff

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2.2.1 The application contractor shall ensure that there are at all times sufficient suitably qualified, experienced and skilled staff to carry out and supervise all activities.

2.2.2 Staff shall be qualified in terms of the South African Qualification and Certification Committee for Corrosion {SAQCC(Corrosion)} as follows:
Applicators: General Heavy Duty Coatings Applicator (PA1)
Supervisors: General Paint Supervisors (PS1)
Inspectors: Coating Inspectors (Level 2) or NACE CIP 1

2.2.3 Alternative qualifications may be considered for approval by the Engineer subject to submission of detailed syllabus for review. Courses submitted for consideration must be examined and have unique certification traceability.

3. References

All national and international standards referred to in this document shall form part of this specification. Where reference is made to a code, specification or standard the reference shall be taken to mean the latest edition of the code, specification or standards including addenda, supplements and revisions thereto.

3.1 South African Bureau of Standards (SANS) Codes of Practice,

Specifications
SANS 1217 Internal and external organic coating protection for buried steel pipelines.
SANS 1274 Coatings applied by the powder coating process.

Methods

SANS 5769 Cleanliness of blast cleaned surfaces for painting (assessed by freedom from dust and debris).

SANS 5772 Profile of blast cleaned surfaces for painting (determined by a micrometre profile gauge).

3.2 International Organisation for Standardisation

ISO 4624 Paints and varnishes – Pull-off test for adhesion.

ISO 4628-3 Paints and Varnishes –

Designation of quantity and size of defects, and intensity of uniform changes in appearance.

Part 1 General introduction and designation system.

Part 2 Assessment of degree of blistering.

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Part 3 Assessment of degree of rusting.

ISO 8501-1 Preparation of steel substrates before application of paints and related products -Visual assessment of surface cleanliness.

ISO 8502-3 Preparation of steel substrates before application of paint and related products – Tests for the assessment of surface cleanliness -Part 3: Assessment of dust on steel surfaces prepared for painting (pressure sensitive tape method).

ISO 8503-4 Preparation of steel substrates before application of paint and related products – Surface roughness characteristics of blast cleaned steel substrates – Part 4: Method for the calibration of ISO surface profile comparators and for the determination of surface profile – stylus instrument procedure.

ISO 8504 Preparation of steel substrates before application of paint and related products – Surface preparation methods.

ISO 12944 Paint and varnishes – Corrosion protection of steel structures by protective paint systems. Parts 1 to 8.

ISO 14713 Protection against corrosion of iron and steel structures – Zinc and aluminium coatings – Guidelines.

ISO 145 Hot dip galvanised coatings on fabricated iron and steel articles Specification and test methods.

ISO 209 Aluminium and aluminium alloys – Chemical composition

ISO 2808 Paints and varnishes - Determination of film thickness

3.3 ASTM

ASTM E337 Standard Test Method for Measuring Humidity with a Psychomotor [The Measurement of Wet and Dry Bulb Temperatures].

ASTM A123/A123M Standard Specification for Zinc (Hot–Dipped Galvanized). Coatings on Iron and Steel Products.

ASTM D1293 Standard Test Methods for PH of Water.

ASTM D3359 Standard Test Method for Measuring Adhesion by Tape Test.

ASTM D4285 Standard Test Method for Indicating Oil or Water in Compressed Air.

ASTM D4541 Standard Test Method for Pull–Off Strength of Coatings Using Portable Adhesion Testers.

ASTM D4752 Standard Test Method for Measuring MEK Resistance of Ethyl Silicate (Inorganic) Zinc–Rich Primers by solvent Rub.

3.4 NACE/SSPC

NACE No5/SSPC SP12 Surface Preparation and Cleaning of Metals by Water

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Jetting Prior to Recoating.
NACE 6A192/SSPC TR3 Dehumidification and Temperature Control During. Surface Preparation, Application and Curing for Coatings / Linings of Steel Tanks, Vessels and Other Enclosed Spaces.
NACE 6G198/SSPC TR 2 Wet Abrasive Blast Cleaning
NACE RP0169 Control of External Corrosion on Underground or Submerged Metallic Piping Systems
NACE SP0169 Control of External Corrosion on Underground or Submerged Metallic Piping Systems
NACE SP0178 Design, Fabrication, and Surface Finish Practices for Tanks and Vessels to Be Lined for Immersion Service
NACE SP0188 Discontinuity (Holiday) Testing of New Coatings on Conductive Substrates
NACE SP0198 Control of Corrosion under Thermal Insulation and Fireproofing Materials – A Systems Approach

3.5 Hot-Dip Galvanizers Association Southern Africa

SAHDGA 01-1990 Code of Practice for Surface Preparation and Application of Organic Coatings.

Steel Protection by hot Dip Galvanizing and Duplex Coatings – Chapter 9 – Design for Hot Dip Galvanizing.

3.6 SSPC (Steel Structure Painting Council) SSPC-PA2 Measurement of Dry Paint Thickness with Magnetic Gauges. SSPC-SP1 Solvent Cleaning

SSPC–PA Shop, field and Maintenance Painting of Steel
SSPC–PA2 Measurement of Dry Coating Thickness with Magnetic Gauges
SSPC–Vis3 Guide and Reference Photographs for Steel Surfaces Prepared by Hand and Power Tool Cleaning

3.7 For the Purposes of Aboveground Storage Tanks Refer to:

PL 838/2D for Internal Coating and

PL 838/1C for external coating.

4. EQUIPMENT

4.1 Measuring and Testing Equipment

4.1.1 The application contractor shall have a blast profile gauge, wet film comb, and a dry film thickness gauge at the shop/site at all times. The contractor shall also have at the shop/site instrumentation to measure the pshychromatic conditions and the substrate temperature.

4.1.2 The electronic dry film thickness gauge shall conform to the requirements of SABS ISO 2808:1997 and shall be calibrated using the smooth calibration disc supplied by

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the instrument manufacturer.

4.1.3 All test equipment shall have current calibration certificates.

4.2 Spray Equipment

4.2.1 The spray equipment used shall be capable of properly atomising the material and shall be equipped with suitable pressure regulators and gauges. Air caps, needles and nozzles shall be of the type recommended by the coating manufacturer.

4.2.2 All spray-painting equipment shall be fitted with suitable oil and moisture traps.

4.3 Blast Cleaning Equipment

Effective oil and water separators shall be utilised on all airlines used for abrasive blast cleaning. The separators shall be of the 'cartridge' type.

4.4 Power Mixers

Coatings shall be mixed with power mixers. Low speed mixers which do not induce air into the coating shall be utilised.

5. COATING MATERIALS

5.1 Only approved coating materials as detailed in the relevant specifications shall be used.

5.2 All coating systems used shall be suitable for the intended service in terms of environmental classifications of ISO 12944.

5.3 Coating materials from different manufacturers shall not be mixed in the same coating systems.

5.4 Coatings shall only be supplied by the approved coating manufacturers. The application contractor shall obtain a copy of the coating Batch Certificate, the Product Data Sheet and the Material Safety Data Sheet from the coating manufacturer prior to using the material.

5.5 The solvents used shall be those recommended and manufactured by the coating manufacturer. Where the recommended 'solvent' and 'clean-up thinners' for a material differ, the 'clean-up' solvent must not be added to the coating for dilution purposes.

5.6 The type of thinner and quantities used shall comply with the manufacturer's recommendations. This is to be recorded. All quantities to be measured using suitable measuring beakers or rulers. Lacquers thinners is only permitted to be used for flushing of spray lines and cleaning of equipment and this must be completely removed prior to new coating material being used with such equipment.

5.7 Excessive dilution of paints is not permitted. Solvent additions for application purposes shall be in strict accordance with the coating manufacturer's Product Data Sheet. The maximum capacity of containers shall be 25 litres.

5.8 The coating manufacturer's recommended shelf life and other storage requirements shall be met.

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5.9 The colours of the paints to be used shall be as specified by the Engineer and shall comply with SANS 1091.

5.10 No coated items shall be dispatched to site until they have been inspected and cleared and a certificate issued that the work has been carried out to specification.

5.11 All paints and coatings shall be brought to site in new unopened containers. All containers shall be clearly marked with the manufacturer's material batch numbers.

5.12 The application contractor shall ensure that the colour selection of the coat immediately prior to the finishing coat shall be suitable for complete obliteration by the finishing coat.

5.13 All corrosion prevention shall conform to this specification and standards and codes of practice. A concession needs to be requested for any deviations from this specification. Any concession shall be part of Databooks.

6. GENERAL PAINTING REQUIREMENTS

6.1 Identification of Non-Painted Items

The following items do not require any surface preparation or painting unless otherwise specified:

- Non-metallic items such as concrete, glass, plastic, wood etc.
- Non-ferrous metals such as aluminium, copper, brass, etc.
- Insulation weatherproofing.
- Stainless steel surfaces.

6.2 Items Requiring Protection from Painting

6.2.1 Surfaces that could be damaged by abrasives, dust or paint overspray shall be protected by wrapping, taping, or other means to prevent damage. Such surfaces shall include, by way of example, but not by limitation, the following:

- Alloys (Monel, Incaloy or Hastelloy)
- Bearings
- Conduit
- Control panels
- Control valves
- Couplings
- Equipment nameplates
- Expansion joint bellows
- Fire sprinkler heads
- Flange and nozzle faces
- Glass, rubber, gasket materials etc.
- Identification tags
- Instrument glasses and gauge dials
- Wall thickness gauge points
- Machined surfaces (sealing, threads, valve stems, pump and cylinder rods, shafts etc.)

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- Screws
- Spring hanger graduations
- Stainless steel surfaces (except as specified)
- Valve stem and position indicators.

Note: Stainless steel surfaces shall be protected from zinc and aluminium rich coatings. Any accidental overspray of zinc and aluminium, including trace amounts, over stainless-steel surfaces must be completely removed.

7. COATING MATERIAL REQUIREMENTS

7.1 Coating materials used, and in particular tank linings, shall be compatible with the following list of petroleum products:

- Diesel – LSD & ULSD
- Jet fuel
- Unleaded petrol – 93 & 95
- Crude Oil.

7.2 Unleaded petrol will contain

- Benzine
- Toluene
- Xylene
- Ketones (known in USA as 'Oxygenated Gasoline').

7.3 All responsibility shall be placed on the coating manufacturer for ensuring the suitability of the proposed coating materials and their compliance with the guarantee requirements given in Section 17 of this document.

7.4 The Engineer's approval shall not exonerate the coating manufacturer or coating applicator from any liability, should the linings fail within the guarantee period.

8. SURFACE PREPARATION

8.1 General

8.1.1 Sharp edges shall be dressed to a radius of not less than 2mm, but no more than half of the wall thickness. All burrs, rags and weld spatter shall be removed as per the requirements of ISO 12944-3.

8.1.2 Welds should be free from imperfections (e.g. asperities, undercutting, blowholes, craters, and spatter) which are difficult to cover effectively with a protective paint system.

8.2 Pre-cleaning

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8.2.1 Oil and grease shall be removed by high pressure water washing with detergent solution and rinsing with clean water prior to abrasive blast cleaning and application of coatings.

8.2.2 Chemical contamination shall be removed by means of neutralising, flushing, or both prior to additional surface preparation.

8.3 Mechanical and Hand Cleaning

8.3.1 Mechanical cleaning shall be in accordance with the procedure specified in Clause 4.3 of SANS 10064 (ISO 8504).

8.3.2 The standard of surface preparation shall be in accordance with ISO 8501/1 and as specified in the relevant coating system.

8.4 Abrasive Blast Cleaning

8.4.1 Abrasive blast cleaning shall be carried out in accordance with Clause 4.3 of SANS 10064 (ISO 8504) and the degree of cleanliness achieved shall be in accordance with ISO 8501/1 as specified in the relevant coating system.

8.4.2 The profile, peak to valley, when measured by SANS 5772 (ISO 8503-4), shall be as specified in the relevant manufacturer's Data Sheet for the primer coating being used.

8.4.3 The abrasive may be any abrasive material (except silica sand) which meets the following requirements. It shall be composed of clean, sound, hard particles free from foreign substances such as dirt, oil, grease, toxic substances, organic matter and water-soluble salts. It shall be capable of producing the surface profile as specified for the relevant coating system.

8.5 Surface Cleanliness

8.5.1 No coating shall be applied to any surface containing traces of grit, grease, oil, loose rust, mill scale, surface contaminants (i.e. dust), chemical fall-out, salt deposits or corrosion products of any kind.

8.5.2 The following requirements shall apply prior to coating application:

- Freedom from dust and debris shall be less than 0.2% when tested in accordance with SANS 5769 (ISO 8502-3).
- If the blast cleaned surface changes colour, or rust bloom begins to form, the surface shall be reblasted.

8.6 Soluble Salts

8.6.1 Soluble salts shall be removed by cleaning and flushing with fresh potable water. Persistent salt deposits may be removed by proprietary solutions with the prior approval of the Engineer.

8.6.2 Soluble salts levels shall be measured using Weber Rielly Soluble Salts Test Kits or equivalent approved methods. The level of salts shall not exceed as per below given table:

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Table

Coating Category	New Construction	Maintenance
Internal surfaces	50 mg/m^2	50 mg/m^2
External surfaces	100 mg/m^2	100 mg/m^2

8.7 Stainless-Steel

8.7.1 The preferred method of surface preparation for coating of stainless-steel surfaces is by means of abrasive blasting with ceramic grit. All other requirements of section 8 shall apply to stainless steels.

8.7.2 Alternative preparation regimes may be applied (e.g. acid pickling) subject to submission of detailed procedures and approval by the Engineer.

9. COATING APPLICATION

9.1 Approval

No work shall be performed until the Quality Control Plan is approved by the Engineer or the Project Manager.

9.2 Mixing

9.2.1 The application contractor shall ensure that all paints are mixed in accordance with the coating manufacturer's instructions.

9.2.2 During application, containers shall be agitated often enough to keep pigments in suspension.

9.3 Coating

9.3.1 All surfaces shall be coated as specified. Surfaces which do not require coating shall be suitably protected as per clause 6.2.

1.1.1 The primer coat shall be applied as soon as possible after the surface preparation operation and at least during the same shift as the blast cleaning operation, but under no circumstances may the primer be applied over rust bloom or over surfaces

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that have changed colour due to humidity or other contamination.

9.3.2 Successive coats shall be of distinctly different colour to the previous coat to ensure correct coverage. Special attention shall be given to cracks, crevices and edges to ensure complete coverage and paint thickness.

9.3.3 On pre-coated surfaces all traces of soluble salts and other corrosive airborne contaminants shall be removed with potable water and surfaces shall be allowed to dry prior to further paint application.

9.3.4 Concealed surfaces shall be completely coated. Suitable sponges may be used for application of coating to concealed surfaces or back to back angles. In the case where it is impractical to coat the concealed surface, the opening shall be sealed utilising an approved mastic material.

9.3.5 All edges, corners, bolt holes, cut ends and weld beads shall be stripe coated by brush application, prior to the application of the intermediate coat. The stripe coating shall be an additional coat of the specified intermediate coat. In order to assist in its identification, the stripe coat shall be a different colour to both the specified intermediate coat and finishing coat.

9.3.6 The stripe coat is not intended to increase the overall specified dry film thickness of the system but to ensure that the minimum thicknesses required are actually achieved at the edges.

9.4 Application

9.4.1 Unless otherwise specified, all coatings applied in the shops or on site shall be airless spray applied.

9.4.2 In instances where spray application is considered not to be possible, practical or feasible, this must be brought to the attention of the Engineer at the time of tendering.

9.4.3 The application contractor should note that many of the high build coatings specified in the relevant systems are only capable of achieving their recommended film thicknesses by spray application. Other application methods such as brush and roller can result in lower film builds being achieved per coat. The application contractor must take cognisance of this in his tender. If during the course of the project the application contractor is instructed to change his method of application any labour cost implications must be brought to the attention of the Engineer before any such costs are incurred.

9.4.4 All application work shall be carried out in strict accordance with the recommendations and instructions given in the most current Product Data Sheet supplied by the coating manufacturer. This includes required climatic conditions, methods of surface preparation, substrate temperatures, blast profiles, over coating times, application equipment and methods to be utilised and pertinent requirements not listed in this specification. The Product Data Sheet shall be deemed to be part of this specification.

9.4.5 Prior to the application of any coating material, the selected manufacturer's Product Data Sheet for the material being used shall be obtained by the application

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contractor. A copy of the data sheet shall be signed by the coating manufacturer. This is to ensure that the latest product data sheet has been provided to the contractor, that the coating manufacturer is aware of the relevant coating specification and the conditions under which the material will be applied and to allow for technical back-up where required in support of the joint guarantee as detailed in Section 17.0.

9.4.6 All coatings shall be evenly applied to form a smooth, continuous, unbroken coating free from tears, runs, sags, wrinkles, blisters, mud-cracking, changes in colour or gloss, orange peel, visible pin-holes, dirt, dust or fluff occlusions or any other visible defects.

9.4.7 Surfaces which rest on concrete or other floors shall receive the full coating system prior to erection.

9.4.8 The application contractor shall take adequate precautions to protect areas being painted against contamination and fall-out from adjoining sections of the structure during painting operations, should this become necessary.

9.4.9 Coated steel to be embedded in concrete or soil shall be painted so that the coated areas extend at least 100 mm into the concrete or soil, unless otherwise specified.

9.4.10 Where surfaces are to be welded, no paint shall be applied within 50 mm of the weld and the subsequent intermediate and finishing coats (where applicable) shall be stepped at 25 mm intervals to produce a feathered edge for patch repairs after welding. The steps may be achieved by using masking tape at the time of surface preparation and coating applications. The masking tape on the blast cleaned surface adjacent to the weld area shall be left in place to provide temporary protection until the welding is carried out.

9.4.11 The contractor shall apply the full painting system specified on the bearing surfaces of catwalks before the gratings or relevant floor sections are put in place.

9.5 Ambient Conditions

Coatings shall not be applied under the following conditions:

- When the surface may become damaged by rain, air borne dust, chemical fall-out, fog or condensation. When it is anticipated that these conditions will prevail during the drying period, suitable enclosures shall be provided to protect the surfaces.
- When the ambient air temperature or the steel temperature is outside the coating manufacturer's recommended range.
- When the ambient relative humidity exceeds 85%.

9.6 Galvanizing

9.6.1 Hot dip galvanizing shall be in accordance with the requirements of SANS 121 (ISO 1461:1999).

9.6.2 Galvanized surfaces that are to receive duplex organic coatings shall not be passivated.

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9.7 Thermal Spray Aluminium (TSA)

9.7.1 TSA coatings may be specified as a protective coating for atmospheric exposure, under thermal insulation, hot surface and (sea) water immersion applications. The TSA procedure shall be submitted to Transnet for approval prior application.

9.7.2 TSA will be applicable, if Hot Dip Galvanising is damaged on site before or during installation.

9.8 Patch Repairs to Transport and Erection/Construction Damage

9.8.1 Following erection, all areas of coating damage shall be patch repaired by brush application. The extent of the damage shall be carefully inspected to assess which coats in the system have been damaged. When the damage extends to the steel substrate, all coats in the system shall be reinstated. Areas to be primed shall be cleaned of dust, dirt, grease, salts or other deleterious matter and mechanically cleaned to grade St 3 of ISO 8501/1. All edges of existing coatings shall be feathered back to a hard edge. The patch primer used shall be in accordance with the requirements of the relevant coating system. Areas that become inaccessible after erection **shall** be 100% patch primed and coated prior to erection to the satisfaction of Transnet.

9.8.2 For components that have been fully coated in the shop prior to despatch, patching of the final coat on site may be conducted provided that:

a) The end product is aesthetically acceptable and not "patchwork quilt".

b) Any further finishing coats required to provide an aesthetically acceptable finish shall be at no cost to the owner.

9.9 Fasteners and Friction Grip Surfaces.

9.9.1 All nuts and bolts shall be hot dip galvanized for all galvanized structures.

9.9.2 Friction grip areas shall be left uncoated with the exception of steel work that is either galvanized or primed with inorganic zinc silicate. The uncoated friction grip areas shall be sealed to prevent the ingress of corrodants. The sealer used shall be recommended by the coating manufacturer as being suitable for the environment and compatible with the protective coating system. The sealing material shall be applied either by gun or spatula after erection. Where possible the sealant should be the same colour as the finishing coat.

10. SHOP PAINTING

The application contractor shall furnish the coating materials specified and ensure that they

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are applied in strict accordance with this specification.

The application contractor shall be wholly responsible for surface preparation and coating application. The coated surfaces shall meet the minimum dry film thickness required by this specification.

Where possible all paint coatings up to the intermediate coat stage shall be applied in the shops.
Provisions must be made for the repair of handling damage to the coating after erection and before the application of the finishing coats.

Finishing coat may be applied in the shop prior to despatch to site subject to Engineer's approval.

No site welding is permitted after final coat.

10.1 SITE PAINTING

10.1.1 The application contractor shall furnish the coating materials specified and ensure that they are applied in strict accordance with this specification.

10.1.2 All finishing coats shall be applied on site after erection.

10.1.3 The finishing coats being applied on site shall be sourced from the same manufacturer as the shop applied primer and intermediate coats.

10.1.4 All shop coated surfaces shall be inspected and examined for mechanical damage upon arrival on site. If the damage is excessive, it may be preferable to repair this transport damage before erection whilst access is easier. Alternatively, all repairs may be carried out after erection.

10.1.5 The shop applied coats must be thoroughly washed to remove all traces of dust, dirt, grease, salts or any other forms of surface contamination. Where deemed necessary, detergent cleaners, as recommended by the respective coating manufacturers, may be used.

10.1.6 After cleaning, all areas of damaged coating shall be patch repaired as detailed in 9.7.1. and 9.8.

10.1.7 Where more than one coat is being applied on site, washing as per 8.5 shall be carried out between coats.

11. HEALTH, SAFETY AND ENVIRONMENTAL COMPLIANCE

11.1 General

11.1.1 The application contractor shall ensure that he complies with all statutory regulations, municipal by-laws, etc. concerning pollution and the health and safety of his personnel and members of the public who may be affected by his work.

11.1.2 The application contractor shall provide for all necessary safety assessments precautions and risk.

11.1.3 The application contractor shall advise the Engineer of all hazardous materials to be

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brought on site.

11.2 Safety Plan

The loss control or safety officer shall prepare a safety plan for the area to be worked in, which plan will be adhered to by the application contractor.

11.3 Fire Hazards

The application contractor shall ensure that adequate precautions are taken to avoid fire hazards.

11.4 Storage of Hazardous Materials

11.4.1 Oily or solvent rags shall be kept segregated in closed containers and in minimum quantity. Any spillage of volatile material shall be wiped up immediately.

11.4.2 Solvents and volatile materials shall be stored in designated areas.

11.6 Scaffolds and Rigging

11.6.1 The application contractor shall provide and erect such scaffolds and rigging as may be required. All scaffolds and rigging shall comply with the requirements of the Occupational Health and Safety Act.

11.6.2 Temporary welded support elements are not permitted except where written approval has been granted by the Engineer.

12. INSPECTION AND TESTING

12.1 Surface Preparation

The blast profile shall be measured in accordance with SANS 5772 / ISO 8503-4.

12.2 Visual Inspection

Visual inspection for paint film defects shall be performed after each coat is applied. All defects including pinholes, runs, sags, dry spray etc shall be corrected before the next full coat is applied.

12.3 Dry Film Thickness (DFT)

12.3.1 DFT shall be measured in accordance SABS ISO 2808:1997 or SSPC-PA2 and instruments shall be calibrated using the smooth calibration disc supplied by the instrument manufacturer.

12.3.2 The frequency of dry film thickness readings shall be a minimum of one reading per square metre of coated surface or as agreed between the application contractor and the Engineer at the start of the coating applications.

12.3.3 The DFT is given in a range for each coat in the relevant coating system, these are the required minimum and acceptable maximum thicknesses. No individual thickness shall be less than 90% of the specified minimum thickness and not more than 10% of thickness measurements taken shall be less than the specified thickness.

12.3.4 Where excessive film thickness can be detrimental to the integrity of the coating, the manufacturer's recommended maximum thickness shall apply.

12.3.5 The increase in thickness created by the application of the stripe coat shall not be

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used to justify recorded thicknesses that are in excess of the maximum specified thickness of the system.

12.3.6 All deficient film thicknesses shall be rectified to the approval of the Engineer at the application contractor's expense.
Actual readings and not averages shall be recorded.

12.4 Adhesion Tests

12.4.1 Random pull-off adhesion tests shall be carried out on the applied coatings using the ISO 4624 test method. No adhesion break to the substrate (A/B) shall be allowed unless pull-off values are 5 MPa or more.

12.4.2 The number and location of tests shall be agreed with the application contractor at the start of works.
Repairs to the coating damaged by the tests shall be carried out in accordance with clause 9.7.1.

13. QUALITY ASSURANCE

Application Contractor Qualification

13.1 The Engineer may, at his discretion, require a Quality Audit of the application contractor to ensure that he has the management, facilities and skilled staff to carry out the work in accordance with the specification.

13.1.2 The application contractor shall accept full responsibility for the quality of his work and of materials used, irrespective of any quality surveillance that may be carried out by the Engineer.

13.2 Quality Control

13.2.1 The application contractor shall have the necessary equipment and qualified staff to carry out the quality control required to ensure compliance with the specification.

13.2.2 Quality control shall be carried out by a qualified inspector who is independent of the application activities. Quality control cannot be carried out by the site supervisor or any member of staff involved in production and programming.

The application contractor shall keep at least the following records

- Material batch records
- Product Data Sheets
- Psychrometric records (including steel temperatures)
- Records of surface preparation
- Records of dates and times of the application of each coat
- Dry film thickness measurements per coat

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- Records of specific tests as required by the Engineer

13.2.3 These records shall be kept in a format that meets the approval of the Engineer.

13.2.4 The cost of quality control shall be included in the application contractor's tender price.

13.2.5 Before the commencement of the contract, the application contractor shall prepare a Quality Plan detailing each activity to be carried out during the execution of the works. Each activity shall be supported by a detailed Coating Procedure Specification for that activity. The Quality Plan will also detail the inspection requirements of each specific activity, listing whether it be a review, witness or hold point, and defining the responsibilities of the various parties at each stage of the works.

13.2.6 The application contractor shall provide the necessary documentation to be used during these inspections. Such documentation shall be reviewed and approved by the Engineer beforehand.

13.2.7 All causes for rejection as well as violations against the specification shall be captured and reported as an NCR. NCRs shall be raised by both TPL and the Service Provider. NCRs shall form part of the Data Books.

13.2.8 Punch lists shall form an ongoing part of the quality system to ensure that no step is uncompleted as per the specification. Punch lists shall be signed and dated with an action. The work shall be completed as per the specification and the signed off by the Service Provider once completed. Punch lists shall form part of the Data Books

13.3 Quality Surveillance

13.3.1 The Engineer may employ an independent technically qualified organisation to carry out Quality Surveillance of the work on his behalf. In the event of dispute, the decision of the Engineer shall be final.

13.3.2 For the purpose of carrying out quality surveillance, the Engineer or his authorised representative shall be granted access to any part of the application contractor's premises relevant to the work being carried out, at any reasonable time. The application contractor shall provide, at his own cost, any equipment or labour necessary to gain access to surfaces which are coated, to be coated or are in the process of being coated.

13.3.3 The Engineer or his authorised representative may remove any reasonable samples of materials to be used in the coating application. Rejection of the samples will place a hold on the use of material of the same batch number and may lead to rejection of all that batch of material and the reworking of any components that have already been coated with rejected material.

13.3.4 The Engineer or his authorised representative may carry out reasonable destructive tests to ascertain compliance with the specification. Areas thus damaged shall be

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repaired by the application contractor to the satisfaction of the Engineer at no additional cost.

13.3.5 The cost of quality surveillance will be borne by the Engineer, except where surveillance results in rejection of the work or when notice by the application contractor results in a fruitless trip, in which cases the cost of surveillance shall be carried by the application contractor.

13.3. A report shall be compiled by the surveyor for each visit. A copy of the report will be given to the application contractor on completion of each surveillance visit.

13.4 Release Certificate

13.4.1 The coatings applied in the shops will be inspected by the Engineer or his authorised representative at the application contractor's premises before releasing the coated items for delivery. A clearance certificate will be issued authorising the release.

13.4.2 The application contractor shall notify the Engineer or his authorised representative at least 48 hours in advance of the date on which the coating activities will be complete and ready for inspection.

13.4.3 The coatings applied on site will be inspected by the Engineer or his authorised representative. A final acceptance certificate will be issued after the completion and final inspection and acceptance of each area of the installation.

13.5 Data Book

13.5.1 Upon completion of the works, the application contractor shall provide the Engineer with a Data Book containing all the relevant Quality Control documents and records pertaining to the works.

13.5.2 This data book shall contain, as a minimum, the following:

- The Quality Plan.
- Copies of the relevant coating specifications.
- Copies of all Batch Release Certificates, Product Data Sheets and Material Safety Data Sheets from the paint manufacturer.
- All relevant QC Records listed in clause 13.2.2.
- All release certificates.

13.5.3 The application contractor shall submit to the Engineer the number of copies of the Data Book as required by the contract. In addition, the application contractor shall keep a copy of the Data Book for his own records.

14. CORROSION PROTECTION SYSTEM SELECTION

The Corrosion Protection systems relevant to the respective areas of the installation are given in Annexure 1. Annexure 2 provides summary specifications for each system together with the approved coating product brands.

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15. ALTERNATIVE COATING MATERIALS

Should the application contractor or coating manufacturer wish to propose alternative products or coating materials he shall submit a detailed motivation to the Engineer.
The motivation shall include, but not be limited to, the following:

15.1 Benefit to the client.
15.2 Product licensor and technical back-up available.
15.3 Location, experience and ISO quality rating of the production facility.
15.4 Detailed case histories.
15.5 Performance guarantee offered.
15.6 Manufacturer's data sheets for each product.

16. COLOURS

16.1 Identification of Colours for Pipelines

The identification for piping systems shall be in accordance with SANS 10140-3 for the pipeline and Transnet Pipelines TPL-TECH-MECH-SPEC-PL877.

17. GUARANTEES

17.1 The Engineer requires performance guarantees for the applied coating systems. Such guarantees shall be provided jointly by the coating manufacturer and application contractor at the time of tender.
17.2 The minimum guarantee period will be 15 years for coating system with a polysiloxane finishing coat and 10 years for all other systems. The criteria for failure must not exceed Ri 3 of ISO 4628-3.
17.3 Although visible coating defects such as blistering, cracking, flaking and peeling are not always associated with visible rusting, they indicate defects that could either lead to substrate corrosion or are shielding substrate corrosion that has already taken place beneath the coating. Any such defects noted during the guarantee period shall be repaired.
17.4 At the end of the coating work a performance guarantee document shall be developed by the application contractor and coating manufacturer and co-signed by the Engineer and client.

17.5 **Guarantee Reference Areas:**
17.5.1 The guarantee shall be subjected to the application of Reference Areas as described in Annex B of ISO 12944-8 to assess the performance of the coating at any time after completion.
17.5.2 The Reference Areas shall be selected and agreed by the Engineer, the coating manufacturer and the coating applicator as being fully representative of the operating environment.

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17.5.3 The coatings applied to the Reference Areas shall be the same as those specified and from the same manufactured batches of coatings used for the project. If more than one batch of coating is used, the Reference Area coatings shall be from the same manufactured batches as the initial batches supplied at the start of the project.

17.5.4 The coatings in the Reference Areas shall be applied either by the coating manufacturer or the coating applicator under the strict supervision of the manufacturer. Where the coatings are applied under supervision by the coating applicator, the manufacturer shall issue a certificate confirming that the coatings have been applied under in strict accordance with the manufacturer's product data sheets.

17.5.5 In the event of defect areas occurring during the period of the guarantee, the Reference area and rest of the defect areas shall be inspected by the coating applicator and the manufacturer.

17.5.6 If defect areas have occurred in the Reference Area, the remedial costs for both material and application under this guarantee shall be recovered from the manufacturer.

17.5.7 If defect areas have not occurred in the Reference Area but occurred in the rest of the coated areas, the remedial costs for both material and application under this guarantee shall be recovered from the coating applicator.

18. HANDLING AND STORAGE

The following precautions shall be taken for the site storage of coated items.

18.1 **Handling** All coated components shall be handled using soft slings.

18.2 **Loading** All coated components to be transported shall be loaded with support blocks, packing between pieces and tight lashing to avoid chafing.

18.3 Off-loading at site shall be conducted using the same care and precautions for on-loading. Components shall not be tipped off the transportation.

18.4 **Cover**

Coated items shall be stored under cover where possible.

Items not stored under cover shall be stored in such a manner as to avoid retention of water and allow good air circulation.

Items shall be stored on baulks of timber to raise the lowest level above the rain splash zone.

18.5 **Stacking** Items shall be stacked using timber packings or other approved means to avoid coating to coating contact. Sufficient bearing area of packing shall be used to avoid damage to coatings.

19. Records

Refer to Transnet Pipelines Standards TPL-TECH-DO-STD-001/002/003/004 for Records and Retention Procedure for detailed records and record requirements.

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ANNEXURE A	
System	**Description**
1	Structural steelwork and piping located inside and outside of buildings in marine environments.
2	Structural steelwork and piping located inside and outside of buildings in inland environments.
3	Proprietary Equipment such as pumps, motors, gearboxes etc.
4	Transformers.
5	Hand-railing and stanchions.
6	Stair treads and open grid floor grating and fixing systems.
7	Cable ladders, cable trays and associated support structures.
8	Control panels, switchgear cabinets, power and lighting distribution boards internal to buildings.
9	Internal of carbon steel fire water piping, Internal and external of fire hydrant risers
10	UV protection of above-ground Pipeline.
11	Coating of 304/L stainless steel in marine environments.
12	Manifold piping located inside and outside of buildings in inland environments.

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System 1

Environment	Atmospheric – Marine – ISO 12944 C5-M		
Material	Mild steel		
Temperature	Ambient to 50°C		
Typical Applications	Structural steelwork and the external surfaces of small tanks and piping located inside and outside of buildings.		
New Works Surface Preparation	Abrasive blast clean to Grade Sa 2½ Surface profile as specified by the primer coating manufacturer		
	Primer	Intermediate	Finishing
Generic System	two component epoxy zinc primer (min 80% zinc in the dry film) 75 – 100 micron	two component recoatable epoxy micaceous iron oxide intermediate coat 125 – 200 micron	two component polysiloxane finishing coat 50 – 75 micron
International Paints	Interzinc 52	Intergard 475HS	Interfine 878
Jotun	Barrier	Jotamastic Plus	Hardtop Optima
Sigma	Sigmazinc 109 HS	Sigmacover 435S	Ameron PSX 700
Stoncor	Carbozinc 859	Carboguard 880	Carboxane 2999

Notes: 1. Primer and intermediate coats to be applied in the shops with due cognisance being taken of the overcoating time requirements between the various coats. 2. Stripe coating to be carried out in accordance with Clause 9.3.6 3. All site repairs to handling and erection damage shall be carried out in accordance with Clause 9.7.1. 4. Finishing coat to be applied on site after erection in accordance with Clause 11. 5. All nuts and bolts to be patched with intermediate coat prior to the application of the finishing coat.

System 2

Environment	Atmospheric – Inland – ISO 12944 C3	
Material	Mild steel	
Temperature	Ambient to 50oC	
Typical Applications	Structural steelwork and the external surfaces of tanks and piping located inside and outside of buildings.	
New Works Surface Preparation	Abrasive blast clean to Grade Sa 2½ Surface profile as specified by the primer coating manufacturer	
	Primer	Finishing
Generic System	two component recoatable epoxy zinc phosphate primer 75 – 100 micron	two component polyurethane acrylic finishing coat 50 – 75 micron
International Paints	Intergard 251 or Intercure 200	Interthane 990
Jotun	Penguard Express ZP	Hardtop AS / Flexi
Sigma	Sigmacover 256	Sigmadur 550
Stoncor	Carboguard 893	Carbothane 134

Notes: 1. Primer coat to be applied in the shops. 2. Stripe coating to be carried out in accordance with Clause 9.3.6 using the primer. 3. All site repairs to handling and erection damage shall be carried out in accordance with Clause 9.7.1. 4. Where the primer has weathered, chalking shall be removed by water washing and drying. 5. Finishing coat to be applied on site after erection in accordance with Clause 11. 6. All nuts and bolts to be patched with intermediate coat prior to the application of the finishing coat

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System 3		
Environment	Atmospheric	
Material	Mild steel	
Temperature	Ambient to 50oC	
Typical Applications	Proprietary Equipment such as pumps, motors, gearboxes etc. (To be applied over the manufacturer's proprietary coating system where this is deemed inadequate for the site environment).	
New Works Surface Preparation	Hand clean, abrade and degrease as per coating manufacturer's recommendations	
	Primer	Finishing
Generic System	two component epoxy barrier/tie coat 50 -75 micron	two component polyurethane acrylic finishing coat 50 – 75 micron
International Paints	Interseal 670 HS Aluminium	Interthane 990
Jotun	Penguard Primer	Hardtop AS / Flexi
Sigma	Sigmacover 230	Sigmadur 550
Stoncor	Carbomastic 186	Carbothane 134
Notes: 1. Conduct an adhesion test on the proprietary coating in accordance with SANS 5159. If the adhesion coefficient is less than 8, return item to manufacturer for replacement. If the adhesion coefficient is 8 or 10, apply upgrade system as above. 2. All upgrade coatings to be applied at suppliers shops prior to shipment to site and installation unless otherwise instructed in the equipment order. 3. All site repairs to handling and installation damage shall be carried out in accordance with Clause 9.7.1.		

System 4	
Environment	Atmospheric
Material	Mild steel
Temperature	Ambient to 50oC
Typical Applications	Transformers
New Works	Transformers shall be coated in accordance with SANS 780. Inland: Clause 4.17.3 'Coating of exterior surfaces of transformers for use in non-corrosive environments', i.e. phenolated alkyd/alkyd gloss flow coating system or epoxy/polyurethane sprayed system. Marine: Clause 4.17.4 'Coatings of exterior surfaces of transformers for use in corrosive environments', i.e. hot dip galvanizing in accordance with SANS 121 (ISO 1461) or zinc metal spray in accordance with BS EN 22063 followed by phenolated alkyd/alkyd gloss flow coating system or epoxy/polyurethane sprayed system.
Notes: 1. The transformer supplier must submit his particular detailed Coating Procedure Specification to the Engineer for approval.	

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System 5		
Environment	Atmospheric	
Material	Mild steel	
Temperature	Ambient to 50oC	
Typical Applications	Hand-railing and stanchions.	
New Works	The hollow tubing hand-railings and stanchions shall be hot dip galvanized in accordance with SANS 121 (ISO 1461) and then duplex coated as detailed below.	
	Primer	Finishing
Generic System	galvanising tie-coat/ primer 35 -50 micron	two component polyurethane acrylic finishing coat 50 – 75 micron
International Paints	Intergard 269	Interthane 990
Jotun	Penguard Primer	Hardtop AS / Flexi
Sigma	Sigmacover 280	Sigmadur 550
Stoncor	Carboguard 193	Carbothane 134
Notes: 1. The galvanized surface shall not be passivated. 2. Any transport and erection damage to the hot dip galvanized coating shall be repaired in accordance with SANS 121 (ISO 1461). 3. Surface preparation shall be by means of sweep blasting or a suitable galvanized iron cleaner as recommended by the coating manufacturer.		

System 6	
Environment	Atmospheric
Material	Mild steel
Temperature	Ambient to 50oC
Typical Applications	Stair treads and open grid floor grating and fixing systems.
New Works	Stair treads and open grid flooring shall be hot dip galvanized to SANS 121 (ISO 1461)
Notes: 1. The zinc coating thickness shall be as specified for the section thickness. 2. The design and fabrication of the grating shall be appropriate for the process of hot dip galvanising. 3. The fixing systems shall be either hot dip galvanized or sherardized. 4. The flooring sections shall be made to measure before hot dip galvanizing so that modifications that damage the galvanizing are not necessary. 5. All site repairs to handling and installation damage shall be carried out in accordance with SANS 121 (ISO 1461).	

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System 7	
Environment	Atmospheric
Material	Mild steel
Temperature	Ambient to 50oC
Typical Applications	Cable ladders, cable trays and associated support structures.
New Works	Inland: All components to be hot dip galvanised to SANS 121 (ISO 1461) Marine: All components to be hot dip galvanised to SANS 121 (ISO 1461) followed by powder coating with an approved powder coating system in accordance with SABS 1274. The thickness of the powder shall be a minimum of 100 to 120 micron
Notes: 1. The duplex coating shall comprise a minimum of two coats, i.e. either two coats of powder or a wet applied primer followed by the powder coating. 2. Textured or 'structured' powder coatings will not be acceptable due to variations in film thicknesses. 3. Fixing systems shall be either hot dip galvanized or sherardized. 4. All site repairs to handling and installation damage and the coating of the fixing systems shall be carried out in accordance with Clause 9.7.1.	

System 8	
Environment	Atmospheric (internal)
Material	Mild steel
Temperature	Ambient to 50oC
Typical Applications	Control panels, switchgear cabinets, power and lighting distribution boards internal to buildings.
New Works	Control panels, switchgear cabinets, power and lighting distribution boards shall be powder coated with an approved powder coating system in accordance with SABS 1274. The thickness of the powder shall be a minimum of 100 micron.
Notes: 1. Textured or 'structured' powder coatings will not be acceptable due to variations in film thicknesses. 2. All site repairs to handling and installation damage shall be carried out in accordance with Clause 9.7.1.	

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System 9		
Environment	Atmospheric	
Material	Mild steel	
Temperature	Ambient to 50oC	
Typical Applications	Internal of carbon steel fire water piping Internal and external of fire hydrant risers	
New Works Surface preparation	Abrasive blast clean to Grade Sa 3 Surface profile as specified by the primer coating manufacturer	
	Primer	Finishing
Generic System	Glass flake reinforced epoxy / phenolic 400 – 500 micron Total DFT	Glass flake reinforced epoxy / phenolic 400 – 500 micron Total DFT
International Paints	Interzone 1000	(single coat)
Jotun	Marathon 460	Marathon XHB
Sigma	Sigmashield 460	(single coat)
Stoncor	Phenoline 1205	Phenoline 1205
Corrocoat	Zip E	(single coat)
Notes: 1. Total DFT required is 400 – 500 microns. Depending on coating manufacturer, this may require 1 or 2 coats. 2. After the coating has cured sufficiently, it shall be tested for Electrical Insulation Defects (pin holes) in accordance with SANS 1217 Clause 8.12.1 (NACE RP0188-8) 3. Any defects found shall be patch repaired and retested. 4. The coating shall not be put into immersed service until it has fully cured and has been tested and certified by the coating manufacturer. 5. For colour coding of the fire hydrant risers above ground, refer to system 2 finishing coat.		

System 10			
Environment	Atmospheric / Buried Interface		
Material	3LPE or Liquid epoxy coated steel pipe		
Temperature	Ambient to 50oC		
Typical Applications	Line pipe at terminals and pump stations between buried location and IJ		
SITE Surface Preparation	Solvent clean in accordance with SSPC SP1 Hand / Power tool clean to St2		
	Primer	Intermediate	Finishing
Generic System	Solvent based polymer modified bitumen 20µm	Polymer modified bitumen / acrylic tape 1250µm	Pure Acrylic 3m²/l
Denso	Primer D	Steelcoat 500	Acrylic Topcoat
Notes: 1. Tape overlap minimum 25mm 3. Tape wrapping system to be extended minimum 300 mm below soil surface 4. All application in accordance with manufacturer's recommendations.			

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System 11		
Environment	Atmospheric – Maine – ISO 12944 C5-M	
Material	304 / 304 L Stainless Steel	
Temperature	Ambient to 50oC	
Typical Applications	Exterior of flush Tanks Coating of 304/L	
New Works Surface Preparation	Blast Clean with Alumina or garnet to remove weld tarnish and roughen the surface. Surface profile as specified by the primer coating manufacturer	
	Primer	Finishing
Generic System	Special two – component epoxy primer for stainless steel 40 – 60 microns	two component polysiloxane finishing coat 50 – 75 micron
International Paints	Interguard 269	Interfine 878
Jotun	Penguard Primer	Hardtop Optima
Sigma	Sigmacover 280	Ameron PSX 700
Stoncor	Carboguard 193	Carboxane 2000
Notes: 1. The stainless steel shall be de-greased and washed prior to blast cleaning. 2. Primer to be applied in the shops with due cognisance being taken of the overcoating time requirements between the various coats 3. Stripe coating to be carried out in accordance with Clause 9.3.6 4. All site repairs to handling and erection damage shall be carried out in accordance with Clause 9.7.1 and 9.7.2 5. Finishing coat may be applied in the shop or on site in accordance with Section 10 6. All nuts and bolts to be patched with primer prior to the application of the finishing coat.		

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System 12		
Environment	Atmospheric – Inland – ISO 12944 C3	
Material	Carbon and Mild Steel	
Temperature	Ambient to 50^0C	
Typical Applications	Manifold Pipe and Ancillary equipment	
New Works Surface Preparation	Wire brush cleaning in accordance with the Swedish Code of Practice SIS 055900-1967. Grade ST2	
	Primer	Finishing
Generic	Self-Priming High Build Coat Aluminium filled Epoxy Mastic	Aliphatic polyurethane

Note: Prior to wire brushing, all welds shall be free of slag, slag inclusions and pinholes.

1. Adjacent areas shall be free of weld spatter.
2. All oil and grease deposits shall be removed prior to wire brushing by the use of approved degreasing agents. In this regard, special attention shall be paid to drillings and bolt holes.
3. Following the degreasing, as described above, all surfaces under this category shall be scraped and wire brushed to remove all loose rust, scale and deleterious matter followed by sandpapering the existing paint with medium (80) sandpaper to feather sharp edges, remove chalking.
4. The Contractor may utilise hand wire brushing provided the required standard of finish is achieved. Where necessary, mechanical brushing shall be used.
5. The surfaces shall finally be blown clean, using dry, oil-free compressed air to remove dust and loose matter. The finish shall be in accordance with the Swedish Code of Practice SIS 055900-1967. Grade St.2
6. All wire brush cleaned or partially cleaned surfaces shall be coated with aluminium filled epoxy mastic. No wire brush cleaned surfaces will be left uncoated overnight.

Where Ethyl based inorganic zinc is specified this must conform to the limits below :

Percentage zinc in dry film : 86% min (by weight)

Theoretical solids content of mixed material : 79%min (by weight)

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TRANSNET

pipelines

Specification

Specification for Steel Flange Insulating Kit

PL 415 E

March 2014

1. SCOPE

1.1 This specification covers Transnet Pipelines' requirements for a steel flange insulating kit comprising of gasket, insulating sleeves, insulating washers, machine faced steel washers, and, where applicable, stud bolts and nuts.

1.2 Operating temperature will not exceed 45·C.

1.3 The insulating sets must be suitable for use with class 150, 300 or 600 rated ASME B16.5 / latest standard raised face weld neck flanges.

2. PRODUCT SPECIFICATIONS

2.1 All the material must be compatible with the following products as listed below: -

Regular and Premium Petrols
Diesel
Fuel Alcohol
Crude Oil
Jet Fuel
Synthetic Olefinic Petrol
Unleaded Petrol

2.2 In addition, the characteristics of the following products are approximately as follows:

2.2.1 Fuel Alcohol

C_2 Alcohol content	:	70 mass % minimum
C_3 and C_4 Alcohol content	:	28 mass % maximum
C_5 and heavier Alcohol content	:	2 mass % maximum
Acidity	:	0,09 mg/KOH/g maximum
Water content	:	0,9 mass % maximum
Denatured alcohol	:	Gasoline content of 5 mass %
Chemical formula	:	C_2H_5OH to $C_6H_{13}OH$
PH	:	6 - 8

2.2.2 Synthetic Olefinic Petrol

C_5 H_{10}
C_6 H_{12}

2.2.3 Unleaded Petrol

Will contain - Benzine
Toluene
Xylene
Ketones (known in USA as "Oxygenated Gasoline")

3. REFERENCES

3.1 B.S. (British Standard) 1832 / latest: Oil Resistant compressed Asbestos Fibre Jointing.

3.2 ASME Standard B16.5 / latest: Pipe Flanges and Flanged Fittings.

3.3 ASME B31.4 - 1992: Liquid Transportation Systems for Hydrocarbons, Liquid Petroleum Gas, Anhydrous Ammonia, and Alcohols.

4. **REQUIREMENTS**

The flange insulating kit shall conform to the following requirements.

See also drawing PLSK No 2131 on page 7.

4.1. SPECIFICATION

PARAGRAPH	DESCRIPTION	DETAILS OF OFFER
4.1	**Insulating gasket**	
4.1.1	To be compatible with the products mentioned in Clause 2.	
4.1.2	The following oil resistant compressed asbestos fibre jointing (Klingerit Universal). Was used in the past.	
4.1.3	The gasket material shall have a minimum thickness of 3 mm.	
4.1.4	Be suitable for pressures up to 15 000 kPa.	
4.1.5	**Dimensions**	
4.1.5.1	The dimensions tabulated on Annexure A are taken from Specification ASME B16.5. This table is to be adhered to.	
4.1.5.2	Where gasket inside diameters are not specified by the purchaser, then these are to be 2 mm smaller than the sizes specified in the relevant table of ASME B16.5 per class where listed therein, or as Schedule 80 where not listed therein.	
4.1.5.3	The gasket outside diameters given in Annexure A are based on the diameter of bolt circle minus the diameter of one standard size bolt such that the gasket will then fit touching within the bolts.	
4.2	**Insulating Sleeve**	
4.2.1	Insulating sleeve material shall be made from fibreglass reinforced epoxy.	
4.2.2	Sleeve wall thickness must not be less than 1mm.	
4.2.3	Outside diameter of the sleeve must be not less than 1,5 mm in diameter smaller than the flange hole diameter for each class and size of flange.	
4.2.4	The sleeve shall be of length to give a total longitudinal gap of 1mm at the ends when the flange bolts are fully tightened. (i.e. the sleeves must be 1mm shorter.	
4.3	**Insulating washer**	
4.3.1	Insulating washer material shall be made from fibre reinforced phenolic resin sheet.	
4.3.2	Washer material thickness shall be 4mm for nominal pipe sizes from ½" to 6", 5mm for 8" to 10" pipe sizes, and 6mm for 12" pipe sizes and above.	
4.3.3	The inside diameter of the washers shall have a neat fit on the insulating sleeve, for each class and size. No rattling or forced fit.	
4.3.4	The outside diameter of the washers shall be as specified by the purchaser. Where not specified, it shall be made such that during assembling it does not overlap with the outside diameter of the hub at the base for each class and size.	
4.3.5	Washers shall have truly parallel faces and they shall not deform or crack under the stress of tightening the flange bolts and any accepted form of testing it may be subjected to.	
4.4	**Machined steel washers**	

4.4.1	The material for the machined steel washers shall be galvanised mild steel.	
4.4.2	The inside diameter of the washers shall have a neat fit on the insulating sleeve, for each class and size. No rattling or forced fit.	
4.4.3	Steel washers shall have machined and truly parallel faces.	
4.4.4	Washer material thickness shall be 4mm for nominal pipe sizes from ½" to 6", 5mm for 8" to 10" pipe sizes, and 6mm for 12" pipe sizes and above.	
4.4.5	The outside diameter of the washers shall be as specified by the purchaser. Where not specified, it shall be made such that during assembling it is 2 mm smaller than that of the insulating washers for each class and size.	

4.5 **BOLTING**

If the purchase request requires stud (or machine) bolts to be supplied then this shall be according to the following:

4.5.1 The Tenderer is to calculate the length of the bolts or stud bolts based on the principles embodied in ASME B16.5 but additionally taking into account the dimensions of the insulating washers and the machined steel washers. Bolts or stud bolts shall extend completely through the nuts.

4.5.2 Bolts and nuts shall conform to ASTM A193 grade B7 and ASTM A194 Grade 2H respectively.

4.5.3 Bolting shall be 1/8" undersize when compared to standard bolting dimensions given in ASME B16.5 latest, as per clause 408.5.3 Bolting for Insulating Flanges of ASME B31.4, 1992.

5. TENDERS TO NOTE THAT -

5.1 The flange insulating kit shall be properly marked for easy identification and packed adequately to prevent damage.

5.2 All material supplied is subjected to inspection.

5.3 Offers will not be considered unless full particulars and sufficient literature is provided at the tendering stage to enable Transnet Pipelines to assess each offer properly.

5.4 Tenderers shall complete the relevant questionnaire in full and must indicate whether their offer complies with each item of the requirements.

5.5 Should there be insufficient space for furnishing full details; the tenderer shall provide the additional details in a covering letter. The details shall be numbered in accordance with the applicable clause specified in the requirements.

5.6 When deemed necessary, Transnet Pipelines may require a tenderer to submit an insulating gasket kit or any part thereof for the purpose of an in-service or laboratory test. The purpose of this test will be to determine whether the insulating gasket kit or any part thereof meets the requirements, under operating conditions, peculiar to Transnet Pipelines.

6. ALTERNATIVES

6.1 This specification is not intended to be rigid to the extent of requiring a tenderer to depart from his normal practice, and it shall in no way relieve him of full responsibility as to design, material and

workmanship.

6.2 All departures from the specification are to be stated in the tender.

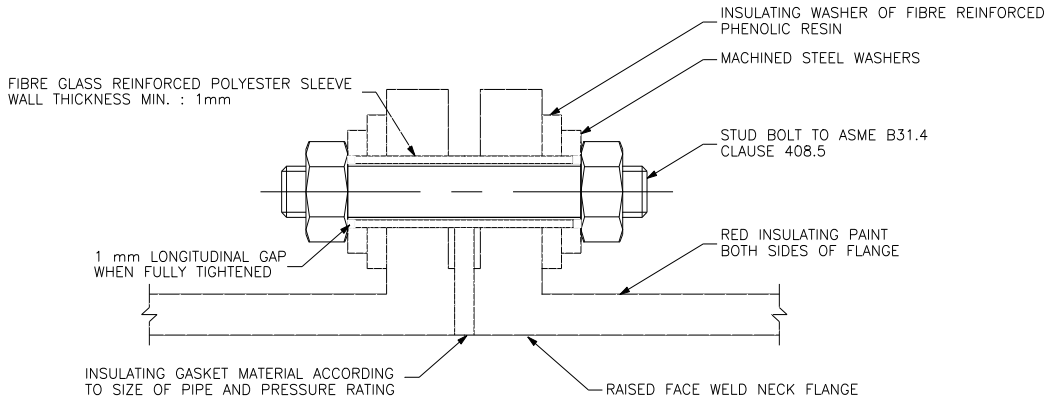
7. AMENDMENTS TO SPECIFICATION

This specification may be amended without prior notice.

ANNEXURE A

MAJOR GASKET DIMENSIONS FOR WELDING NECK FLANGES

NOMINAL PIPE SIZE (inches)	NOMINAL SIZE (mm)	INSIDE DIAMETER (mm)	OUTSIDE DIAMETERS FOR VARIOUS ANSI RATINGS (mm)		
			150	**300**	**600**
½	12,70	TO BE SPECIFIED BY PURCHASER (THE SAME AS THE INSIDE DIAMETER OF PIPE) SEE CLAUSE 4.1.5.2 OF THIS SPECIFICATION	47,75	53,80	53,80
¾	19,05		57,15	66,50	66,50
1	25,40		66,50	73,15	73,15
	31,75		76,20	82,60	82,55
	38,00		85,90	95,30	95,30
2	50,80		104,60	111,30	111,30
	63,50		124,00	130,00	130,00
3	76,20		136,70	149,40	149,40
	88,90		162,00	165,00	162,00
4	101,60		174,75	180,80	193,50
	127,00		196,90	215,90	241,30
6	152,40		222,25	251,00	266,70
8	203,20		279,40	307,98	320,68
10	254,00		339,90	362,00	400,00
12	304,80		409,40	422,00	457,20
14	355,60		450,90	485,60	492,30
16	406,40		514,40	539,75	565,20
18	457,20		549,10	596,90	612,60
20	508,00		606,50	654,00	682,75



PETRONET

TYPICAL INSULATION JOINT

REVISIONS			
PROJECT NAME			
DRAWN	G.W.R.	REF.	
TRACED	CAD	DATE	20-5-98
CHECKED		APPROVED	
DRAWING No. PL SK No 2131			REV

I confirm that all information furnished is correct and complies with Transnet Pipelines Specification PL 415 E.

Signature: _____ Designation: _____

Name: _____ Company: _____

Date: _____

Witness 1: _____ Witness 2: _____

TRANSNET
pipelines

TRANSNET PIPELINES

General Welding Specification

Specification : PL 804/A

February 2014

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1. SCOPE

This is a general welding specification for production welding, manifold modifications and any other welding on Transnet Pipelines' related equipment.

This specification must be read in conjunction with the statement of work for a project.

2. CODES AND STANDARDS

ASME B31.4	-	Liquid Transportation Systems for Hydrocarbons, Liquid Petroleum Gas, Anhydrous Ammonia and Alcohols.
API Standard 1104	-	Welding of pipelines and related facilities.
API Standard 5L	-	Specification for Line Pipe.

3. GENERAL

All welding, Welding Procedure Specifications, Welding Procedure Qualifications, control of, and usage of welding consumables, welder qualifications, the repair of, or removal of weldment defects shall conform in all respects to the requirements of ASME B31.4 and API Std 1104, latest editions, supplemented by the requirements of this specification. The requirements of this specification shall govern where conflict exists.

3.2 The Contractor shall provide and install all temporary connections required to properly earth the pipe or pipeline to prevent hazardous conditions from electrical sources. In no case shall the pipe earths be welded to the pipe.

3.3 The Contractor shall collect and properly dispose of all partially used or damaged welding electrodes.

3.4 Electrode stub-ends shall not be thrown in the pipe trench, or in the construction zone.

3.5 The Contractor shall furnish all labour, equipment, tools, supplies and approved electrodes required to perform this work.

3.6 The Engineer may at any time require the electrodes to be submitted for test and only those strictly conforming both in respect of specification and location of manufacture to an approved sample may at any time be utilised on the Contract Works.

3.7 All welding shall be to the approval of the Engineer. Any welding not to his or her approval will be rejected and work shall cease until the Engineer permits work to recommence.

3.8 The Contractor shall mark each and every weld on the pipeline with an identifying number. Such marking shall be to the approval of the Engineer and shall be preserved and remain legible up to the time that the section has been completely passed by the Engineer in respect of radiography and repairs.

3.9 The minimum length of any one piece of pipe to be installed in the mainline shall be 1,5 metres. All short pieces of pipe 1,5 metres or more length shall be carried forward to the bending operation and welded intermittently into sections of the pipeline with the same wall thickness where reasonably practicable.

3.10 All surplus pipes shall be delivered to a pre-determined site and stock piled within two weeks of the welding having passed the area in question.

3.11 Pipe transitions shall be in accordance with ASME B31.4.

4. PROCEDURES

4.1 Before any production welding is commenced, the Contractor shall establish, document and obtain approval from the Engineer for the welding and welding repair procedures to be used.

The Contractor shall submit detailed welding procedure specifications in writing, complete with all technical information, and other data with the tender documents. Written procedures shall be furnished for each combination of essential variables proposed by the Contractor to be used in production welding and weld repairing. Essential and non-essential variables are defined in clause 2.4 of API 1104. In addition, welding electrodes, brand names and the manufacturer shall be approved by the Engineer.

The Contractor shall be responsible for demonstrating at his own cost by trials and subsequent tests that the Procedures are capable of producing timeously a completely satisfactory pipeline installation. If, following such trials and tests the results are not regarded by the Engineer as wholly satisfactory, the Contractor shall be responsible for modifying his detailed procedure specification and qualifications in order to achieve the necessary improvements.

The modifications shall be subjected to similar trials and tests at the Contractor's cost and, when approved, shall be adopted throughout the Contract without any additional charges being made to Transnet Pipelines by the Contractor.

No welding of the pipeline will be permitted until the Engineer certifies that the procedures have been approved.

4.2 All test specimen’s radiographs and other test records shall be permanently marked and cross-referenced for identification and correlation with the welding procedures. On completion of demonstration and testing the Contractor shall submit a copy of all radiographs and other test records to the Engineer as well as all test specimens. All such materials and records shall be retained by Transnet Pipelines for the duration of the work and will become the property of Transnet Pipelines at the completion of the project.

4.3 In order to prevent cracking, the second or hot pass bead is to be made immediately following completion of welding and cleaning of the root or stringer bead, and in no case shall the time between two successive passes exceed five (5) minutes. All welds shall be completed in one continuous operation and shall not be left partially completed.

4.4 The welding of all field joints is to be executed by electric shielded arc welding.

4.5 Where ends of pipe which are damaged cannot satisfactorily be welded, the damaged pipe shall be cut and rebevelled.

Field bevels shall be made by machine tool or machine oxygen cutting and shall be cut on the same angle as the original pipe supplied by the manufacturer. Unless the pipe is damaged prior to the Contractor drawing it from the storage sites and a certificate to this effect is obtained from the Engineer, the cost of field welding, cutting and bevelling as necessary, shall be borne by the Contractor. Similarly, laminations, split ends and other defects shall be cropped, repaired or removed from the line as directed by the Engineer at the Contractor's cost unless written acknowledgement of such defects was obtained when drawing the pipe from the storage site.

4.6 A copy of the written qualified procedure shall be kept on file in the Contractor's site office and shall be made available at all reasonable times upon request for inspection or review by the Engineer.

5. WELDER QUALIFICATIONS

5.1 The formal qualification of welders shall be in accordance with API 1104. Welders shall only be allowed to make production welds or portions of welds for which they have qualified.

5.2 The pipe ends will be bevelled to an angle of thirty degrees (30□) +5□, - 0□ in accordance with API Std 5L.

5.3 Prior to commencing work, all shielded metal arc welders who are to be used on the work shall pass a welder qualification test on manual welds in the presence of the Engineer. Welder qualifications shall be made on fixed pipe sloped at 30 degrees from horizontal. The results of the tests may be determined by both destructive and non-destructive methods.

5.4 The demonstrations and tests described in API Std 1104 shall be successfully carried out by each welder at the Contractor's cost and a certificate signed by the Engineer and a passport size photograph shall be issued by the Contractor for each welder before he is permitted to work on the pipeline.

Failure at the first such demonstration and test shall mean that double the number of test pieces must be successfully accomplished by the welder at the Contractor's cost before obtaining approval for pipeline work. Failure to qualify at the second test will debar the welder from participation in welding work on this Contract.

5.5 All welds shall be marked with plastic paint markers (metal stamps are prohibited) on the top quarter of pipe by each welder according to the mark assigned to the welders by the Contractor. Each welder of root beads shall mark his symbol at the beginning of the upper half of the section he has welded. All other welders shall place their symbol at an appropriate place below the root bead welder's symbol.

5.6 Welders who produce unsatisfactory production welds shall be requalified or removed entirely from the job.

6. PRODUCTION WELDING

6.1 Skids or supports of sufficient number and length shall be supplied and used by the Contractor to support the pipe at a height required for efficient welding.

6.2 Each piece of pipe shall be swabbed internally with a leather or canvas belt disc of the proper diameter, or cleaned to the satisfaction of the Engineer, to remove all dirt, loose scale or other foreign matter before being placed in alignment for welding. Care shall be taken by the Contractor that no dirt, welding rods or other foreign matter gets into and is left in the pipe during construction.

6.3 All bevels shall be buffed by machine wire brushing to a bright finish just prior to welding.

6.4 The internal and external surfaces of each pipe end shall be machine buffed a minimum length of 20mm from the welding edge to remove all rust, scale, dirt or other foreign materials before placing in alignment for welding. Grinding shall not be used for this purpose.

6.5 Field cut bevels shall be cut with a bevelling machine approved by the Engineer. The root face shall be at right angles to the pipe axis. Flame cut bevels will require mechanical facing. No mitred joints shall be allowed. The Engineer may carry out dye penetrant or ultrasonic examination of field cut bevels. Bevelled ends shall be free from all laminar and crack type defects.

6.6 Pipe shall be lined up in such a manner as to prevent damage thereto. The longitudinal seam shall be lined up in the top third of the completed pipeline and shall be staggered in successive pipes by no less than twenty degrees (20□) on alternate sides of the top centre of the pipeline. The pipe shall be welded so that this seam shall remain in the top third of the pipe during coating and lowering operations.

6.7 The open ends of completed sections of the pipeline shall be securely closed at the end of each day's work or upon completion of the section and shall not be re-opened until work is resumed.

6.8 Any obstruction remaining in the pipeline after completion of the line shall be removed and then re-welded and re-wrapped. This, together with all consequential work, shall be done at the Contractor's expense.

6.9 The root opening shall be between 1,6mm and 3,2mm. The alignment of the abutting pipe ends shall be such as to minimise the offset there may be between pipe surfaces due to manufacturing tolerance and wall thickness change. Such offset shall not exceed 1,6mm.

6.10 Internal line-up clamps shall be used wherever possible. Under exclusive circumstances such tie-ins where it is impractical to use internal clamps will the Engineer approve the use of external line-up clamps.

6.11 The line-up clamps shall not be released until the root bead is 100% completed. When an external line-up clamp is used, the root bead shall be made in equally spaced lengths around the circumference with a maximum cumulative length of no less than 60% of the

pipe circumference before the clamp is released. It is prohibited to effect alignment by heating, cold springing or hammering the pipe ends.

6.12 Where transition pieces are required the Contractor shall cut internal tapers of 5 degrees using an internal tapering machine or by some other approved method. Internal taper shall not be flame cut. To assure quality radiography, the Contractor shall inform the Engineer of the transition weld location and number, stake value, pipe diameter and wall thickness.

6.13 Pipe ends shall be rebevelled if any bevels or root faces contain dents, grooves or notches exceeding 1.6mm (0.063 inches). Cracks or laminations are not allowed.

6.14 The Contractor shall ensure that arcing does not occur between the ground leads of the welding machines and the pipe or fittings. Magnetic ground clamps are recommended. Striking the arc on the pipe or fittings at any point other than the welding groove shall not be permitted.

6.15 Arc burns on the pipe shall be removed from the pipeline by cutting out a cylinder of pipe containing the arc burns.

6.16 In the case of high winds, cold, rainy or stormy weather the Contractor shall provide protection for the welders at their work and shall protect the welds from sudden variations in temperature until they are cool.

6.17 Welding shall not be performed when, in the opinion of the Engineer, the weather is unsuitable for welding operations.

6.18 Movement of the pipe during welding of the root bead shall be prohibited. The hot pass shall be made as soon as possible after completion of the root bead pass and in no case shall the time between the two passes exceed five (5) minutes. All welds shall be completed in one continuous operation and shall not be left partially completed.

6.19 When complete lengths of pipe are to be cut the pipe identification shall be transferred to each side of the cut.

7. DISPOSITION OF SHORT PIECES

The Contractor shall not allow pipe to accumulate and shall move all short pieces of pipe 1,5 metres or more in length.

8. WELDING ELECTRODES

Suggested type of manual arc welding electrodes to be used for all aspects of mainline and manifold pipe welding applications, are as follows:

8.1 Application: Cold Work

"Cold work" is the terminology used when referring to welding on empty pipe (e.g. laying of new pipe, manufacture of manifolds, etc.).

ELECTRODE TO BE USED:

Classification	:	E7010G
Specification	:	AWS A5.5 / ASTM. SFA 5.5
Type	:	"Lincoln Shield-Arc Hyp"

Size

☐ 2,50 mm for pipes 2 - 4 inch in size
☐ 3,25 mm
☐ 4,00 mm
☐ 5,00 mm

8.2 **Application: Hot Work**

"Hot work" is the terminology used when referring to welding on a pipe containing product under flow conditions (e.g. stopple fittings, "Weld + Ends", etc.)

ELECTRODE TO BE USED

Classification	:	E7018
Specification	:	AWS A5.1 / SABS 455 E435 B26 GJ
Type	:	"Rockweld Basac - Low Hydrogen" or equivalent.

Classification	:	E 8018 (For welding API 5L X60 and X65)

Size

☐ 3.15 mm
. 3,25 mm
☐ 4,00 mm
☐ 5,00 mm

AS WITNESSES

1. _____ _____
CONTRACTOR

2. _____ DATE: _____

AS WITNESSES

1. _____ _____
TRANSNET PIPELINES

2. _____ DATE: _____



TRANSNET

pipelines

SPECIFICATION,

GENERAL NON-DESTRUCTIVE TESTING

PL805/A

October 2016

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1. SCOPE

This is a general non-destructive testing specification for all welds on Transnet Pipelines' related equipment that required testing.

This specification must be read in conjunction with the statement of work for the project.

Paragraphs marked with " " are not applicable for this project.

The contractor is required to carry out radiographic inspection in accordance with the procedure set out in API 1104/Latest Clause 11.0 (Radiographic Test Methods). Radiographic inspections of welds may be required during welding operations but generally after the weld is completed. The Engineer will indicate which welds are to be radiographed and depending on the quality of the welds, may be required more than the requested amount of the welding done in one day to be radiographed. This higher incidence of inspection will be required when field welding in each spread first commences, or at any other stage during the course of welding operations when the Engineer has reason to require a more thorough check on the quality of welding.

The Contractor shall carry out the primary interpretation of all radiographs suitable recorded on standard forms. The radiographs and forms shall then be made available to the Engineer who will carry out the final interpretation and will determine the incidence of injurious defects in terms of the standards of acceptability of Clause 9 of API 1104/Latest

2. CODES AND STANDARDS

API 1104/Latest - Welding of pipelines and related facilities.

3. REPAIR OF WELDS

All welds found to be unsatisfactory upon visual, or non-destructive inspection, shall be repaired in accordance with Section 10 of API 1104/Latest. Cracked welds shall be removed from the line, no repair method will be allowed for cracks.

If repaired areas are found by radiography or otherwise to be non-acceptable to the Engineer the section of pipeline containing the weld shall be cut out of the pipe and the line made good at the Contractor's expense.

The cost of all re-radiographing of repaired areas shall be to the Contractor's account.

4. REQUIREMENTS

4.1 Inspection Requirements

The contractor is required to carry out the following amount of radiographic inspections on circumferential welds :-

- 10% of all welds of the day;
- 100% of all welds of the day;

- 100% of all welds to be placed in class I (major rivers) and class II (Lesser rivers, canals and water courses) water course crossings;

- 50% of all class III (Minor water courses) water course crossings;

- 100% of all welds at all tie-ins;

- 100% of all welds where pipe is to be concreted or installed in a pipe casing;

4.2 **Additional Inspections**

Each weld that fails to comply with the specification, must be repaired and re-tested, plus the following additional welds per failed weld will be tested and the all the cost will be borne by the contractor;

- additional three welds will be nominated by the Engineer;

- additional five welds will be nominated by the Engineer;

- all the welds of the day;

- all the welds of the welder/welders that is responsible for the failures.

5. EQUIPMENT AND ORGANISATION

All radiographic equipment shall be of first class quality in good working order and capable of producing radiographs as required to detect all injurious defects. Any equipment found to be unsatisfactory shall be replaced by the Contractor immediately upon request of the Engineer at no additional cost to the Owner.

For pipeline construction projects, the number of gamma-ray units and mobile dark rooms must be adequate to cope with the weld testing requirements of the main spread, the town spread, at Class I and II water course crossings, at tie-ins and sufficient spare equipment and dark rooms must be available for all normal and intensified non-destructive inspection requirements.

For pipeline construction projects, radiographic inspection shall not lag behind the main spread by more than 1,5 km or the various sections (if more than one) of the town spread by more than 0,5 km without the approval of the Engineer; and shall be so organised that the wrapping and laying procedures are at no stage delayed.

No cleaning or wrapping may be carried out on any section of the pipeline until all radiography is completed and all repairs have been completed and re-radiographed and accepted by the Engineer.

6. RADIOGRAPHIC PROCEDURE

Radiographic procedure shall be in accordance with Section 11 of API Std. 1104/Latest except to the extent modified and/or amplified hereunder.

The Contractor shall submit with his tender details of the type of equipment to be used and a detailed procedure for the productions of radiographs and, before non-destructive testing on site commences, shall be responsible for demonstrating at

his own cost of the above Standard that radiographs produced by the use of such procedure shall have sufficient density, clarity and contrast so that defects in the weld or in the pipe adjacent to the weld are clearly discernible. The evaluation of radiographs shall be in terms of paragraph 11.1 of the above standard. If the Engineer is not satisfied with the results of the procedure the contractor shall introduce modifications in order to achieve the necessary improvements. Once the Engineer is satisfied with the results achieved, the procedure will be regarded as qualified and shall be used throughout the contract without variation.

The detailed radiographic procedure to be submitted by the Tenderer shall cover the items listed in API Std 1104/Latest, and shall be subject to the following requirements.

(a) Radiation source: Gamma-ray sources of radiation shall be used.

(b) Type of Equipment: Generally the source of radiation shall be located outside of the pipe and the double-wall technique shall be employed. Alternative where the source is located inside the pipe and the single wall technique is used will be considered for mainline use.

The Engineer shall have the right to reject unsatisfactory radiographs and instruct the contractor to re-radiograph the weld concerned. No payment will be made to the contractor for radiographs rejected by the Engineer.

Fully equipped mobile darkrooms shall be provided which shall at all times be at the work sites. An adequate supply of water shall be provided by the contractor. Wet radiographs must be ready for viewing by the Engineer within 60 minutes of the radiographs being taken. Approved film-viewing illuminators shall be available in each darkroom for the Engineer to view radiographs. All radiographs shall become the property of the owner.

7. RADIOGRAPHIC PERSONNEL

Radiographers shall be qualified in accordance with the requirements of API Std 1104/Latest, and shall satisfy the requirements of the South African Atomic Energy Board.

Any personnel who, although qualified, proves to be unsatisfactory, shall be replaced by the contractor immediately upon request at no extra cost to the owner.

8. RECORDS AND FIELD REGISTER

Radiographs shall be correctly filed and shall be handed to the engineer at regular intervals.

The contractor shall number all radiographs for identification purposes and record each radiograph in triplicate in an approved register. The register shall detail date, location, chainage, pipe number, radiograph number and weld mark, and columns must be provided for the Engineer's interpretations and comments.

Two copies of each register page shall be handed to the Engineer within 24 hours of radiographing the welds recorded.

Tenderers must submit with their tender a sample page from their intended field register.

9. DESTRUCTIVE TESTING OF WELDS

In amplification of Clause 8 of API 1104/Latest (Inspection and Testing of Production Welds) the following procedure for destructive testing shall be followed :-

The Engineer may require that each welder be subject to having one weld cut from the line for testing purposes at no expense to the owner. The cost of cutting out the
weld, cutting pipe to fit the space in the line, bevelling and welding the pipe into the line shall be borne by the contractor. The Engineer shall decide when this option is to be exercised. The Engineer reserves the right to cut any number of welds from the line for test purposes. If, on testing, a weld fails to comply with the specification, the welder or welders responsible shall be disqualified from further work on the line.

Should the Engineer exercise his option to cut more than one weld for each welder, all costs resulting from this additional work shall be borne by the owner if the weld is found to be satisfactory, and by the contractor if the weld fails the prescribed test.

AS WITNESSES

1. _____ _____
CONTRACTOR

2. _____ DATE :_____ _____

COLOUR CODING REQUIREMENTS OF PIPELINES AND ANCILLIARY EQUIPMENT

Document number	TPL-TECH-MECH-SPEC-PL877
Version number	1.0
Effective date	30 November 2020
Review date	30 November 2024

SUMMARY VERSION CONTROL

VERSION NO.	NATURE OF AMENDMENT	PAGE NO.	DATE REVISED
1.0	New Procedure		30 November 2020

Note: Only latest amendments and/or additions will be reflected in italics in the body of the document.

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DOCUMENTATION SIGN-OFF SHEET

I, the undersigned hereby approve this procedure.

ROLE	CAPACITY/ FUNCTION	SIGNATURE	DATE
Revised By:	**Mechanical Specialist** **Transnet Pipelines**		
Accepts document for adequacy and practicability. Comments:			
Approval: Thershni Pillay	**Mechanical Manager** **Transnet Pipelines**		23/07/2021
Approves document for use. Comments by :			
Errol Pilusa:			
Mxolisi Phiri:			

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1. PURPOSE

The purpose of this document is to provide the specification for the uniform colour coding of equipment, distinctive identification of equipment and pipeline contents.

2. APPLICABILITY

The scope of this document covers Transnet Pipelines (TPL) colour coding, labelling and banding requirements for pipelines, ancillary equipment and pipeline contents.

3. REFERENCE DOCUMENTS

All national and international standards referred to in this document shall form part of this specification. Where reference is made to a code, specification or standard the reference shall be taken to mean the **latest edition** of the code, specification or standard, including addenda, supplements and revisions thereto.

SANS 10140-3
SANS 1091
SANS 1186-1
TPL Specification No PL 407
Tech-Servitude-Manual-PCRS Element 1 (Module CRS)

4. DEFINITIONS

Basic colour of a Pipeline
This is a colour used to identify the basic nature of the pipeline contents. It is painted along the peripheral area of a pipeline.

Colour Code Indicator
A pipeline display of colour indicators used to identify the specific nature of the pipeline contents. Refer to Appendix B

Descriptive Code Indicator
Descriptive code indicators are chemical formulae, words, flow direction arrows and other signs that can be used in conjunction with colour code indicators if required by TPL. Descriptive code indicators must be black in Colour. Yellow Colour can be used to obtain a better contrast to the background if black is not appropriate (Refer to SANS 10140-1).
Example: Descriptive code indicator (ULP 95) and flow direction arrow:

ULP 95 →

5. ACCOUNTABILITY, RESPONSIBILITY AND AUTHORITY

TPL Technical department is responsible for updating this specification and other related paint specifications.

6. LABELLING APPLICATION

6.1 Labelling Methods

Labels may be applied by means of stencilling or sticker banding. Labels must be visible from the indicative walkways access point.

6.1.1 Labelling Requirements

Piping and equipment shall be labelled as follows:

- On the lower side of the pipe if a person has to look up to the pipe.
- On the upper side of the pipe if a person has to look down towards the pipe.
- Directly facing the person if on the same level as the pipe.
- Labels should be UV resistant.

6.1.2 Colour Banding

Colour bands can be applied as follows:

- Every 50 metres of straight pipe sections.
- Less than 50 metres is required when the next stencil is not visible or unclear.
- On straight segments, spacing between labels can be increased such that it allows for easy identification.
- On header lines.
- Before or after pipebends and T-pieces, 100mm or less from the weld of existing elbow or tee.
- Combined size of colour band shall be 300mm for a pipe length of 700mm weld to weld.
- Combined size of colour band shall be 150mm for a pipe length less than 700mm weld to weld.
- No product names for single products are required, only colour banding.
- No operational pressures are required.
- Directional arrows are not required at colour banding.

For any other products not defined in the Transnet specification, such as cooling water, it will have a colour band as defined in SANS 10140-3 Dialogic Pipeline Colour Coding.

6.1.3 Stenciling

- ❖ Font to be used: Tahoma Bold Capital Letters.
- ❖ All stencilling to be single line with the indication arrow at the centre bottom of the letters.
- ❖ Double lines are allowed where space limitations are present but should be limited.
- ❖ Placing of stencilling are to be at all direction changes and where spacing runs longer than 50m. This must be confirmed during a detailed site walk.
- ❖ Less than 50m is required when the next stencil is not visible or unclear.
- ❖ Stencilling for vertical lines to be bottom up.
- ❖ All stencilling to be visible from at least two directions.
- ❖ As a rule, the arrow should be in the centre of the pipe dependant on angle of view.
- ❖ Letter size of 89mm must be used on all pipes over 250mm. Font size: 400pt.
- ❖ Letter size of 64mm must be used on all pipes 200mm to 250mm. Font size: 250pt. Line spacing: if double line is used must be 10mm.
- ❖ The arrow size for 64mm letters to be 64mm high at the arrowhead and the total length of the arrow to be 200mm.
- ❖ Letter size of 32mm must be used on all pipes 64mm to 150mm. Font size: 125 pt. Line spacing: if double line is used must be 5mm.
- ❖ The arrow size for 32mm letters to be 32mm high at the arrowhead and the total length of the arrow to be 100mm.

Example: The wording for stencilling should be as follows:

First word: To be Source, Destination or Function as defined below:

CODE	NAME
SEC	Secunda
CBK	Coalbrook
ALR1	Alrode 1
VLR	Villiers
KEN	Kendal
HP4	HP Manifold 4
VLR BYPASS	Villiers Bypass

Second word: to be per Product as follows:

- MULTI PRODUCT
- INTERMIX

Drain lines: Drain lines shall be stencilled only at the sump tank turrets and on the headers. Wording to be:

- OPEN DRAIN
- CLOSED DRAIN
- CLOSED VENT

7. EQUIPMENT IDENTIFICATION

The following equipment must be painted/marked as follows:

7.1 Fire Piping (Refer to Appendix B for pipe material)

1	Water ring mains and sprinklers	Signal Red
2	Reservoir feed-pipe	Signal Red
3	Fire pump feed-pipe	Signal Red
4	Hydrant pipes	Signal Red
5	Foam Premix	Signal Red and White
6	Foam Concentrate	Royal Blue

7.2 Mechanical Equipment

1	Critical valves	White
2	Petroleum pipe (High Pressure /Low Pressure /Drain piping)	French Grey

7.3 Servitude Equipment

1	Local and Remote chamber lids	Galvanized/Silver or Concrete Casting
2	Chamber lids labelling	See Drawings PL 1071 87-90 For: Size, Shape Colours, Text, Quantity and Orientation
3	Line markers	White (See PCRS Element 1 Module CRS)
4	Block Valve chambers (Exterior)	White

7.4 Electrical Equipment

1	Rectifier casing	White / Admiralty Grey
2	Rectifier top cover	Oxford Blue
3	Transformers	Battleship Grey
4	Transformer conservator tank	White
5	Mainline and Booster motors	White
6	Out door high voltage equipoment	Grey
7	Rail Bond	Oxford Blue

7.5 Petroleum Liquid Storage Tanks

1	Tank Shell Exterior	Refer to TPL Spec PL838/2D
2	Tank Shell Interior	Refer to TPL Spec PL838/1C
3	Tank label/number	800h X 180w mm Black Arial Font on a 1000 X 1000mm Golden Yellow background
4	Prover Transfer Tanks	French Grey

8. ANNEXURE A

APPENDIX A- COLOUR IDENTIFICATION TABLE

Pipeline Contents and Equipment Identification	Colour Code Indicator	SANS 10140-3: 2003
Manifold low/high pressure and drain lines	French Grey	H30
Pumps	French Grey	H30
Critical valves	White	White
Mainline and Booster Motors	White	White
Insulating flanges	Signal Red Insulating varnish (Glyptol Red –Such as Insuldyn). Paint from weld to weld. Wrap once dried	A11
Walkways and platforms	Galvanized State or Black	Galvanize/Black
Stair and Platform Rails	Hand and Knee Railing: Golden Yellow Stanchions: Black	B49 Black
Unleaded petrol 95	Lime Green	H41
Unleaded petrol 93	Lime Green/Canary Yellow/Lime Green	H41/C61/H41
Diesel 500	Middle buff	B33
Diesel 50	Middle buff/Dark Violet/Middle buff	B33/F06/B33
Jet A1	Black	Black
Air Compressed	Arctic Blue	F28
Air Instrument	Arctic blue /Salmon pink/ Arctic Blue	F28 / A40 / F28
Air Vacuum	Arctic blue/Primrose/Arctic Blue	F28 / C67 / F28
Acetylene	Light stone/Maroon/Light Stone	C37 / A01 / C37
Hydrogen	Light Stone /Poppy Red/ Light Stone	C37 / A14 / C37
Argon	Light Stone / Peacock Blue / Light Stone	C37 / F08 / C37
Oxygen	Light stone / White / Light Stone	C37/White /C37

Nitrogen	Light stone / Light Grey / Light Stone	C37 / G29 / C37
Water Potable Cold	Brilliant Green / Cornflower / Brilliant Green	H10 / F29 / H10
Water Potable Hot	Brilliant Green / Crimson / Brilliant Green	H10 / B49 /H10
Drainage Water	Black	Black
Firefighting water/equipment	Signal Red	A11
Fire foam premix	Signal Red / White /Signal Red	A11/White/A11
Fire foam concentrate	Royal Blue	F01

9. ANNEXURE B. PIPELINE COLOR CODE CHART (SANS 1091 : 2004)

WATER LINES	
1.Water **Drinkable Cold**	**Cornflower A03** **Brilliant Green H10**
2.Water **Drainage Sewage**	**Black**
3.Water **Industrial**	**Golden Yellow B49** **Brilliant Green H10**
4.Water **Fire Fighting**	**Signal Red A11** **Carbon Steel Pipe**
5.Foam Concentration **Fire Fighting**	**Royal Blue F01** **(In Carbon Steel Pipe)**
6.Foam Premix **Fire Fighting**	**Red White Red White Red** **(In Carbon Steel Pipe)**
9.Cooling Ring **Fire Fighting**	**Signal Red A11 (Every 2 Meters)** **(Stainless Steel Pipe)**

PETROLEUM PRODUCTS AND OIL Basic Color is French Grey H30	
10.Diesel 500	**Middle Buff B33** **French Grey H30** **French Grey H30**
11. Diesel 50	**Middle Buff B33** **Dark Violet F06** **Middle Buff B33**
14.ULP 95	**Lime Green H41**
15.ULP 93	**Lime Green H41** **Canary Yellow C61** **Lime Green**
16.Crude Oil	**Dark Brown B01**
17.Jet Fuel	**Black**
18.Lubricating Oil	**Verdigris Green E22**

AIR	
19.Compressed Air 	**Arctic Blue F28 (Entire Line Blue)** 
20.Instruments Air 	**Salmon Pink A40** 
21.Oxygen 	**White** **Light Stone C37** 
22.Acetylene 	**Maroon A01** 

TRANSNET PIPELINES TECHNICAL FIRE PROTECTION DESIGN STANDARD

Document number	TPL-TECH-F-STD-001
Version number	3
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Review date	1 July 2029

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SUMMARY VERSION CONTROL

VERSION NO.	NATURE OF AMENDMENT	PAGE NO.	DATE REVISED
0	New Specification	ALL	10 February 2015
1	Internal TPL reviewal	ALL	20 May 2024
2	Comments and review from TPL	ALL	27 December 2025
3	Updated to align with recent fire specifications developed during the Witbank and Fire Upgrade Projects	ALL	16 February 2026

Note: Only latest amendments and/or additions are reflected in italics in the body of the document.

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DOCUMENTATION SIGN-OFF SHEET

I, the undersigned hereby approve this procedure.

ROLE	CAPACITY/ FUNCTION	SIGNATURE	DATE
Compiled by:	**Pieter Jacobs**		
Approved by:	**Papa Moratwe**		

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1 EXECUTIVE SUMMARY

The Transnet Pipelines Technical Fire Protection Design Standard (TPL-TECH-F-STD-001, Rev 3) establishes the mandatory technical, operational, and governance framework for the design, upgrade, and standardisation of fire protection systems across all Transnet Pipelines (TPL) facilities. The standard applies to bulk fuel depots, pump stations, manifolds, loading facilities, buildings, bunded areas, spill basins, and associated infrastructure, and is binding on all EPC, EPCM, *Contractors*, *Consultants*, and responsible engineers engaged by TPL.

The standard adopts a risk-based fire protection philosophy, where fire protection systems are designed to mitigate the largest Credible Event identified through structured fire risk assessments. Systems are explicitly not designed for incredible or highly improbable events, ensuring that protection measures remain practical, defensible, and aligned with the ALARP principle. Fire protection capacity calculations exclude replenishment during an incident, thereby ensuring system autonomy, resilience, and reliability under emergency conditions.

The document establishes a minimum firefighting duration of 60 minutes for both fire water and foam concentrate systems, with an additional 10% contingency allowance. This requirement applies uniformly across all sites and asset classes and governs the sizing of fire water tanks, foam concentrate tanks, pumps, proportioning systems, and associated reticulation infrastructure.

The standard is firmly grounded in South African legislation and codes, with SANS 10089 and SANS 10400 forming the primary prescriptive basis. These are supplemented, where appropriate, by relevant NFPA, API, FM Global, IEC, ISO, and British Standards, as well as a comprehensive suite of Transnet Pipelines equipment-specific specifications. Where prescriptive requirements cannot be met, the standard permits a performance-based engineering approach, supported by formal fire risk evaluation, modelling, and approval by the responsible engineer and the *Employer*.

A core feature of the standard is the standardisation of fire protection equipment, control philosophy, and system architecture across all TPL sites. Fire protection systems are controlled via a hard-wired relay logic Fire Control Panel (FCP), with scenario-based activation to ensure rapid and intuitive response by non-professional first responders. The control philosophy provides for fail-safe operation, local and remote activation, manual override capability, and future integration with the National Operations Centre (NOC), ensuring both operational continuity and scalability.

The document defines area-specific fire protection requirements for all major risk zones, including bulk storage tanks, bunded areas, manifolds, pump houses, road and rail loading facilities, spill basins, and buildings. These requirements encompass fixed foam systems, tank cooling systems, medium-expansion foam pourers, hydrant and monitor systems, fire detection where required by

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regulation, and portable fire-fighting equipment, with application rates, layouts, and system configurations aligned to recognised industry best practice.

The standard further addresses infrastructure protection, maintainability, access, safety distances, Valve Bank design, drainage, and emergency escape provisions, ensuring that fire protection systems remain operable, inspectable, and maintainable throughout their lifecycle. Emphasis is placed on equipment accessibility, standardised spares philosophy, local supplier support, and long-term operational reliability, supporting TPL's business continuity and asset protection objectives.

Overall, this standard provides a uniform, technically robust, and defensible fire protection framework for Transnet Pipelines. It integrates regulatory compliance, risk-based engineering, operational practicality, and standardisation to ensure life safety, asset protection, environmental protection, and continuity of fuel transportation operations across the TPL network.

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2 ABBREVIATIONS

The table below includes a list of abbreviations used within this document:

Abbreviation	Description
ALARP	As Low as Reasonably Practical
API	American Petroleum Institute
ANSI	American National Standards Institute
BS	British Standards
CO_2	Carbon Dioxide
DCP	Dry Chemical Powder
DTS	Deemed to Satisfy
ECP	Engine Control Panel
ECSA	Engineering Council of South Africa
EPC	Engineering, Procurement and Construction
EPCM	Engineering, Procurement and Construction Management
FCP	Fire Control Panel
FRP	First Responder Panel
FM	Factory Mutual
FMSS	Field Mounted Start Stations
IEC	International Electrotechnical Commission
IF	Insulating Flange
L	Litre
LPG	Liquefied Petroleum Gas
m	Metre
m^2	Square Metre
mm	Millimetre
min	Minute
HMI	Human-Machine Interface
MEX	Medium Expansion Pourers
NB	Nominal Bore
NBR	National Building Regulations
NFPA	National Fire Protection Association
NOC	National Operations Centre
OEM	Original Equipment Manufacturer

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Abbreviation	Description
P&IDs	Process and Instrumentation Diagrams
MPa	Megapascal
SANS	South African National Standards
TPL	Transnet Pipelines (The *Employer)*
UL	Underwriters Laboratories

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3 DEFINITIONS

3.1. Active Fire Protection

Active fire protection consists of all fire protection systems that are actuated in the event of a fire and need to operate in terms of discharging a suppression medium. These include fire protection by water, water mist, foam, and gas.

3.2. Bulk depot

Premises (sometimes referred to as marketing installations or terminals), on which the capacity for the storage of flammable goods or combustible goods (or both) exceeds 200 m^3 in above-ground tanks, on which goods are normally received from a refinery or other bulk depot by road, rail, sea or pipeline (or a combination of these), and from which such flammable goods or combustible goods (or both) are delivered.

3.3. Bunded Area

An area bounded by ground contours that confine spillage, or an area surrounded by walls referred to as bund wall.

3.4. Competent Person

The competent person shall be identified as the responsible engineer because of the individuals relevant registrations, qualifications and experience

This is by means of the competent person possessing at least the following qualifications:

- Registered Professional Engineer with ECSA
- At least 5 years' experience in design and engineering of fire systems for bulk fuel storage depots, having designed, completed, commissioned and signed-off as the Professional Engineer on at least two (2) similar projects

3.5. Consequences

The direct, undesirable result of an incident, usually involving a fire, an explosion, or the release of toxic material.

3.6. Credible event

An event that has a degree of probability (likelihood) of occurring, or for which reasonably practical mitigating actions can be taken by the owner of the depot to minimize the consequences (or both).

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3.7. Combustible Liquid

A liquid that has a closed-cup flash point of 38 °C or above, see SANS 10089-1.

3.8. Contractor or Consultant

The *Contractor* or *Consultant* refers to the competent person, the responsible engineer, systems designer, and designer.

3.9. Flammable Liquid

The definition given in SANS 10089 is used: a flammable liquid is a liquid that has a flash point of below 38 °C.

3.10. Incident

An unplanned event or sequence of events that results in undesirable consequences.

3.11. Incredible event

An event that is extremely improbable (with, for example; a likelihood of less than 1 in 1000), or for which “reasonably practical’ measures to minimize the consequences are beyond the capabilities of the owner of the site (or both).

3.12. Liquid Class

Petroleum Industry (e.g. SANS 10131 and SANS 10089)

Class of petroleum product, based on the following classification:

- Class 0: liquefied petroleum gas;
- Class IA: liquids that have a closed-cup flash point of below 23 °C and a boiling point of below 35 °C;
- Class IB: liquids that have a closed-cup flash point of below 23 °C and a boiling point of 35 °C or above;
- Class IC: liquids that have a closed-cup flash point of 23 °C or above, but below 38 °C;
- Class II: liquids that have a closed-cup flash point of 38 °C or above, but below 60,5 °C;
- Class IIIA: liquids that have a closed-cup flash point of 60,5 °C or above, but below 93 °C;
- Class IIIB: liquids that have a closed-cup flash point of 93 °C or above.

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3.13. System Designer

In Engineering, Procurement and Construction Management (EPCM) contracts, the *Consultant* shall act as the System Designer.

In Engineering, Procurement and Construction (EPC) Contracts, the *Contractor* shall act as the System Designer.

3.14. Responsible engineer

An engineer who is registered in terms of the Engineering Profession Act, 2000 (Act No. 46 of 2000), and is viewed competent as prescribed in The National Building Regulations A19 and SANS 10089.

3.15. Risk

A quantitative or qualitative measure of an incident loss potential in terms of both the event likelihood and the conditional, aggregate consequences.

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4 INTRODUCTION

This Technical Fire Protection Design Standard establishes the mandatory requirements governing the specification, design, construction, commissioning, operation, maintenance, and modification of fire protection systems across Transnet Pipelines (TPL) facilities. The standard is intended for use by all responsible persons, including competent persons, system designers, responsible engineers, contractors, and consultants engaged in fire protection activities on behalf of TPL.

The standard is primarily developed for existing Transnet Pipelines sites, recognising the operational, spatial, and infrastructure constraints inherent to brownfield facilities. Accordingly, it references applicable South African legislation, national standards, international codes, and Transnet Pipelines technical specifications to provide a coherent and defensible framework for fire protection system design and implementation. The principles, philosophies, and technical requirements contained herein may also be applied to new or other TPL facilities, subject to local authority approval and statutory requirements.

The effective performance of fire protection systems is critical to ensuring life safety, asset protection, environmental protection, and continuity of operations within the Transnet Pipelines network. Fire protection systems must therefore be designed to operate reliably and immediately during a fire incident, often under adverse conditions and without reliance on external intervention. This necessitates robust system design, high equipment reliability, and a clear, intuitive control philosophy suitable for first responders who may not be professional firefighters.

To achieve and sustain this level of reliability, the standard emphasises the importance of appropriate system selection, sound engineering judgement, standardisation of equipment, and maintainability throughout the asset lifecycle. Inspection, testing, and maintenance requirements are recognised as integral components of the fire protection strategy and must be considered from the earliest stages of system design.

This document adopts a risk-based fire protection philosophy, whereby systems are designed to mitigate credible fire scenarios specific to each site, while remaining compliant with applicable deemed-to-satisfy provisions and recognised industry best practice. Where prescriptive requirements cannot be met, the standard allows for performance-based engineering solutions, subject to formal fire risk evaluation and approval by the responsible engineer and the *Employer*.

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5 SCOPE

This design standard is aimed at the *Contractor* or *Consultant* who is responsible for the specification, design, construction, commissioning, operating, maintenance, and modification of fire protection systems for the *Employers* facilities. It contains the general requirements for these systems, however the site-specific firefighting requirements will be developed in conjunction with the *Employer* and the responsible engineer, as required by SANS 10089.

It shall also assist other parties to determine the most suitable systems to be installed in a specific area within a petrochemical pumping station and bulk fuel depot, namely; maintenance companies, insurance surveyors, building control practitioners, fire safety officers, risk assessors, and fire and rescue service inspectors.

5.1 Purpose

The purpose of this document is to provide a fire protection systems guide for the responsible persons for the specification, design, operation, maintenance, and modification of fire protection systems at the *Employers* sites. The standard aims to capture best practices, and the experience gained from various implementations recently conducted on similar projects, across various countries.

This standard is developed to complement the National Building Regulations and relevant standards; SANS 10400-T, Fire Protection Code & SANS 10089 Part 1: The Petroleum Industry- Storage and distribution of petroleum products in above-ground bulk installations, which provides prescriptive “rules”, or so-called Deemed to Satisfy (DTS) provisions, that, if followed is considered to provide an acceptable level of safety. These rules offer a baseline level of life safety protection for structured purpose use.

5.2 Applicability

This document shall apply throughout Transnet Pipelines, including buildings, bunded areas, spill basins, process plant, road loading, rail loading, pump, and manifold areas, and where similar equipment is used by the *Employer*.

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6 REFERENCED STANDARDS

The standards listed and categorised below were collectively used in the construction of this fire design standard, hence parties using this document shall apply the most recent edition of the documents listed in the respective categories below.

6.1 Normative

General Standards

OSHAct	Occupational Health and Safety Act
ISO 9001	Quality Management System
NBR	National Building Regulations and Building Standards Act No. 103 of 1977

South African National Standards

SANS 246	Code of Practice for Fire Protection for Electrical Equipment Installations
SANS 10287	Automatic Sprinkler Installations for Fire-Fighting Purposes
SANS 1128-1	Hydrant Systems
SANS 1128-2	Fire Hose Reels
SANS 1186	Symbolic Safety Signs
SANS 1910	Portable Refillable Fire Extinguishers
SANS 10090	Community Protection against Fire
SANS 10131	Above Ground Storage Tanks for Petroleum Products
SANS 10139	Fire Detection and Alarm Systems for Buildings – System Design, Installation and Servicing
SANS 10089:1	The Petroleum Industry: Storage and distribution of petroleum products in above-ground bulk installations
SANS 10089:2	The Petroleum Industry: Electrical and other installations in the distribution and marketing sector
SANS 10089:3	The Petroleum Industry: The installation, modification, and decommissioning of underground storage tanks, pumps/ dispensers and pipework at service stations and consumer installations
SANS 10108	The Classification of Hazardous Locations and the Selection of Apparatus for Use in Such Locations
SANS 10400-A	The Application of the National Building Regulations Part A: General Principles and requirements
SANS 10400-T	The Application of the National Building Regulations Part T: Fire Protection
SANS 10400-W	The Application of the National Building Regulations Part W: Fire Installation

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TPL

TPL-TECH-F-STD-001	Standard for non-percolating synthetic lay flat fire hose
TPL-TECH-F-STD-002	Standard for fire system valve numbering system
TPL-TECH-DO-STD-001 - PL100 - REV 04	Drawing Standard Document
TPL-TECH-DO-STD-002 - PL101 - REV 05	Plant & Equipment Tag Numbering Standards
TPL-TECH-DO-STD-003 - PL102 - REV 02	Equipment, Instrument & Electrical Symbology
TPL-TECH-DO-STD-004 - PL103 - REV 05	General Drawing Standards
PL 835	Specification for the Minimum Structural Requirements for Walkway and Platforms and Stairways
PS 2139B – Model	General Structural Standard for Walkways, Stairways and Platforms
XPS/1015/13013 Rev 2	Hazardous Area Classification Guidelines Report for Transnet Pipelines (TPL) Infrastructure
TPL-TECH-STD-002 -	Standard for Spill Basin Design
TPL - TECH-PL-897	Ball Valve Specification
TPL - TECH-PL-898	Butterfly Valve Specification
TPL-TECH-PL-899	Control Valve Specification
TPL-TECH-PL 900	Gate Valve Specification
TPL - TECH-PL-901	Fire Pump Specification
TPL - TECH-PL-902	Water Tank Specification
TPL - TECH-PL-903	Actuating Expanding Plug Valve
TPL - TECH-PL-904	Foam Generating Equipment
TPL - TECH-PL-905	Tank Cooling Protection
TPL - TECH-PL-906	Non-Return Valve
TPL - TECH-PL-907	Back Flow Preventer
TPL - TECH-PL-908	Jockey Pump-set Specification
TPL - TECH-PL-909	Pressure Gauge Specification
TPL - TECH-PL-910	Fire Department Interface Equipment Specification
TPL - TECH-PL-911	Foam Concentrate Tank Specification
TPL - TECH-PL-912	Piping Specification
TPL - TECH-PL-913	Control System Specification
TPL - TECH-PL-915	Foam Concentrate Specification
TPL - TECH-PL-916	Engine Control Panel Fire Control Panel Control Narrative

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TPL - TECH-PL-917	Equipment Document Handover Procedure
TPL - TECH-PL-918	Commissioning and Handover Procedure
TPL - TECH-PL-919	Containerised Fire Pump-Set

6.2 Informative

SANS 62	Steel Pipes
SANS 121	Hot Dip Galvanized Coatings on Fabricated Iron and Steel Articles – Specification and Test Method
SANS 719	Electric Welded Low Carbon Steel Pipes for Aqueous Fluids (Large Bore)
SANS 1091	National Colour Standard
SANS 1475-1	The production of reconditioned fire-fighting equipment Part 1: Portable and wheeled (mobile) rechargeable fire extinguishers
SANS 1475-2	The production of reconditioned fire-fighting equipment Part 2: Fire hose reels and above-ground hydrants.
SANS 1700	Fasteners
SANS 2001-DP2	Construction work, medium pressure pipelines
SANS 2001-DP6	Construction work, below-ground water installations
SANS 10140:2	Identification Colour Marking: Identification of Hazards and Equipment in Work Situations
SANS 10142-1	The wiring of premises – Low-voltage installations
SANS 10177	Fire Testing of Materials, Components, and Elements Used in Buildings
SANS 10400 XA	Environmental Sustainability
SANS 14520	Gaseous Fire Extinguishing Systems – Physical Properties & System Design
SANS 1748-3	Glass Fibre Reinforced Thermosetting Plastics (GRP) Pipes: Part 3 Pipes, Fittings, and Ancillaries for Underground (Buried) Fire Protection Services

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National Fire Protection Association

NFPA 11	Standard for Low, Medium, and High Expansion Foam
NFPA 13	Standard for Installation of Sprinkler System
NFPA 15	Standard for Spray Fixed Systems
NFPA 16	Standard for the Installation of Foam Water Sprinkler and Foam Water Spray Systems
NFPA 20	Standard for the Installation of Stationary Pumps for Fire Protection
NFPA 22	Standard for Water Tanks for Private Fire Protection
NFPA 25	Standard for the Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems
NFPA 30	Flammable and Combustible Liquids Code
NFPA 31	Standard for the Installation of Oil-Burning Equipment
NFPA 37	Combustion Engines & Gas Turbines
NFPA 55	Compressed Gases and Cryogenic Fluid
NFPA 58	Liquefied Petroleum Gas Code
NFPA 72	Fire Alarm Code
NFPA 80A	Recommended Practice for Protection of Buildings from Exterior Fire Exposures
NFPA 110	Standard for Emergency and Standby Power Systems
NFPA 220	Standard on Types of Building Construction
NFPA 221	Standard for High Challenge Fire Walls, Fire Walls, and Fire Wall Barriers
NFPA 251	Standard Methods of Tests of Fire Resistance of Building Construction & Materials
NFPA 550	Guide to the Fire Safety Concepts Tree
NFPA 551	Evaluation of Fire Risk Assessments
NFPA 750	Standard on Water Mist Fire Protection Systems

British Standard

BS 7974	Application of fire safety engineering principles to the design of buildings – code of practice

API Standards

API 650	Welded Steel Tanks for Oil Storage
API 2003	Protection against ignitions arising out of static, lighting, and stray currents
API RP 2021	Management of Atmospheric Storage Tank Fires

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ANSI/UL/AWWA Standards

ANSI/UL 142	Standard for Steel Aboveground Tanks for Flammable and Combustible Liquids
ANSI/AWWA D100	Storage Tanks

Factory Mutual Global Data Sheets

Data Sheet 4-1N	Fixed Water Spray Systems for Fire Protection
Data Sheet 7-83	Drainage Systems for Flammable Liquids
Data Sheets 7-88	Flammable Liquid Storage Tanks

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7 ROLES AND RESPONSIBILITIES

Protection measures detailed in this document are to be implemented by a competent person only. The competent person is to ensure that they fully comply with TPL requirements.

7.1 System Designer

The design of the fire protection systems and protection measures detailed in this document are to be implemented by the System Designer only as defined in the National Building Regulation (NBR), section A19 and AZ4 or SANS 10089, as applicable. The System Designer shall fully comply with the *Employers* requirements and company design philosophy.

The System Designer who uses this document for designing the Fire Protection systems must be a competent person as specified and shall act as the responsible engineer defined herein.

8 TPL PHILOSOPHY REQUIREMENTS

This section outlines the core principles guiding the project's execution, including the Project Principles that ensure alignment with key objectives, and the Fire System Control Philosophy, detailing the safety and operational protocols for fire safety systems.

8.1 Project Principles

First Principle: A risk-based approach will be used to determine the firefighting system requirements per site (development of Credible Event).

To determine the extent of firefighting requirements, each site is to be subjected to a risk assessment considering amongst other issues:

- Firefighting support from:
    - Local authorities
    - Others
- Pipeline network criticality
- Proximity of assets
- Value of assets

Second Principle: The basis for design will cater for the largest Credible Event.

Fire water requirements for fire-fighting purposes shall be determined for the highest fire risk at a site and therefore if the Fire Water and Foam Systems are designed to mitigate the largest Credible Event,

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then it can be reasonably assumed that the probability is that all other events will be mitigated successfully.

Planning and design of the fire protection systems must not be for the incredible event.

Third Principle: The project will allow for all new equipment. Equipment removed from a site may be refurbished and reused on future sites, subject to the written approval by the *Employer*.

Some fire equipment have a long lifespan and could be reused at a secondary facility at the discretion of the *Employer*.

Fourth Principle: The Fire System shall provide for fire suppression for all Credible Events to extinguish a fire.

Fifth Principle: SANS 10400, SANS Codes 10089-1, 10089-2 and SANS 10089 3, will be the primary codes which the design needs to be based on. These may be supplemented by relevant NFPA codes and standards as well as the *Employer* approved specifications.

Sixth Principle: The replenishment rate of fire water will not be considered during the calculation of firefighting water capacity required.

Seventh Principle: The firefighting water capacity will be based on minimum of 60-minute duration to cater for the Credible Event for all sites. The fire water tank capacity will include an additional 10% of this volume for contingency.

Eighth Principle: The firefighting foam concentrate capacity will be based on minimum of 60-minute duration to cater for the credible event for all sites. The foam concentrate tank capacity will include an additional 10% of this volume for contingency. The reserve volume of foam may be stored within the foam tank, or stored separately, depending on the *Employers* operational requirements.

In addition, the *Employer* will carry a reserve stock of foam at each of its three main stores, situated at Pinetown, Ladysmith, and Alrode.

Ninth Principle: All sites are staffed 24 hours a day, 7 days a week. Fire detection relies entirely on human observation in the field.

8.2 Plant Arrangement

The bunded area, high pressure and low-pressure manifold, spill basin, road loading bay, rail loading bay and peripheral buildings shall be subdivided into separate fire zones for the purpose of limiting the spread of fire and limiting the resultant consequential damage to tanks, plant, and facilities. The overall

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philosophy shall be that in the worst fire situation; the capabilities of not more than one bulk fuel tank will be interrupted.

Where assets positioned within fire zones are not compliant to the applicable SANS spacing and layout requirements, a performance-based approach will be taken to the assessment of the separate fire zones, aimed at limiting fire spread and minimising loss whilst ensuring life safety and business continuity. Where appropriate, modelling of parameters such as expected radiant heat flux on targets, smoke transport and toxic species resulting from fires, will be considered in determining the boundaries of such fire zones.

8.3 Fire System Control Philosophy

Fire Systems will be controlled by a hardwire relay logic Fire Control Panel (FCP). The FCP design and functionality must be standardised across all TPL sites in accordance with TPL-TECH-PL 913 - Control System Specification.

To achieve rapid response on a complex site with personnel who are not professional fire fighters, the various subsystems are grouped together in scenarios. Typically, a scenario will comprise of fire protection system/equipment, i.e. bund pourer system and cooling rings of the associated tank. Activation of the scenario will be via a First Responder Panel in the Fire Pump House, control room and the guard house. On activation of the scenario, the firefighting control system will:

- Start a fire pump,
- Activate all equipment associated with the scenario.

Once professional fire fighters arrive on site, the system will be controlled from the main Fire Control Panel (FCP) in the Fire Pump House. From the FCP, the fire fighters will be able to operate individual actuated control valves. This panel will also indicate which valves are open and which are closed.

The remotely activated valves will be fail safe closed, energise to open, in the event of failure of the electrical supply to the valve. If the control system fails, it is possible to operate the actuated valves from the valve itself by bypassing the pilot valve, by opening a manual valve in the trim. The valves will only be operated this way as a last resort.

All electrically operated fire system valves and apparatus will be powered from the FCP. These will be fed from a back-up power supply, thus a power failure will not affect the fire system.

The FCP will also be used to send signals to the fire pump Engine Control Panels (ECP's) to start the pumps, and will also interface with the sites existing process control system in accordance with TPL-TECH-PL 901 - Fire Pump Specification, TPL-TECH-PL 919 - Containerised Solution Specification,

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TPL-TECH-PL 913 - Control System Specification and the TPL-TECH-PL-916 - Engine Control Panel Fire Control Panel Control Narrative

Off-site remote control must be possible in future via a voltage free interfacing unit which facilitates fire control from the future National Operations Centre (NOC) to reset and re select scenarios if incorrect scenarios were initially activated during a fire incident.

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9 TPL ASSET CLASSES

The general plant arrangements are subdivided into fire zones. This is done for the purposes of limiting the spread of a fire and consequential damage to tanks, plants, and facilities. The various types of infrastructure found at the depots are listed as the fire zones/ protection areas below.

1) Indoor fuel pumping facilities
2) Pump slabs
3) Fuel pipeline manifold
4) Road loading facilities
5) Rail loading facilities
6) Buildings
7) Spill Basin
8) Fire Pump House
9) Peripheral buildings
10) Fuel Storage Tanks
11) Bunded areas

9.1.1 Classification of Hazardous Locations

Diesel storage tanks for the fire pump-sets require a hazardous zoning review to be conducted in accordance with SANS 10108, and XPS/1015/13013, Hazardous Area Classification Guidelines Report for Transnet Pipelines (TPL) Infrastructure and certified by the responsible design engineer.

Positioning of the Fire Pump House as well as fire equipment located in the field shall also be subjected to review against the standards.

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10 DEPOT FIRE PROTECTION DESIGN REQUIREMENTS

The range of depots consist of various buildings and infrastructure. This includes fire risk areas and additional areas within the depot that require protection. The general plant protection design requirements listed in this standard is to be further applied to the design of the site-specific fire protection system. The information provided below is further supplemented with detailed requirements of the fire system design in section 12. The following sections highlight the typical fire system requirements to be addressed for all areas. This chapter needs to be read with Appendix A: Best Industry Practice Active Fire System Requirements.

10.1 Fire Detection System

The site-wide fire detection system shall be designed in accordance with the 9th Project Principle.

Fire detection systems within buildings shall be done in accordance with SANS 10139 (also see NFPA 72) where required by the applicable regulation. The fire detection device design is to automatically detect the presence of fire and initiate an alarm system and other appropriate action. An FM200 system shall be installed in accordance with relevant fire safety standards and local regulations to provide rapid fire suppression in critical areas. The system will include detectors, pressurized agent cylinders, Human-machine Interfaces (HMIs), panels and discharge nozzles for efficient fire control. This system will also include a fully addressable fire detection panel used for the termination and programming of point fire detectors.

The fire alarm will provide notifications and warning of an occurrence at the depot, as well as on-site visual and audible alarms and activation of such.

10.2 Selection of Fire Protection Requirements

This section defines the most appropriate systems and technologies to use within each specific area of the site.

The proposed systems are combinations of codes, standards, industry best practice, and experience.

Even though this document provides for a Deemed to Satisfy (DTS) approach, there are unforeseen factors that require additional engineering, such as:

- Suitability of the Fire Protection system components.
- Nature of the site, buildings, and equipment.
- Environmental and atmospheric factors specific to the area, such as temperatures, wind, dust, humidity, and smog, etc. Particularly in relation to how the fire protection system is to be actuated.

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- Operations in the areas.
- The level of monitoring and control required for the sites.
- Areas not covered in the documents.

A risk-based approach is therefore required in undertaking the selection of the fire protection system best suited for the risk area. This approach considers both the risk associated with the response of the detection system to fire phenomena and the on-going reliability of the system components and interconnection in potentially aggressive environments.

10.3 System Requirements

Based on the study of the Normative and Informative reference standards in section 6, Transnet Pipelines has generated its own protection standard with applicable values. This standard includes the list of system requirements that the System Designer must apply.

All fire equipment used in the fire protection system shall comply with the applicable Transnet Pipeline specification listed in section 6.

10.3.1 Fire Water

The water supply on site must be sufficient when supplying the necessary devices during the Credible Event. The water supply shall be independent of the municipal supply and shall be stored in circular or pressed steel tanks.

Notwithstanding this requirement, if a municipal water supply is available, then it must pressurise the fire water reticulation system downstream of the fire water pump-sets.

The total volume of water tanks must be determined in accordance with the Sixth and Seventh Principles.

10.3.2 Fire Water and Foam Concentrate Pump-sets

The fire water and foam concentrate pumps-sets shall be designed, selected and tested based on the requirements in the TPL-TECH-PL 901 - Fire Pump-set Specification, or TPL-TECH-PL 919 – Containerised Fire Pump-set Specification as applicable.

Two diesel engine driven fire water pumps are required, each sized to meet the water flow requirements determined by the Credible Event at the required pressure.

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Two identical foam concentrate pumps will be provided, each driven by the same diesel engine driving the water pumps. Each foam pump shall be sized to meet the foam concentrate requirements determined by the Credible Event at the required pressure.

Diesel fuel tanks must be sized to provide at least 60 minutes of firefighting and 45-minute bi-monthly fire pump tests of each diesel engine. The tanks must be designed and manufactured according to SANS 10131.

The jockey pump must deliver 50 L/min to replenish the fire protection system pressure due to allowable leakage and normal drops in pressure. The requirements that must be met for the jockey pump is provided in TPL-TECH-PL 908 - Jockey Pump-set Specification.

- Pump-sets will be housed within the Fire Pump House or containerised solution, that will either be in a brick and steel structure, or steel structure when a containerised solution is used.
- The decision to use a containerised pump-set solution will be evaluated on a site-by-site basis on consultation with Transnet Pipelines.

Firefighting pump start signals must be activated in each of the following locations:

- At each of the pump-sets ECP's
- By push-button on the FCP and FRP in the Fire Pump House.
- By push-button on the FRP in the control room on site.
- By push-button on the FRP in the guard house.
- By remote field mounted start stations at road tanker loading facilities, rail tank car facilities and truck staging areas.
- At the National Operations Centre (NOC) in future.

The firefighting pump-sets must only be stopped in the fire pump-house at the Engine Control Panel for the respective pump.

10.3.2.1 Fire Water Pump Recirculation Line

The fire water pump recirculation line shall be piped back to the water storage tank and shall be sized for the minimum flow rate of the water pump to prevent damage and shall be fitted with an-line venturi flow meter. The venturi flow meter readings shall be in m^3/h and l/min, with the reading clear during operation with minimal vibration.

Separate water pump pressure relief lines are not required.

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10.3.3 Foam Concentrate and Proportioning

When reviewing this section, it is essential to follow the TPL-TECH-PL 915 - Foam Concentrate specification, TPL-TECH-PL 904 - Foam Generating Equipment, TPL-TECH-PL 911 - Foam Concentrate Tank Specification, and the Eighth Project Principle.

A motorised expanding plug valve (EPV) with manual override, shall be provided to positively isolate the foam concentrate piping reticulation system from the water system when the fire system is offline or while running in Test mode. During Test mode, water and foam is recirculated to the respective storage tanks using the fire pump-sets.

AR- SFFF 3% firefighting foam concentrate, in accordance with TPL-TECH-PL 915 - Foam Concentrate specification, shall be used at all sites, and stored within a glass reinforced plastic (GRP) storage tank in accordance with TPL-TECH-PL 911 - Foam Concentrate Tank Specification. The foam concentrate tank must be sized to comply with the Eighth Principle.

A dedicated foam concentrate loading pump with integral relief valve, sized at 50 L/min, shall be provided within the Fire Pump House to facilitate foam receipt and loading of foam concentrate into the foam storage tank.

The foam tank shall be fitted with dessicant breathers on the vents to prevent the ingress of moisture.

The Equipment used must be complaint to TPL-TECH-PL-904- Foam Generating Equipment.

- One balance-pressure proportioner (one duty, no standby) will be provided to supply foam premix at the required flow rate and pressure to the foam-making equipment provided. The balanced proportioner will introduce foam concentrate at a rate of 3%.
- The balanced-pressure proportioner should be designed considering the required minimum upstream and downstream straight lengths, as well as the minimum equipment flow rates.

The foam concentrate tank, foam proportioning equipment, and control valves will be in the Fire Pump House.

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10.3.4 Ring Mains and Hydrants

Fire hydrants shall be provided in accordance with the TPL-TECH-PL 910 – Fire Department Interface Equipment Specification. The following general requirements apply to hydrants:

- Four-headed pillar hydrants located on a ring main shall be provided for all sites with bulk storage tanks.
- Single-header hydrants located on a ring main or spur will be subject to acceptance by the *Employer* based on the risk profile of the site, typically at pumpstations that do have bulk storage tanks.
- Hydrants on the perimeter of tank bund areas should be at least 15m away potential fire risk areas.
- Hydrants shall be located as a minimum at intervals of 90 m and shall be supplied by 150 mm risers for four-headed pillar hydrants, and an 80 mm riser for a single hydrant.
- All risers shall be provided with a dedicated butterfly isolation valve and pressure indicator

A suitable number of ring main isolation valves shall be provided for effective isolation of significant sections. Sectionalizing and damage control of the reticulation system shall be catered for by providing isolating valves allowing of any artery or of a section of pipe of length exceeding 300 meters in any area to be shut down. This is to allow for a section of the main to be isolated in the event of damage to a portion of the water ring main, this is not applicable to spurs.

Adjacent to all fire hydrants there shall be a fire hoses box that shall consist of:

- Two non-percolating hoses with instantaneous couplings.
- Spray type branch pipe or equivalent.
- Hydrant valve rubber, lip washer.

Notwithstanding the requirements of SANS 10089-1, water main pressure is not required to be supplied to the most remote site location at a running pressure of 1 MPa (10 bar) at the design flow rate. Dynamic pressure at hydrants shall be in the range of 5 - 7 bar.

10.3.4.1 Fire Water Hydrants

During determination of the Credible Event, an allowance does not need to be made for the flow rate from any hydrants.

Provision of Fire Department booster connections as close as possible to the main entrance to site are required to pressurise the ring main, as well as fire department connection points to fill the tanks and extract fire water from the tank.

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The fire hydrant system shall be designed in accordance with SANS 1128, with flow rate requirements taken from SANS 10089-1.

10.3.4.2 Foam Fire Hydrants

One foam hydrant shall be placed upstream of the isolation valve on each monitor. Where two monitors are located immediately adjacent to one another, a single foam hydrant will suffice.

A dedicated foam pre-mix ring main with foam fire hydrants will be assessed on a site-by-site basis, and if required, are to meet the same requirements as the fire water ring main and hydrants.

10.3.5 Fire Department Interface Connections

Dedicated fire department interface connections are to be provided as an interface between the *Employers* fire system and the local fire department, in accordance with TPL - TECH-PL-910 Fire-Department Interface Equipment Specification

Without interrupting the operation of the fire system, the fire department interface connections shall be configured for the following:

- To enable the fire department to supplement or fill the fire water storage tanks on site
- Draw water from the fire water storage tanks on site, for the fire department to use the available water supply on site during use of their own firefighting equipment
- Use their own firefighting equipment to supply water to the sites fire system

The fire department connections must be set up so that, if the fire departments flow and pressure are adequate and the *Employers* fire water pumps are offline, the entire system will still function properly.

10.3.6 Manifold Protection

Approved oscillating foam monitors with spinning tooth nozzles, or cannons with blabber mouths for fog and jet spray patterns selection, must be provided to distribute foam premix onto manifolds, however fixed foam monitors will be considered for manifolds with a smaller footprint. The application rate shall be 4.1 l/m^2/min to the product pipe manifold area in the event of a fire.

The design requirements of the foam monitors are provided in the TPL-TECH-PL 904 - Foam Generating Equipment specification.

Each monitor shall be provided with a butterfly isolation valve. A pressure indicator at the monitor is not required.

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10.3.7 Road and Rail Tanker Loading Area Protection

For depots with loading gantries, foam premix systems and foam deluge nozzles shall be installed, ensuring an application rate of 6.5 l/m²/min. Nozzles shall be positioned at roof level, below mezzanine levels, and at low-level to direct foam beneath the vehicle.

Manually directed foam monitors can be considered for the protection of tanker loading areas, especially in depots without tanker loading gantries, however this is subject to the risk profile of the site and the design of the tanker loading facility.

The design should also account for the full curbed ground area beneath the loading bay canopy, protecting the canopy, pumps, meters, equipment, and vehicles. If an overhead foam-water sprinkler system is used, it must adhere to NFPA 16 standards, in addition to SANS 10089.

The considerations of a loading rack operation spill fire is applied from SANS 10089-1 section A.7.3.1 to A.7.3.5. These considerations are applicable to both bulk truck loading racks and rail sidings.

10.3.8 Product Pump House Protection

Foam premix sprinkler systems with a coverage rate as per NFPA 16 must be provided for pipeline and rotating equipment for fuel products that are housed within buildings.

10.3.9 Bulk Tank Protection

Fixed top foam pourers supplying foam into the storage tanks are required. Enough pourers, in accordance with NFPA 11, must be provided to ensure an application rate (6.5 l/m^2/min) as per SANS 10089 for all fixed roof tanks (with or without internal floating blankets).

The pourers must be installed as high as possible and above the overflow level of tanks considering the level of the blanket and requirements of API 650.

The control of foam premix to the tank foam pourers must be by a ‘double-knock’ system, with a tank foam pourer master valve installed upstream of the individual tank top foam pourer control valves. Opening of the tank foam pourer master valve must be by separate activation on the FCP and FRP’s.

10.3.10 Bulk Tank Cooling

Fixed cooling spray rings are required for bulk tanks. The cooling system shall include a full ring at the top of the tank shell and a mini-ring at the roof apex to protect the tank roofs. The application rate for the respective cooling rings as per SANS 10089 is:

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- 30.3 l/linear meter for shell cooling
- 4.1 l/m²/min for roof cooling as per SANS 10089.

10.3.11 MEX Pourer Protected Areas

Medium expansion (MEX) pourers are used as the primary protection system for a bunded area (typically tank bund areas and spill basins) and shall be designed in accordance with the following:

- The pourers must have an application rate of 6.5 l/m^2/min for the duration of 60 minutes, as specified in SANS 10089-1.
- A foam solution supply pipe shall, where possible, be installed on the outside perimeter of the bund wall, below the radiant heat exposure zone
- MEX pourers are attached to the supply pipe and mounted on top of the bund wall and should not protrude past the bund wall into the bund area.

As per NFPA 11, MEX pourers are required to be spaced a maximum distance based on the individual equipment flow rate:

- For flow rates that are 230 l/min and lower, the distant between pourers need to be within 9m.
- For flow rates that are greater than 230 l/min, the distance between pourers need to be within 18m.

10.3.11.1 Spill Basin and Separator Protection

Medium expansion (MEX) pourers must be provided to protect the spill basin and stand-alone separators, with at least one bund pourer for each compartment. These pourers must have an application rate of 6.5 l/m^2/min for the duration of 60 minutes, but the water and foam demand requirements may not exceed the requirements of the largest Credible Event.

Additional MEX pourers are not required where separators are located within or immediately adjacent to the manifold bund, as protection by manifold monitors is deemed adequate.

Additional suitable foam fire protection systems that can be considered for bund areas without tanks, includes the following:

- Monitors
- Foam-water spray nozzles or a foam sprinkler system over the hazard area
- Supplementary support with portable foam application equipment

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10.3.11.2 Bulk Tank Bund Protection

The design of MEX pourer layouts shall allow for the deployment into each bund and/or the subdivisions of the tanks in a bunded area.

10.3.12 Fire Extinguishers

Fire extinguishers are to be located at the Fire Pump House, based on the level of risk. The fire extinguisher types that must be supplied are as follows:

- 9kg Dry Chemical Powder (DCP) fire extinguishers rated for class A, B and C fires; and
- 5kg CO_2 (carbon dioxide) that will essentially be for the protection of control panels.
- Portable fire extinguishers shall comply with the requirements of SANS 1910 & SANS 1475-1.

10.3.13 Valves

Valves must be supplied and installed as specified by the referenced standards in this document, and they are to include polypropylene seals according to the locked and sealed open/close requirements detailed on the approved P&IDs.

10.3.14 Piping

All piping requirements and piping accessories are described in the TPL-TECH-PL 912 - Piping Specification.

Stainless steel 316 piping shall be used for all foam concentrate piping, as well as foam premix deluge systems at tanker loading areas, top foam pourer risers, and all tank cooling piping. A 6 mm weep-hole installed at the base of all risers must be provided to completely drain the system after use. An insulating flange (IF) kit shall be installed on the cooling ring and top foam-pourer riser headers in the horizontal plane. The weep-hole for cooling ring and top foam pourer risers at the base of product storage tanks shall be positioned to drain liquid past insulating flange kits, ensuring protection of the tank's cathodic system.

In-line piping shall be flanged, whereas small-bore short branch take-offs to instruments, such as pressure gauges, can be threaded. Pressure indicators connections shall be 15NB with an isolation valve upstream of the gauge.

System pressure control valves will typically be located within the Fire Pump House or within a dedicated semi-enclosed valve bank in the field.

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All small diameter piping and valves (50NB and smaller) must be protected against freezing except for the Durban Depot, Hillcrest Depot and uMngeni Booster station at which no weather proofing is required.

All gauges, isolation devices, test valves, control valves shall be located at a height between 1.2 m and 1.5 m above floor, walkway or platform level and shall be easily accessible and visible and free of clutter.

Where appropriate, platforms, steps or elevated walkways shall be provided to negate trip hazards and obstacles. Positioning of equipment close to exhaust pipes or manifolds shall be avoided.

A spare pipeline repair kit, of the mechanical clamp on type, made of stainless steel plate vulcanised onto the rubber seal, for each fire system pipeline size must be available to contain leaks at design pressure.

10.3.15 Bund Spill Fire

During determination of the design Credible Event, the following shall be considered during a bund spill fire due to largest tank failure:

- The largest tank is assumed to be full when it ruptures, spilling its contents into the bund. Refer to the latest edition of SANS 10089 allowances.
- An allowance should be made for the application of foam into the failed tank
- Where a large bund area has been subdivided into smaller bunds, the design solution will be based on the largest of the smaller intermediate bund area.

10.3.16 Alarms

Audible and visual alarms shall be provided at the Fire Pump House in accordance with TPL - TECH-PL-913 Control System Specification.

Sirens shall be installed at all valve banks and at the Fire Pump House. A red visual flashing beacon is required only at the Fire Pump House while the system is operating, and an orange flashing light shall operate during system issues that still allow the system to start.

10.3.17 Bund Drainage

The removal of all liquids directly to safe areas as well as confinement of liquid spills to a defined catchment area will be governed by the requirements of SANS 10089 and TPL-TECH-STD-002 - Standard for Spill Basin Design.

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Where additional guidance is required, NFPA 13 and 15 on the provisions to be adopted to remove fire water from the area of discharge will be consulted, together with the recommendations of FM Data Sheet 7-83 for the removal of flammable liquid.

10.3.17.1 Remote Bunds

Generally, the principle of remote bunding is to contain a spill in a safe location where there is no threat to adjacent facilities. If so, foam application need only commence in the remote bund once the fire in the main bund has been extinguished.

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11 INFRASTRUCTURE AND OTHER REQUIREMENTS

11.1 Fire Pump House

The safety distances between the Fire Pump House (considered as an Important Building as designed by SANS 10089) and the potential heat source, must be calculated according to SANS 10089-1 section 4.4. The Fire Pump House building is not required to be blast proof if these requirements are adhered to. If it is not possible to maintain the required separation, then a 240-minute (SANS 10400) fire resistant wall must be constructed between the potential heat source and the Fire Pump House.

11.1.1 Valve Banks

Valve banks are designed to safeguard both valves and the personnel operating them during a fire. These shall be built using reinforced concrete, with a solid floor and roof. Every valve bank must include fire-rated viewing openings so areas serviced by the valves in the bunkers can be monitored.

11.2 Emergency Exit and Escape Route Signage

Any escape route on the site should be clearly marked and signposted to indicate the available escape routes to a place of relative safety for all operatives. The provision of emergency exit signage should be evaluated in tandem when determining the actual escape routes available.

Given the nature of the site and areas to be protected, and the associated risk of the areas, the actual requirement to provide exit signage within individual areas should be considered during the risk assessment. For instance, emergency exit signage should be provided from these areas to assist with means of escape for any occupants carrying out repairs and maintenance.

All escape signage provided shall be either internally or externally laminated, or be of the photo luminescent type, and shall be designed in accordance with SANS 1186-1, 1186-3 & 1186-5.

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12 FIRE SYSTEM DESIGN

The depot's fire protection system must stay fully operational during upgrades, using temporary spool connections from the new infrastructure.

12.1 Design Objectives

The design objectives for the plant layout from a fire protection standpoint include the following:

- Limit interruption of plant operation by ensuring the loss of only one pump unit or one distribution unit or one bulk fuel tank, given a large fire.
- Reduce the frequency of fires to zero.
- Optimize life safety considerations for plant operating personnel.
- Arrange the plant layout to facilitate fire department access and operation.
- Eliminate primary risks of exposure fires and minimize secondary exposures.

12.1.1 Fire Risk Management

The recommended priority of fire risk management strategies is:

1. Identify hazards relating to life safety
2. Identify hazards relating to disruption of fuel pumping and storage capability
3. Remove hazard with design (non-flammable oil).
4. Contain hazard passively (pipe in pipe construction or self-bunded tanks, etc.).
5. Contain risk passively (trenches, bund, firewalls, drainage, etc.).
6. Fixed fire suppression systems.
7. Water based.
8. Gas based.
9. Fire detection.
10. Fire extinguishers and manual fire-fighting

SANS 10089 and NFPA 30 gives specific guidelines and recommendations on risk management.

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12.1.2 Fire Hazard and Risk Analysis

In order to develop requirements designed to accomplish the objectives stated in section 10.3 and 8.1, it is first necessary to review the broad spectrum of hazards commonly associated with the applicable depot or site being built or upgraded. The principal hazards include:

- The spontaneous combustion of fuel
- Process and operational failures that lead to product spillages
- Combustible and flammable liquid hazards
- Electrical equipment and associated items such as:
    - Transformers
    - Switchgear
    - Transformers
    - Switchgear
    - Cable insulation
    - Fuel Pumps
    - Fans and motors
- Mechanical failure
- Flammable liquid spills
- Lightning strikes
- Heat producing devices
- Exposure from dry grass and brush
- Bund areas cracked to allow spreading of flammable liquids
- Bund areas not correctly sized due to increase of storage volume in the bunded area
- Insufficient or incorrect firefighting systems
- Remote sites firefighting response times
- Human involvement factor
    - Hot working procedures and training
    - Human alarm time without automatic detection
    - Fire system operation and control priority (on site 1st command and off-site 2nd command)
- And the contributing factors of combustible construction and interior furnishings.

The fire risk evaluation should be initiated as early in the design process as practical, to ensure that the fire prevention and fire protection recommendations as described in this document have been evaluated in view of the plant-specific considerations regarding design, layout and anticipated operating requirements.

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The evaluation should result in a list of recommended fire prevention features to be provided, based on acceptable means for separation or control of common and special hazards, the control or elimination of ignition sources, and the suppression of fires. Section 9 provides an overview for the Fire Protection Systems Design Engineer of the available systems suitable for inclusion within specific areas, and around certain items of equipment within the Fuel depot and pumping station technologies covered by this document.

12.2 Area and System Matrices

The matrix found in Appendix A: Best Industry Practice Active Fire System Requirements, details the areas typically found at the *Employers* sites and the level of active and/or passive protection systems applicable to such areas.

Section 9 requirements shall also be reviewed to ensure any specific item of plant or material related to the *Employers* sites generally is incorporated into the Fire Protection Design.

12.3 Maintainability

All Plant and Material used in the works must be maintainable in accordance with Health and Safety laws and OHS requirements. Keep access panels and doors clear and provide enough space and equipment for future plant or parts replacement.

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13 FIRE EQUIPMENT STANDARDISATION

The *Employer* will standardise fire equipment across all sites to improve reliability and simplify maintenance. Limited storage space means only essential spare parts for mechanical failures will be kept, and spare parts for different OEM's for similar equipment is discouraged.

Standardisation reduces system complexity and downtime, ensuring business continuity. Preferred suppliers are those with a local presence in South Africa who reliably stock spare parts. The equipment must be appropriate for its intended use, constructed from suitable materials, and represent the best available technology or offer meaningful improvements over current solutions.

Any variation from the manufacturer's installation procedures should be communicated directly with the manufacturer to confirm that any proposed alternative method will provide the requisite level of performance. Formal documentation of the correspondence is required, and it should be incorporated into the project's quality assurance records.

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14 DOCUMENT CHANGE HISTORY

The owner of this document is responsible for the revision and control of the document, including updating of the table below, which contains the history of the document with details of each revision.

Date	Previous Rev No.	New Rev No.	Details of Revision
9/1/2018	Rev 0	Rev 01	• 2.1.1 Removed continents/first PAR • 2.1.1 Removed Last PAR This baseline, however, cannot cater for all building use as such clause 4.1.1 (b) SANS 10400-part T up designs of buildings. • 2.2.1 Removed – The so called “worse case” scenario under bullet (4)/Second principle • 2.2.1 Fourth principle change wording – The fire system shall provide for fire suppression for all events • 2.2.1 Fifth principle replace “These are supplemented” with These may be supplemented • 2.2.1 Eight principle move bullets 2-6 ninth principle as a note/remove interface with security upgrade • 2.2.2 Change wording – Temporary spool connections from the new infrastructure to existing where required • 2.2.2 Fire water include option 1 and 2 for tanks • 2.2.2 Add “preferably” first PAR • 2.2.2 NOTE 2: add – Municipal water supply to tie into fire water ring main • 2.2.2 FOAM CONCENTRATE – add proportioning to the heading • 2.2.2 PAR 4 – replace 3% with 1%

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			• 2.2.2 PAR 5 – remove -and pressure • 2.2.2 PAR 6 – FIRE DETECTION change to – Only provide to buildings that require detection by regulation • 2.2.2 PRODUCTPUMP HOUSE PROTECTION – add coverage rate as per NFPA 16/remove stainless steel piping • 2.2.2 BULK TANK PROTECTION – Remove half rings replace with full rings/remove last sentence in first PAR “manual control of individual sections” • 2.2.2 FOAM FIRE HYDRANTS -Add foam fire hydrants to be supplied on ring main as per fire hydrants • 2.3 FIRE PROTECTION – Replace zones with subsystems first and second PAR/3PAR add subsystems as per definition/ PAR 4 replace open bund foam, cooling, and curtain with “Activate all equipment associated with the scenario /PAR 9 FCP and not engine batteries/ PAR 10 add – will send a signal to the fire pump controllers to start the pump
16/2/2026	02	03	Modifications to the existing fire standard to include EPC and EPCM procurement strategy, as well as incorporation of the equipment specific fire specifications.

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APPENDIX A: BEST INDUSTRY PRACTICE ACTIVE FIRE SYSTEM REQUIREMENTS

Active & Passive Fire Protection Systems		Ventilation		Fire Detection		Water Supply to Permanent Fire Protection Systems (60 minutes supply min or as prescribed)	Foam Premix System	Tank Cooling System	Tank Top Foam Pourer System	Foam Monitors with Foam Fire Hydrants	Bund Foam Pourers	Containment & Drainage		Fire Hydrants & Yard Mains	Fire Pumps	Booster Connection for Fire Service		Fuel Storage & Dedicated Piping/Pumping System	Shut Off, Control, & Sensing Valves	Plant Shutdown and Interlocks		Passive Fire Protection (60 minute rating)	Separating Distance from Adjacent Structures			Emergency Exit & Escape Route Signage	Note: It is not the intention to include every item of fire equipment into the design (e.g. premix sprinkler and foam monitor at road tanker loading facility is not required) but rather only the 'Best-fit' fire equipment. (Sprinkler or Monitor)
Location\ Equipment to be Protected		System Types																									Comments
General site wide requirements						▲								▲		▲		▲	▲	▲						▲	
Indoor Fuel Pumping Facilities		▲				▲	▲					▲							▲	▲			▲				*Where indoor pumping facilities are provided as part of the oil handling facilites, ventilation should be provided to prevent the build up of flammable vapours. * Either foam water sprinkler systems or monitors are required at pump slabs.
Pump/manifold slabs						▲	▲			▲		▲							▲	▲			▲				
Tank Farm						▲	▲	▲	▲		▲	▲							▲	▲		▲	▲				
Fuel Pipeline Manifold						▲	▲			▲		▲							▲	▲			▲				
Road Loading facilities						▲	▲			▲		▲							▲	▲			▲				
Buildings				▲																							
Rail Loading facilities						▲	▲					▲							▲	▲			▲				
Sump pits: Spill Basin						▲	▲				▲	▲							▲				▲				
Fire Pump Rooms		▲													▲				▲				▲				*Fire protection by means of portable fire equipment. *Fire pump-house needs ventilation to aid the cooling of fire pump sets etc.

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FIRE SYSTEM SPECIFICATION

BALL VALVE

Document number	PL 897
Version number	2
Classification	Unclassified
Effective date	1 July 2025
Review date	1 July 2028

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SUMMARY VERSION CONTROL

VERSION NO.	NATURE OF AMENDMENT	PAGE NO.	DATE REVISED
0	New Specification	ALL	1 July 2025
1	Comments during review between TPL and GreyJones included	ALL	11 July 2025
2	Comments and review from TPL	ALL	27 August 2025

Note: Only latest amendments and/or additions are reflected in italics in the body of the document.

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DOCUMENTATION SIGN-OFF SHEET

I, the undersigned hereby approve this procedure.

ROLE	CAPACITY/ FUNCTION	SIGNATURE	DATE
Compiled by:	**Pieter Jacobs**		
Approved by:	**Papa Moratwe**		

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TECHNICAL SPECIFICATION – BALL VALVES

1 INTRODUCTION

This specification covers the design, fabrication, manufacture, procurement, supply, delivery to site and handover documentation of the ball valves to be used as quarter-turn isolation valves within Transnet Pipelines fire protection systems.

Where the terms ‘valve’ and ‘equipment’ are used in this specification, they shall be interpreted to mean Plant and Materials as defined in NEC3 Clause 11.2(12).

This specification is not site specific but has been prepared as a generic project specification. Site specific valve summary sheets and valve data sheets specifying the site-specific data pertaining to the valves are to be developed by the *Contractor* and submitted to the *Employer* for acceptance.

The process fluid for the valves will be either potable water (supplied by the municipality for the respective site), foam concentrate, a foam premix (a 1% or 3% mixture of foam concentrate and potable water) and diesel.

Properties of the foam concentrate can be found in the Foam Concentrate Specification, document PL915. The *Contractor* shall review the properties of the foam concentrate when determining the suitability with the equipment.

The importance of correctly tagging the valve is underscored as the *Employer* relies on the *Contractor* to provide the valves as specified and with the correct corresponding tag number as shown on the approved P&IDs. The installation *Contractor* will receive the valves on site and will install the valves after pairing the valve tag number with the valve number indicated on the construction drawings.

A selection of valves are located on the pump suction lines and it will need to operate under vacuum conditions. The function of the valves are primarily for isolation/ for maintenance and therefore will be subjected to intermittent usage with long idle periods of the valve being maintained within the open or the closed condition.

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2 DEFINITIONS

The following definitions shall apply when reading this specification;

Term	Definition
^{0}C	Degrees Celsius
ASME	American Society of Mechanical Engineers
ASTM	American Society for Testing & Materials and its successor ASTM International
API	American Petroleum Institute
cP	Centipoise
cSt	Centistoke
DFT	Dry Film Thickness
IA	Intrinsic Approval
ISO	International Standards Organisation
kg/m^3	Kilograms per cubic metre
OEM	Original Equipment Manufacturer
PTFE	Polytetrafluoroethylene
SANS	South African National Standards
SOQ	Schedule of Quantities
Contractor	The successful tenderer
Employer	Transnet Pipelines
UV	Ultra-violet

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3 ENGINEERING STANDARDS

Although not bound in nor issued with this document, the following standardized specifications shall form part of the contract document:

3.1 Applicable Standards

ASME B16.1	Gray Iron Pipe Flanges and Flanged Fittings
ASME B16.34	Valves-Flanged, Threaded, and Welding End
ASMEB16.42	Ductile Iron Pipe Flanges and Flanged Fittings
ASME B16.5	Pipe Flanges and Flange Fittings
FM1112	Indicating Valves (Butterfly or Ball Type) (Threaded)
EN10204	Metallic products - Types of inspection documents
ISO 5211	Industrial valves — Part-turn actuator attachments
SANS 1091	National colour standard
SANS 10140-2	Identification Colour Marking Part 2: Identification of Hazards and Equipment in Work.
SANS 1700	Fasteners
SANS 10089-1	The Petroleum Industry Part 1: Storage and distribution of petroleum products in above-ground bulk installations
SANS 10140-2	Identification Colour Marking Part 2: Identification of Hazards and Equipment in Work.

3.2 Application Based Standards - Diesel and Foam Concentrate Application

API 6D	Specification for Pipeline Valves
API 607	Fire Test for Quarter-Turn Valves and Valves Equipped with Non-metallic Seats (Diesel only)
API 608	Metal Ball valves
API 6FA	Specification for Fire Test for Valves (Diesel Only)
API 598	Valve Inspection and Testing

3.3 Referenced Standards

PL 915	Foam Concentrate

4 LOCATION

The *Contractor* shall take cognizance of the following data of the valve location when preparing the offer;

City	*Contractor* to indicate on data sheet.
Depot	Transnet Pipelines – *Contractor* to indicate on data sheet
Area	*Contractor* to indicate on data sheet
Hazardous Area Classification (SANS10089 Part 2 and SANS 10108)	*Contractor* to indicate on data sheet

5 PROCESS FLUID DATA

The *Contractor* shall take cognizance of the following process fluid data for the when preparing the offer;

Process Fluid 1	Water
Temperature @ Operating Point	5 - 50 °C
Density @ Operating Point	997 kg/m³ @ 25°C
Viscosity @ Operating Point	0.9 cP at 25°C
Process Fluid 2	Foam Concentrate
Temperature @ Operating Point	5 - 35 °C
Density @ Operating Point	1000 - 1100 kg/m³
Viscosity @ Operating Point	2625 cP at 20°C (Non-Newtonian)
Process Fluid 3	Foam Pre-mix
Temperature @ Operating Point	5 - 50 °C
Density @ Operating Point	997 kg/m³ @ 25°C
Viscosity @ Operating Point	0.9 cP at 25°C
Process Fluid 4	Diesel
Temperature @ Operating Point	5 - 50 °C
Density @ Operating Point	845 kg/m³ @ 25°C
Viscosity @ Operating Point	2.95 cP at 25°C

Process fluid data shown to be confirmed by the *Contractor* during the detailed design.

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6 PROCESS DATA

The *Contractor* shall take cognizance of the following process data for the valve when preparing the offer;

Maximum Flow Rate	*Contractor* to indicate on data sheet
Minimum Flow Rate	*Contractor* to indicate on data sheet
Flow Direction	To be indicated on valve body if applicable
Maximum Design Temperature	60°C
Maximum Operating Temperature	50°C
Minimum Operating Temperature	0°C
Design Pressure	16 barg. *Contractor* to indicate on data sheet
Maximum Upstream Operating Pressure	*Contractor* to indicate on data sheet
Minimum Upstream Operating Pressure	*Contractor* to indicate on data sheet
Maximum Downstream Operating Pressure	*Contractor* to indicate on data sheet
Minimum Downstream Operating Pressure	*Contractor* to indicate on data sheet
Maximum Valve Differential Pressure	To be the same as the design pressure
Minimum Valve Differential Pressure	To be the differential between the minimum upstream and the minimum downstream pressures. *Contractor* to indicate on data sheet

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7 VALVE DESIGN

The *Contractor* shall take cognizance of the following physical properties of each valve when preparing the offer;

7.1 Valve design for Process Fluid 1 & 3 – Water and Foam Premix

Valve Design Specifications	ASME B16.34
End Connections (Refer to Figure 1)	25NB ≤ Valves ≤ 200NB ANSI Class 150 raised face to ASME B16.5 15NB ≤ Valves ≤ 25NB Threaded NPT
Valve Body	Floating type two piece threaded/flanged
Size Range	15NB – 200NB
Anti-static Stem Required	No
Blow-out proof stem	Yes
Fire Safe	Not required
Lockable	Yes
Bore	Full bore unless otherwise indicated
Spring Loaded Seat	Where required, *Contractor* to indicate on data sheet
Actuator	Valves ≤150NB – Lever operated. Valves >150NB – Gear operated with handwheel
Gearbox Orientation	*Contractor* to determine during detailed design
Handwheel Orientation	*Contractor* to determine during detailed design
Position Indicators	Yes - if gearbox provided
Ball Stops	Yes. Located to prevent valve from rotating past fully open and fully closed positions.
Special Fasteners	Bolts and nuts other than those used for the flange class shall be supplied with the valve. Metric bolts and nuts shall be used at all times.
Test Pressure	Typically, 1.5 x design pressure.
Liquid Tightness	Yes, to ISO 5208 Rate A.

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7.2 Valve design for Process Fluid 2 – Foam Concentrate

Valve Design Specifications	ASME B16.34
End Connections (Refer to Figure 1)	25NB ≤ Valves ≤ 200NB ANSI Class 150 raised face to ASME B16.5 15NB ≤ Valves ≤ 25NB Threaded NPT
Valve Body	Floating type two piece threaded/flanged
FM Approval and/or UL Listing	Not required
Size Range	15NB – 200NB
Anti-static Stem Required	No
Blow-out proof stem	Yes
Fire Safe	Not required
Lockable	Yes
Bore	Full bore unless otherwise indicated.
Spring Loaded Seat	Where required, *Contractor* to indicate on data sheet
Actuator	Valves ≤150NB – Lever operated. Valves >150NB – Gear operated with handwheel
Gearbox Orientation	*Contractor* to indicate on data sheet
Handwheel Orientation	*Contractor* to indicate on data sheet
Position Indicators	Yes - if gearbox provided *Contractor* to indicate on data sheet
Ball Stops	Yes. Located to prevent valve from rotating past fully open and fully closed positions.
Special Fasteners	Bolts and nuts other than those used for the flange class shall be supplied with the valve. Metric bolts and nuts shall be used at all times.
Test Pressure	Typically, 1.5 x design pressure.
Liquid Tightness	Yes, to ISO 5208 Rate A.

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7.3 Valve design for Process Fluid 4 – Diesel

Valve Design Specifications	API Spec 6D, API 598, API 608, API 607
End Connections (Refer to Figure 1)	15NB ≤ Valves ≤ 50NB ANSI Class 150 raised face to ASME B16.5 Threaded NPTF
Valve Body	Floating type two piece flanged/ threaded
FM Approval and/or UL Listing	Not required
Size Range	15NB – 50NB
Anti-static Stem Required	Yes
Blow-out proof stem	Yes
Fire Safe	Yes
Bore	Full bore unless otherwise specified indicated
Spring Loaded Seat	Where required, *Contractor* to indicate on data sheet.
Actuator	Valves ≤150NB – Lever operated
Gearbox Orientation	*Contractor* to indicate on data sheet.
Handwheel Orientation	*Contractor* to indicate on data sheet.
Position Indicators	Yes - if gearbox provided *Contractor* to indicate on data sheet.
Ball Stops	Yes. Located to prevent valve from rotating past fully open and fully closed positions.
Special Fasteners	Bolts and nuts other than those used for the flange class shall be supplied with the valve. Metric bolts and nuts shall be used at all times.
Test Pressure	Typically, 1.5 x design pressure.
Liquid Tightness	Yes, to ISO 5208 Rate A.

Note: During the design review stage and prior to the design valve assembly, the *Contractor* shall submit to the *Employer* for acceptance the dimensioned General Arrangement (GA) drawings of each valve that shows the actuator, gearbox and handwheel location and sizes.

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8 MATERIALS OF CONSTRUCTION

The *Contractor* shall take cognizance of the following physical properties of each valve when preparing the offer;

Body	Refer to table below. Cast iron is not acceptable. *Contractor* to indicate on data sheet.
Body Seal	Manufacturers recommendation – to be compatible with process fluid
Seat	PTFE
Seat Ring	Manufacturers recommendation – to be compatible with process fluid
Seat Seal	Manufacturers recommendation – to be compatible with process fluid
Stem	Manufacturers recommendations, to be compatible with process fluid - exact specification to be submitted by the *Contractor* with offer for review by the *Employer*
Seals	Compatible with process fluid
Ball	Manufacturers recommendations, to be compatible with process fluid - exact specification to be submitted by the *Contractor* with offer for review by the *Employer*
Nameplate	Stainless steel

The table below displays the appropriate material selection of the valve body based on the Process Fluid and Process Data. The schematic below is used to assist in the understanding of the contents in the table below.

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Material	Process Fluid							
	Water		Foam Concentrate		Foam Pre-mix		Diesel	
	Inline	Take-off	Inline	Take-off	Inline	Take-off	Inline	Take-off
Flanged								
Carbon Steel	x				x		x	
Ductile Iron	x				x			
Stainless Steel 316	x		x		x		x	
Brass/ Bronze	x							
Threaded								
Carbon Steel		x				x		
Ductile Iron		x				x		
Stainless Steel 316		x		x		x		
Brass/ Bronze		x						

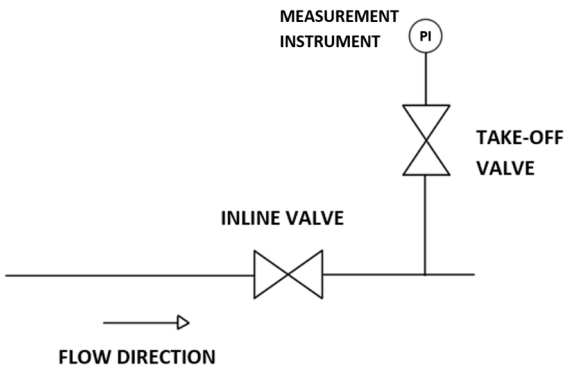


Figure 1: The figure above displays the placement of an inline and take-off valve.

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9 CORROSION PROTECTION

Carbon steel units shall be shot blasted and epoxy coated or painted to prevent corrosion. The *Contractor* shall supply their coating specification as a part of the tender.

Corrosion protection specification for all equipment supplied shall be as per the *Contractor's* recommendation and in accordance with international standards specified for installations in normal industrial non-coastal environments.

Each carbon steel valve shall be provided with the minimum corrosion protection system as specified in the table below;

External	Minimum 200 microns DFT epoxy or paint coating to colour Signal Red A11 (SANS 1091, SANS 10140-2(4.4)) preferred. If a Bronze or stainless-steel body is used, no external corrosion coating is required
Internal	Epoxy or Enamel coating (if in contact with aggressive fluids). *Contractor* to indicate on data sheet

The external corrosion protection of all valves shall be UV resistant, and the colour of the valve shall not fade or degrade over time with exposure to the elements.

10 QUALITY CONTROL

The valve shall be provided with the following minimum quality control documentation;

Material Certification	Required
EN10204 Type Certificate	Type 3.2 (3rd party validation)
Valve Certification	Indicating compliance with this specification Valves used in diesel service shall be supplied with API 607 certificates
Valve Data Sheet Approvals	To be prepared by the *Contractor* and submitted to the *Employer* for acceptance prior to procurement of valves
Drawing Approvals	Submission of General Arrangement (GA) drawings to the *Employer* for acceptance during the design stage
Factory Pressure Test Certificate	Required
Site Hydrostatic Pressure Test	Required

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11 DOCUMENTATION

The certificates shall have the valve serial number on them for traceability between documents.

Each valve shall be provided with the following documentation;

At tender stage	• OEM valve data sheet with dimensioned drawing. • Applicable design standards. • Certificates from authoritative bodies (such as API, ISO9001, UL, FM, etc.)
Design phase	• Valve data sheets for *Employers* acceptance. • General Arrangement (GA) drawing for *Employers* approval. The GA shall indicate the location of gearboxes, handwheels etc. to be reviewed and accepted by the *Employer.* • IA Certificates (if applicable)
Delivery to site	• Design standard certificate. • Certificate of manufacture. • Material certificates. • Factory pressure test certificate. • Installation and maintenance manual. • Spare parts list. • A general arrangement. • Maintenance and operation manuals. • Performance data to indicate the hydraulic performance of the valve including the pressure drop at all flow rates (may be graph, chart, or equations).

Material, design standard, Pressure Test and Manufacturing certificates shall be supplied with all valves.

12 GENERAL

The valve selection, supply and delivery shall adhere to the following specific requirements;

12.1 Equipment:

1) The valves shall be of the NATCO, and NIBCO, make or approved equivalent.

2) The direction of flow shall be cast or stamped on the valve body where applicable. Riveted tags are acceptable.

3) Unless otherwise stated in the specification, each valve shall be capable of sealing with design pressure applied from either end of the valve.

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4) The *Contractor* shall review the process conditions on each valve application with reference to the approved P&ID's and advise the seal type required to ensure zero leakage.

5) All valves shall be new and manufactured from all new materials unless otherwise specified in the enquiry.

6) Valves shall:

- Be lockable in the open and closed position.
- Be provided with polypropylene valve lock seals for each valve.
- Be suitable for use under suction conditions such that air is not entrained through the valve.
- All valves shall be right-handed / open through clockwise motion.
- Valves shall be suitable for outdoor use and shall not be adversely affected by rainfall or exposure to sunlight.
- Valves shall be reliably open and close even after extended periods in open or closed position.
- Valves shall comply with ISO 5211:2010 for actuator mounting.

7) All valves must be of high quality and suitable for a long service life of occasional use. Valves should provide at least 20 years of service, subject to the *Contractors'* specified maintenance regime.

8) Each valve shall be tagged and permanently attached with a minimum 16-gauge stainless steel plate of minimum dimensions 15mm high by 50 mm long. The tags shall be attached with 16-gauge stainless steel wire to the valve and shall not be attached to the valve handles or in a way that interferes with installation or operation of the valves. Tags shall not be attached through bolt holes. The valve tag number as specified on the approved P&ID's shall be permanently hammer stamped on the tag. The height of the text on the tag shall be a minimum of 10 mm high.

12.2 Supply:

1) The *Contractor* shall provide installation instructions detailing the labor, equipment and any special procedures, tools, equipment, or personnel required for the installation.

2) The *Contractor* shall include the provision of all specialist tools, equipment, and services necessary for the installation and / or maintenance of the valves.

3) The material of manufacture of all parts shall be specified on the equipment drawings or data sheets. Submission of this information does not in any way negate the Contractor's responsibility to ensure that the specified materials are suitable for the service required by this or any other documents pertaining to the enquiry.

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4) The *Contractor* is to provide full operating and maintenance and overhaul manuals including detailed section and exploded diagrams of the valves, parts lists, typical spares lists and pricing.

5) The *Contractor* is to provide drawings indicating all relevant dimensions affecting the installation including space required to perform maintenance; this information is to be clearly indicated for all required valve sizes.

6) The *Contractor* shall provide a copy of all manufacturers coating specifications relevant to the products specified.

12.3 Storage:

Storage of the valves shall be:

- Undercover
- On dunnage, made of inert material, at least 150mm above ground level.
- All openings shall be sealed.

The valves shall be stored in an area away from regular vehicle movements and contamination by incompatible materials (e.g., carbon steel and stainless steel).

12.4 Delivery:

1) Prior to delivery, the *Contractor* shall invite the *Employer* to the OEM's premises for an inspection of the valves to ensure conformance to this specification. The *Contractor* shall only deliver the equipment to site once a release certificate for each item of equipment shown on the datasheet issued.

2) The valves shall be loaded and transported on suitable transport arranged by the Contractor. All items shall be secured on the transport vehicle to avoid damage to the valves and their coatings. Valves shall not be allowed to rest directly against each other.

3) All stainless-steel valves are to be kept free of contamination by incompatible materials such as carbon steel grindings, etc. Should valves become contaminated, the *Contractor* shall clean the valves at his own expense. If this is unsuccessful, the *Contractor* shall replace the valves at his own expense.

4) Valves shall be supplied with plastic end caps on both ends.

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5) Valves shall be supplied in sealed wooden containers with plastic linings. A plastic lining shall be wrapped around each individual item. Flange faces and mating surfaces shall be protected during transport and handling.

6) Valves shall be separated so as not to bear against each other and shall be firmly secured by suitable padded lashings to prevent movement and damage in transit. The valves shall not be dropped, bumped, or subjected to shock or rough handling and any valve damaged during transport or handling may be rejected by the Project Manager.

7) The *Contractor* shall make allowance for and comply with all the *Employers* Health Safety Security and Environmental (HSSE) requirements at the delivery point.

8) The *Contractor* shall allow for off-loading to a location on site as directed by the *Employers* representative. An off-loading method statement in compliance with the *Employers* HSE policy shall be supplied for approval prior to delivery.

13 INSTALLATION AND COMMISSIONING REQUIREMENTS

The *Contractor* shall allow for the following as a minimum for the supply, installation, and commissioning of the valves:

1) All valves shall be supplied complete and ready for installation, including any special fittings or fixtures required i.e., extended studs for wafer installation of long valve.

2) All valves shall undergo an on-site in-situ (in place) hydro-static test at 1.5 x the design pressure during hydro-static testing of the piping system. The valves will not be removed during testing of the piping system.

3) The *Employer* shall be advised of all Factory testing and allowed the opportunity to observe Factory Acceptance Tests if required by the *Employer*.

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14 DOCUMENTATION SUPPLY

Documents to be supplied upon award of the supply contract shall include:

1) Installation, operation and maintenance manuals

2) Spare parts list.

3) IA certificate as required by SANS 10108 (if applicable)

4) 3D model for integration into the plant model

5) A general arrangement drawing of each valve.

6) Valve data sheets for *Employers* acceptance

7) Equipment design and construction information for each piece of equipment (sales documents)

8) Approval documents (and indication of equivalency if required in section 10 and 11)

9) Performance data to indicate the hydraulic performance of the valve including the pressure drop at all flow rates (may be graph, chart, or equations

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FIRE SYSTEM SPECIFICATION

BUTTERFLY VALVES

Document number	PL 898
Version number	2
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SUMMARY VERSION CONTROL

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0	New Specification	ALL	1 July 2025
1	Comments during review between TPL and GreyJones included	ALL	10 July 2025
2	Comments and review from TPL	ALL	27 August 2025

Note: Only latest amendments and/or additions are reflected in italics in the body of the document.

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DOCUMENTATION SIGN-OFF SHEET

I, the undersigned hereby approve this procedure.

ROLE	CAPACITY/ FUNCTION	SIGNATURE	DATE
Compiled by:	**Pieter Jacobs**		
Approved by:	**Papa Moratwe**		

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TECHNICAL SPECIFICATION – BUTTERFLY VALVES

1 INTRODUCTION

This specification covers the design, fabrication, manufacture, procurement, supply, delivery to site and handover documentation of the butterfly valves to be used as isolation valves within Transnet Pipelines fire protection systems.

Where the terms ‘valve’ and ‘equipment’ are used in this specification, they shall be interpreted to mean Plant and Materials as defined in NEC3 Clause 11.2(12).

This specification is not site specific but has been prepared as a generic project specification. Site specific valve summary sheets and valve data sheets specifying the site-specific data pertaining to the valves are to be developed by the *Contractor* and submitted to the *Employer* for acceptance.

The process fluid for the valves will be either potable water (supplied by the municipality for the respective site), or a foam premix (a 1% or 3% mixture of foam concentrate and potable water).

Properties of the foam concentrate can be found in the Foam Concentrate Specification, document PL915. The *Contractor* shall review the properties of the foam concentrate when determining the suitability with the equipment.

The importance of correctly tagging the valve is underscored as the *Employer* relies on the *Contractor* to provide the valves as specified and with the correct corresponding tag number as shown on the approved P&ID’s. The installation *Contractor* will receive the valves on site and will install the valves after pairing the valve tag number with the valve number indicated on the construction drawings.

The function of the valves are primarily for isolation for maintenance and therefore will be subject to intermittent usage with long idle periods of the valve being maintained within the open or the closed condition.

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2 DEFINITIONS

The following definitions shall apply when reading this specification;

Term	Definition
^{0}C	Degrees Celsius
ASME	American Society of Mechanical Engineers
ASTM	American Society for Testing & Materials and its successor ASTM International
API	American Petroleum Institute
cP	Centipoise
cSt	Centistoke
DFT	Dry Film Thickness
IA	Intrinsic Approval
ISO	International Standards Organisation
kg/m^3	Kilograms per cubic metre
OEM	Original Equipment Manufacturer
SANS	South African National Standards
SOQ	Schedule of Quantities
Contractor	The successful tenderer
Employer	Transnet Pipelines
UV	Ultra-violet

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3 ENGINEERING STANDARDS

Although not bound in nor issued with this document, the following standardized specifications shall form part of the contract document:

3.1 Applicable Standards

ASME B16.5	Pipe Flanges and Flange Fittings
ASME B16.1	Gray Iron Pipe Flanges and Flanged Fittings
EN10204	Metallic products - Types of inspection documents
FM1112	Butterfly Valves for Fire Protection Service
ISO 5211	Industrial valves — Part-turn actuator attachments
MSS-SP-67	Manufacturers Standardization Society for Butterfly Valves
SANS 10089-1	The Petroleum Industry Part 1: Storage and distribution of petroleum products in above-ground bulk installations
SANS 1700	Fasteners
SANS 1091	National colour standard
SANS 10140-2	Identification Colour Marking Part 2: Identification of Hazards and Equipment in Work.
UL1091	Butterfly Valves for Fire-Protection Service

3.2 Reference Standards

PL 915	Foam Concentrate

4 LOCATION

The *Contractor* shall take cognizance of the following data of the valve location when preparing the offer;

City	*Contractor* to indicate on data sheet.
Depot	Transnet Pipelines – *Contractor* to indicate on data sheet.
Area	*Contractor* to indicate on data sheet.
Hazardous Area Classification (SANS10089 Part 2 and SANS 10108)	*Contractor* to indicate on data sheet.

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5 PROCESS FLUID DATA

The *Contractor* shall take cognizance of the following process fluid data for the valve when preparing the offer;

Process Fluid 1	Water
Temperature @ Operating Point	5 - 50 °C
Density @ Operating Point	997 kg/m³ @ 25°C
Viscosity @ Operating Point	0.9 cP at 25°C
Process Fluid 2	Foam Pre-mix
Temperature @ Operating Point	5 - 50 °C
Density @ Operating Point	997 kg/m³ @ 25°C
Viscosity @ Operating Point	0.9 cP at 25°C

Process fluid data shown to be confirmed by the *Contractor* during the detailed design.

6 PROCESS DATA

The *Contractor* shall take cognizance of the following process data for the valve when preparing the offer;

Maximum Flow Rate	*Contractor* to indicate on data sheet.
Minimum Flow Rate	*Contractor* to indicate on data sheet.
Flow Direction	To be indicated on valve body if applicable
Maximum Design Temperature	60°C
Maximum Operating Temperature	50°C
Minimum Operating Temperature	0°C
Design Pressure	16 barg. *Contractor* to indicate on data sheet.
Maximum Upstream Operating Pressure	*Contractor* to indicate on data sheet.
Minimum Upstream Operating Pressure	*Contractor* to indicate on data sheet.
Maximum Downstream Operating Pressure	*Contractor* to indicate on data sheet.
Minimum Downstream Operating Pressure	*Contractor* to indicate on data sheet.
Maximum Valve Differential Pressure	To be the same as the design pressure
Minimum Valve Differential Pressure	To be the differential between the minimum upstream and the minimum downstream pressures. *Contractor* to indicate on data sheet.

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7 VALVE DESIGN

The *Contractor* shall take cognizance of the following physical properties of each valve when preparing the offer;

End Connections	50NB ≤ Valves <450NB Wafer type between ANSI Class 150 raised face to ASME B16.5
Valve Body	*Contractor* to indicate on data sheet.
FM Approval and/or UL Listing	Preferred
MSS-SP-67 Valve Type	Type I (Valves for tight shut-off)
Size Range	50NB – 450NB
Bore	Reduced bore unless otherwise indicated
Actuator	Valves ≤150NB – Lever operated Valves >150NB – Gear operated with handwheel
Gearbox Orientation	*Contractor* to indicate on data sheet.
Handwheel Orientation	*Contractor* to indicate on data sheet. (See below note)
Position Indicators	Yes – visual indication of the disc position required
Special Fasteners	Bolts and nuts other than those used for the flange class shall be supplied with the valve. Metric bolts and nuts shall be used at all times.
Test Pressure	Typically, 1.5 x design pressure
Liquid Tightness	Yes, to ISO 5208 Rate A

Note: During the design review stage and prior to valve design assembly, the *Contractor* shall submit to the *Employer* for acceptance the dimensioned General Arrangement (GA) drawings of each valve that shows the actuator, gearbox and handwheel location and sizes.

8 MATERIALS OF CONSTRUCTION

The *Contractor* shall take cognizance of the following physical properties of each valve when preparing the offer;

Body	Ductile iron. Cast iron is not acceptable.
Shafts	Stainless steel 316
Disc	Stainless steel 316
Bushing	PTFE
Seat	Yes – vulcanised nitrile.
O-ring	EPDM
Nameplate	Stainless steel

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9 CORROSION PROTECTION

Mild steel units shall be shot blasted and painted on the exterior for corrosion protection. The *Contractor* shall supply their paint specification as a part of the tender.

Corrosion protection specification for all equipment supplied shall be as per the *Contractor's* recommendation and in accordance with international standards specified for installations in normal industrial non-coastal environments.

Each valve shall be provided with the minimum corrosion protection system as specified in the table below;

External	Minimum 200 microns DFT epoxy coating to colour Signal Red A11 (SANS 1091, SANS 10140-2(4.4)) preferred
Internal	Not applicable – valve to be supplied with vulcanised liner

The external corrosion protection of all equipment shall be UV resistant, and the colour of the equipment shall not fade or degrade over time with exposure to the elements.

The preferred colour for all valves is Signal Red A11 (SANS 1091), the *Contractors* standard red valve colour will be considered.

10 QUALITY CONTROL

The valve shall be provided with the following minimum quality control documentation;

Material Certification	Required
EN10204 Type Certificate	Type 3.2 (3rd party validation)
Valve Certification	Indicating compliance with this specification
Valve Data Sheet Approvals	To be prepared by the *Contractor* and submitted to the *Employer* for acceptance prior to procurement of valves
Drawing Approvals	Submission of General Arrangement (GA) drawings to the *Employer* for acceptance during the design stage
Factory Pressure Test Certificate	Required
Site Hydrostatic Pressure Test	Required
Internal	Not applicable – valve to have liner

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11 DOCUMENTATION

The certificates shall have the valve serial number on them for traceability between documents.

Each valve shall be provided with the following documentation;

At tender stage	• OEM valve data sheet with dimensioned drawing • Applicable design standards • Certificates from authoritative bodies (such as API, ISO9001, UL, FM, etc.)
Design stage	• Valve data sheets for *Employers* acceptance. • General Arrangement (GA) drawing for *Employer*s approval. The GA shall indicate the location of gearboxes, handwheels etc. to be reviewed and accepted by the *Employer* • IA Certificates (if applicable)
Delivery to site	• Design standard certificate • Certificate of manufacture • Material certificates • Factory pressure test certificate • Installation and maintenance manual • Spare parts list • A general arrangement. • Maintenance and operation manuals • Performance data to indicate the hydraulic performance of the valve including the pressure drop at all flow rates (may be graph, chart or equations)

Material, design standard, Pressure Test and Manufacturing certificates shall be supplied with all valves.

12 GENERAL

The valve selection, supply and delivery shall adhere to the following specific requirements;

12.1 Equipment:

1) The valves shall be of the AMRI, ISORIA or AVK WWE make or approved equivalent.

2) The direction of flow shall be cast or stamped on the valve body where applicable. Riveted tags are acceptable.

3) Unless otherwise stated in the specification, each valve shall be capable of sealing with design pressure applied from either end of the valve.

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4) All valves shall be new and manufactured from all new materials unless otherwise specified in the enquiry.

5) Valves shall:

- Be lockable in the open and closed position.
- Be provided with polypropylene valve lock seals for each valve.
- All valves shall be right-handed / open through clockwise motion of input.
- Valves shall be suitable for outdoor use and shall not be adversely affected by rainfall or exposure to sunlight.
- Valves shall reliably open and close even after extended periods in open or closed position.
- Valves shall comply with ISO 5211:2010 for actuator mounting.

6) All valves must be of high quality and suitable for a long service life of occasional use. Valves should provide at least 20 years of service, subject to the *Contractors'* specified maintenance regime.

7) Each valve shall be tagged and attached with a minimum 16-gauge stainless steel plate of minimum dimensions 15mm high by 50 mm long. The tags shall be permanently attached with 16-gauge stainless steel wire to the valve and shall not be attached to the valve handles or in a way that interferes with installation or operation of the valves. Tags shall not be attached through bolt holes. The valve tag number as specified on the approved P&ID's, shall be permanently hammer stamped on the tag. The height of the text on the tag shall be a minimum of 10 mm high.

12.2 Supply:

1) The *Contractor* shall provide installation instructions detailing the labour, equipment and any special procedures, tools, equipment or personnel required for the installation.

2) The *Contractor* shall include the provision of all specialist tools, equipment and services necessary for the installation and / or maintenance of the valves.

3) The material of manufacture of all parts shall be specified on the equipment drawings or data sheets. Submission of this information does not in any way negate the *Contractor's* responsibility to ensure that the specified materials are suitable for the service required by this or any other documents pertaining to the enquiry.

4) The *Contractor* is to provide full operating and maintenance and overhaul manuals including detailed section and exploded diagrams of the valves, parts lists, typical spares lists and pricing.

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5) The *Contractor* is to provide drawings indicating all relevant dimensions affecting the installation including space required to perform maintenance; this information is to be clearly indicated for all required valve sizes.

6) The *Contractor* shall provide a copy of all manufacturers painting specifications relevant to the products specified.

12.3 Storage:

Storage of the valves shall be:

- Undercover
- On dunnage, made of inert material, at least 150mm above ground level
- All openings shall be sealed

The valves shall be stored in an area away from regular vehicle movements and contamination by incompatible materials (e.g. carbon steel and stainless steel).

12.4 Delivery:

1) Prior to delivery, the *Contractor* shall invite the *Employer* to the OEM's premises for an inspection of the equipment to ensure conformance to this specification. The *Contractor* shall only deliver the equipment to site once a release certificate for each item of equipment shown on the datasheet issued.

2) The valves shall be loaded and transported on suitable transport arranged by the *Contractor*. All items shall be secured on the transport vehicle to avoid damage to the valves and their coatings. Valves shall not be allowed to rest directly against each other.

3) All stainless-steel valves are to be kept free of contamination by incompatible materials such as carbon steel grindings, etc. Should valves become contaminated, the *Contractor* shall clean the valves at his own expense. If this is unsuccessful, the *Contractor* shall replace the valves at his own expense.

4) Valves shall be supplied with plastic end caps on both ends.

5) Valves shall be supplied in sealed wooden containers with plastic linings. A plastic lining shall be wrapped around each individual item. Flange faces and mating surfaces shall be protected during transport and handling.

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6) Valves shall be separated so as not to bear against each other and shall be firmly secured by suitable padded lashings to prevent movement and damage in transit. The valves shall not be dropped, bumped or subjected to shock or rough handling and any valve damaged during transport or handling may be rejected by the *Employer*.

7) The *Contractor* shall make allowance for and comply with all the *Employers* Health Safety Security and Environmental (HSSE) requirements at the delivery point.

8) The *Contractor* shall allow for off-loading to a location on site as directed by the *Employers* representative. An off-loading method statement in compliance with the *Employers* HSE policy shall be supplied for approval prior to delivery.

13 INSTALLATION AND COMMISSIONING REQUIREMENTS

1) The *Contractor* shall allow for the following as a minimum for the supply, installation and commissioning of the valves:

2) All valves shall be supplied complete and ready for installation including any special fittings or fixtures required i.e. extended studs for wafer installation of long valve.

3) During the installation of all valves with ANSI Class 125 raised face to ASME B16.5, the *Contractor* must ensure the torque is adjusted to the appropriate value as per Class 125. As per ASME B16.42 (6.2), it is recommended that low-strength bolting is used within its Limitations. The torque sequence as recommended by the OEM shall be applied.

4) (High strength bolting is used when mating flanges are flat faced and the full-face gasket extended to the outer diameter of the flanged is used, or Class 150 flange pairs are to be joined.)

5) All valves shall undergo an on-site in-situ hydro-static test at 1.5 x the design pressure during hydro-static testing of the piping system. The valves will not be removed during testing of the piping system.

6) The *Employer* shall be advised of all Factory testing and allowed the opportunity to observe Factory Acceptance Tests if required by the *Employer*.

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14 DOCUMENTATION SUPPLY

Documents to be supplied upon award of the supply contract shall include:

1) Installation and maintenance manual

2) Spare parts list

3) IA certificate as required by SANS 10108 (if applicable)

4) 3D model for integration into the plant model

5) A general arrangement.

6) Valve data sheets for *Employers* acceptance

7) Equipment design and construction information for each piece of equipment (sales documents)

8) Approval documents (and indication of equivalency if required in section 10 and 11)

9) Maintenance and operation manuals

10) Performance data to indicate the hydraulic performance of the valve including the pressure drop at all flow rates (maybe graph, chart or equations)

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FIRE SYSTEM SPECIFICATION

CONTROL VALVE SPECIFICATION

Document number	PL 899
Version number	3
Classification	Unclassified
Effective date	1 December 2025
Review date	1 July 2028

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SUMMARY VERSION CONTROL

VERSION NO.	NATURE OF AMENDMENT	PAGE NO.	DATE REVISED
0	New Specification	ALL	1 July 2025
1	Comments during review between TPL and GreyJones included	ALL	23 July 2025
2	Comments and review from TPL	ALL	27 August 2025
3	Insulation specification added	ALL	18 December 2025

Note: Only latest amendments and/or additions are reflected in italics in the body of the document.

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DOCUMENTATION SIGN-OFF SHEET

I, the undersigned hereby approve this procedure.

ROLE	CAPACITY/ FUNCTION	SIGNATURE	DATE
Compiled by:	**Pieter Jacobs**		
Recommended by:	**Papa Moratwe**		

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TECHNICAL SPECIFICATION – CONTROL VALVES

1 INTRODUCTION

This specification covers the design, fabrication, manufacture, procurement, supply, delivery to site and handover documentation of the hydraulic control valves to be used within Transnet Pipelines fire protection systems.

Where the terms ‘valve’ and ‘equipment’ are used in this specification, they shall be interpreted to mean Plant and Materials as defined in NEC3 Clause 11.2(12).

This specification is not site specific but has been prepared as a generic project specification. Site specific valve summary sheets and valve data sheets specifying the site-specific data pertaining to the valves are to be developed by the *Contractor* and submitted to the *Employer* for acceptance.

The process fluid for the valves will be either potable water (supplied by the municipality for the respective site), foam concentrate or foam premix (a 1% or 3% mixture of foam concentrate and potable water).

The various functions of the different control valves will be to provide tank level control, on-off deluge function, pressure control (reducing) deluge function, and pressure sustaining and pressure relief.

The valves will be subjected to intermittent usage with long idle periods of the valve being maintained within the open or the closed condition.

A selection of valves may be installed in Zone 1 or Zone 2 areas as defined in SANS 10108. The supplier shall identify the zoning classification for each valve as per the hazardous area zone classification report for the site.

The importance of correctly tagging the valve is underscored as the *Employer* relies on the *Contractor* to provide the valves as specified and with the correct corresponding tag number as shown on the approved P&ID’s. The installation *Contractor* will receive the valves on site and will install the valves after pairing the valve tag number with the valve number indicated on the construction drawings.

The fire system is pressurized up to the control valves so that the valves may rely on hydraulic pressure in the lines to open and close and will normally remain closed against pressure for long periods.

Properties of the foam concentrate can be found in the Foam Concentrate Specification, document PL915. The *Contractor* shall review the properties of the foam concentrate when determining the suitability with the equipment.

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The valves shall be suitable for fire duty and may be installed in valve bunkers which will be open on one side but will have a roof over.

2 DEFINITIONS

The following definitions shall apply when reading this specification;

Term	Definition
^{0}C	Degrees Celsius
ASME	American Society of Mechanical Engineers
ASTM	American Society for Testing & Materials and its successor ASTM International
API	American Petroleum Institute
cP	Centipoise
cSt	Centistoke
DFT	Dry Film Thickness
IA	Intrinsic Approval
ISO	International Standards Organisation
kg/m^3	Kilograms per cubic metre
OEM	Original Equipment Manufacturer
SANS	South African National Standards
SOQ	Schedule of Quantities
Contractor	The successful tenderer
Employer	Transnet Pipelines
Fail Safe Open (FSO)	Fluid flows through the solenoid valve when the coil is de-energised, and the valve shuts to prevent fluid flowing when the coil is energized.
Fail Safe Closed (FSC)	Fluid is shut off when the coil of the solenoid valve is de-energised, and the fluid flows through the valve when the coil is energized.
Level Control Valve (LCV)	An in-line valve that automatically shuts close when the level of the process medium within a storage tank reaches a predetermined set-point. The set-point is monitored by a remote mechanical sensing device such as a float valve. The valve is not electrically actuated.
Pressure Control Deluge On-off	An electrically actuated hydraulic pressure control valve that maintains a constant downstream pressure regardless of fluctuations in upstream pressure
On-off Deluge	An electrically actuated control valve that is either fully open or fully closed
Pressure Control Valve (PCV)	An in-line hydraulic control valve that provides either a pressure reducing function, pressure sustaining function or pressure relieving function. The valve is not electrically actuated.
Pressure Reducing Valve (PCRV)	An in-line valve that maintains a constant downstream pressure regardless of fluctuations in upstream pressure. The valve is not electrically actuated.

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Term	Definition
Pressure Sustaining Valve (PSV)	An in-line hydraulic control valve that maintains a constant upstream pressure. The valve is not electrically actuated. The valve is intended to operate regularly and is capable of intermittently reducing pressure by accurately regulating and relieving a large range of flow rates to maintain the system pressure.
Pressure Relief Valve (PRV)	An in-line hydraulic control valve that will open fully when the system reaches the upstream set pressure. The valve is not electrically actuated. It is different to a PSV in that it is not intended to maintain a constant upstream pressure, it is not intended to operate regularly and is only intended to operate under conditions of primary equipment failure.
UV	Ultra-violet

3 ENGINEERING STANDARDS

Although not bound in nor issued with this document, the following standardised specifications shall form part of the contract document:

3.1 Applicable Standards

ASME 16.42	Ductile Iron Pipe Flanges and Flanged Fittings: Classes 150 and 300
ASME B16.5	Pipe Flanges and Flange Fittings
EN10204	Metallic products - Types of inspection documents
SANS 10089-1	The Petroleum Industry Part 1: Storage and distribution of petroleum products in above-ground bulk installations
SANS10089-2	The Petroleum Industry Part 2: Electrical and other installations in the distribution and marketing sector
SANS 10108	The classification of hazardous locations and the selection of apparatus for use in such locations
SANS 1700	Fasteners
SANS 1091	National colour standard
SANS 10140-2	Identification Colour Marking Part 2: Identification of Hazards and Equipment in Work.
FM1110	Automatic Control Valves for Fire Protection Systems
UL260	Dry Pipe and Deluge Valves for Fire-Protection Service

3.2 Referenced Standards

PL 915	Foam Concentrate

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4 LOCATION

The *Contractor* shall take cognizance of the following data of the valve location when preparing the offer;

City	*Contractor* to indicate on data sheet.
Depot	Transnet Pipelines – *Contractor* to indicate on data sheet.
Area	Indoors/outdoors - *Contractor* to indicate on data sheet.
Hazardous Area Classification (SANS10089 Part 2 and SANS 10108)	*Contractor* to indicate on data sheet.

5 PROCESS FLUID DATA

The *Contractor* shall take cognizance of the following process fluid data for the valve when preparing the offer;

Process Fluid 1	Water
Temperature @ Operating Point	5 – 50 °C
Density @ Operating Point	997 kg/m³ @ 25°C
Viscosity @ Operating Point	0.9 cP at 25°C
Process Fluid 2	Foam Concentrate
Temperature @ Operating Point	5 – 35 °C
Density @ Operating Point	1000 – 1100 kg/m³
Viscosity @ Operating Point	2625 cP at 20°C (Non-Newtonian)
Process Fluid 3	Foam Pre-mix
Temperature @ Operating Point	5 – 50 °C
Density @ Operating Point	997 kg/m³ @ 25°C
Viscosity @ Operating Point	0.9 cP at 25°C

The *Contractor* shall review the data sheet for each valve to determine the corresponding process fluid for each valve.

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6 PROCESS DATA

The *Contractor* shall take cognizance of the following process data for the valve when preparing the offer;

Maximum Flow Rate	*Contractor* to indicate on data sheet.
Minimum Flow Rate	*Contractor* to indicate on data sheet.
Flow Direction	To be indicated on valve body if applicable
Maximum Design Temperature	60°C
Maximum Operating Temperature	50°C
Minimum Operating Temperature	0°C
Design Pressure	Up to 16 barg. *Contractor* to indicate on data sheet.
Max. Upstream Operating Pressure	*Contractor* to indicate on data sheet.
Min. Upstream Operating Pressure	*Contractor* to indicate on data sheet.
Max. Downstream Operating Pressure	*Contractor* to indicate on data sheet.
Min. Downstream Operating Pressure	*Contractor* to indicate on data sheet.
Max. Valve Differential Pressure	To be the same as the design pressure
Min. Valve Differential Pressure	*Contractor* to indicate on data sheet.

NB: The *Contractor* shall determine the minimum upstream operating pressure and the maximum downstream operating pressure of each valve to determine the minimum pressure differential that each valve will be required to operate at whilst still discharging ALL process fluid to the downstream side of the valve.

The *Contractor* shall individually assess these requirements and propose suitable valve sizes that will satisfy the operating and process conditions.

7 PIPING SYSTEM DESIGN CONSIDERATIONS

The *Contractor* shall take cognizance of the pipe spacing constraints when preparing the offer to ensure that trim, tubing and other equipment fitted onto the valve do not clash with adjacent valves fitted with the same equipment, and to ensure there is adequate spacing between valves to facilitate maintenance.

Pressure Control Deluge Valves and the On-Off Deluge Valves will typically be installed vertically with flow direction upwards and positioned adjacent to one another on the same horizontal centrelines within a pump house or valve bank. To minimize the overall size of the pump house and valve banks, the valve centrelines will be minimized.

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The *Employer* will review the spacing requirements for each of the proposed valves when assessing the offers from the various suppliers to determine whether the proposed valves will fit within the allocated space.

The *Contractor* is therefore encouraged to minimize valves spacing requirements or submit valve spacing minimization proposals when submitting the formal offer.

8 VALVE DESIGN

The *Contractor* shall take cognizance of the following physical properties and design of each valve when preparing the offer;

End Connections	Valves ≥80NB Wafer type between ANSI Class 150 raised face to ASME B16.5 50NB ≤ Valves <80NB ANSI Class 150 raised face to ASME B16.5 Valves ≤ 40NB Threaded NPT
Valve Body	*Contractor* to indicate on data sheet.
FM Approval and/or UL Listing	Required
Body Drain Valve	Pressure Control, Level Control and Deluge Valves – no
Size Range	25NB – 300NB
Bore	*Contractor* to indicate on data sheet.
Actuator	*Contractor* to indicate on data sheet. Pressure Control Deluge on-off – Electric 24V DC On-off Deluge – Electric 24V DC Pressure Control Valve – N/A Level Control Valve – N/A
Position Indicators	Control Valves and Deluge Valves – Preferable – visual indication of the valve open position
Limit and Pressure Switches	Not required on Control and Deluge Valves
Failure Mode	Fail safe closed unless otherwise indicated on the P&ID. *Contractor* to indicate on data sheet For fail safe open or fail safe closed (the solenoid shall not latch the open/close signal)
Special Fasteners	Fasteners shall be supplied by the control valve supplier for all wafer type valves. Galvanised Gr 8.8 stud bolts, washers and nuts to be supplied for all wafer type valves Metric bolts and nuts shall be used at all times.

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Valve Upstream Pressure Supply	Off valve body – a separate connection from the pipework will not be provided for connection to the valve
Valve Downstream Pressure Sensing	Off valve body – a separate connection from the pipework will not be provided for connection to the valve
Relay/Solenoid/Pilot Valve Assembly Discharge	To downstream of valve *Contractor* to indicate on data sheet.
System Pressure	Maintained by jockey pump at approximately 10 barg. Valve to remain in position during failure of jockey pump i.e. valve to remain closed/open upon reduction of upstream pressure
Valve Alarm	Not required
Pressure Gauges	Yes, with gauge isolation valves. Indication of upstream and downstream pressure. Gauge to be glycerine filled min. 100mm dial face
Strainer on trim	Fire water and foam premix – yes with upstream isolation valve Foam concentrate – no but supplied with upstream isolation valve
Manual Override (Emergency Release)	Yes – when activated valve to maintain pressure control function. Discharge of manual override to downstream of valve.
Wetted Mechanical Moving Parts	Not permitted
Valve trim tubing and fittings	Stainless steel
Test Pressure	Typically, 1.5 x design pressure
Liquid Tightness	Yes, to ISO 5208 Rate A

9 MATERIALS OF CONSTRUCTION

The *Contractor* shall take cognizance of the following physical properties of each valve when preparing the offer;

Body	Carbon Steel. Cast iron is not acceptable. Supplier to confirm suitability with process media and propose alternatives if necessary.
Valve Internals	Suitable for process medium
Sleeve/Liner/Elastomer	Suitable for process medium
Nameplate	Stainless steel
Control Trim	Stainless steel

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10 CORROSION PROTECTION

All valves shall be externally and internally protected. The *Contractor* shall refer to the approved P&ID's for each valve when preparing the offer for the corrosion protection system.

Corrosion protection specification for all equipment supplied shall be as per the *Contractor's* recommendation and in accordance with international standards specified for installations in normal industrial non-coastal environments.

Notwithstanding the *Contractors* recommendation, each ductile iron/carbon steel valve shall be provided with the minimum corrosion protection system as specified in the table below;

External	Minimum 200 microns DFT epoxy or paint coating to colour Signal Red A11 ,preferred If a Bronze body is used, no external corrosion coating is required
Internal	Epoxy or Enamel coating (if in contact with aggressive fluids) – *Contractor* to indicate on data sheet

The preferred colour for all valves shall be manufactured according to standard colour specifications of the SANS 1091 and SANS 10140 – 2 (4.4). The *Contractors* standard red or similar valve colour will be considered subject to approval by the *Employer*. The external corrosion protection of all valves shall be UV resistant, and the colour of the valve shall not fade or degrade over time with exposure to the elements.

Equipment made from Brass, Bronze and stainless steel do not require corrosion protection.

11 QUALITY CONTROL

The valve shall be provided with the following minimum quality control documentation;

EN10204 Type Certificate	Type 3.2 (3rd party validation)
Valve Certification	Indicating compliance with this specification
Valve Data Sheet Approvals	To be prepared by the *Contractor* and submitted to the *Employer* for acceptance prior to procurement of valves
Drawing Approvals	Submission of General Arrangement (GA) drawings to the *Employer* for acceptance during the design stage
Material Certification	Required
Factory Pressure Test Certificate	Required
Site Hydrostatic Pressure Test	Required

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12 DOCUMENTATION

The certificates shall have the valve serial number on them for traceability between documents.

Each valve shall be provided with the following documentation;

At tender stage	• OEM valve data sheet with dimensioned drawing. • Applicable design standards. • Certificates from authoritative bodies (such as API, ISO9001, UL, FM, etc.)
Design phase	• Valve data sheets for *Employers* acceptance • General Arrangement (GA) drawing for *Employers* approval. The GA shall indicate the location of gearboxes, handwheels etc. to be reviewed and accepted by the *Employer*. • IA Certificates (if applicable)
Delivery to site	• Design standard certificate. • Certificate of manufacture. • Material certificates. • Factory pressure test certificate. • Installation and maintenance manual. • Spare parts list. • A general arrangement. • Maintenance and operation manuals. • Performance data to indicate the hydraulic performance of the valve including the pressure drop at all flow rates (may be graph, chart or equations).

Material, design standard, Pressure Test and Manufacturing certificates shall be supplied with all valves.

13 GENERAL

The valve design, selection and supply shall adhere to the following specific requirements:

13.1 Equipment:

1) The valves shall be of the Inbal or Bermad make or approved equivalent.

2) All valves shall be new and manufactured from all new materials unless otherwise specified in the enquiry.

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3) Control valves shall:

- Be of ‘non-clack’ type.
- Be suitable for mounting in the horizontal or vertical position with a flow direction up or down through the valve.
- Have the typical wet/dry pilot control valve trim.
- Reliably open with no outside intervention even after extended periods of closure

4) Pressure Control Deluge Valves are to operate on an on/off principle but shall be capable of modulating the downstream pressure. The operation shall facilitate the maintenance of the pressure downstream of the valve at a set value whenever the upstream pressure is greater than that set pressure.

5) When Pressure Control Deluge Valves are in the ‘electrically open state’ and the upstream pressure drops below the set pressure of the valves, the valve shall open fully.

6) The set pressure of Pressure Control Deluge Valves and Pressure Control Valves shall be adjustable and is to be set during commissioning.

- There shall be provision to lock out the pressure modulation setting to prevent erroneous adjustment.

7) Control valves installed outside of a valve bank or pump house are required to be insulated. This includes instrumentation tubing containing process fluid subjected to ambient conditions, to prevent the fluid from dropping below 4°C. The insulation of exposed valves are required to be done by the *Contractor*.

8) All valves must be of high quality and suitable for a long service life of occasional use. Valves should provide at least 20 years of service, subject to the supplier specified maintenance regime.

9) The direction of flow shall be cast or stamped on the valve body where applicable. Riveted tags are acceptable.

10) Each valve shall be tagged and permanently attached with a minimum 16-gauge stainless steel plate of minimum dimensions 15mm high by 50 mm long. The tags shall be attached with 16-gauge stainless steel wire to the valve and shall not be attached to the valve handles or in a way that interferes with installation or operation of the valves. Tags shall not be attached through bolt holes. The valve’s tag number as specified on the approved P&ID’s shall be permanently hammer stamped on the tag. The height of the text on the tag shall be a minimum of 10 mm high.

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13.2 Supply:

1) The *Contractor* shall provide installation instructions detailing the labor, equipment and any special procedures, tools, equipment or personnel required for the installation.

2) The *Contractor* shall include the provision of all specialist tools, equipment and services necessary for the installation and / or maintenance of the valves.

3) The material of manufacture of all parts shall be specified on the equipment drawings or data sheets. Submission of this information does not in any way negate the *Contractors* responsibility to ensure that the specified materials are suitable for the service required by this or any other documents pertaining to the enquiry.

4) Material certificates are to be provided for every supplied valve. Typical certificates are to be supplied with the tender return for each valve type.

5) The *Contractor* is to provide full operating and maintenance and overhaul manuals including detailed section and exploded diagrams of the valves, parts lists, typical spares lists and pricing.

6) The *Contractor* is to provide drawings indicating all relevant dimensions affecting the installation including space required to perform maintenance; this information is to be clearly indicated for all required valve sizes.

13.3 Storage:

The storage of the valves shall be:

- Undercover
- On dunnage, made of inert material, at least 150mm above ground level
- All openings shall be sealed

The valves shall be stored in an area away from regular vehicle movements and contamination by incompatible materials (e.g. carbon steel and stainless steel).

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13.4 Delivery:

1) Prior to delivery, the *Contractor* shall invite the *Employer* to the Suppliers premises for an inspection of the valves to ensure conformance to this specification. The *Contractor* shall only deliver the equipment to site once a release certificate for each item of equipment shown on the datasheet issued.

2) The valves shall be loaded and transported on suitable transport arranged by the *Contractor*. All items shall be secured on the transport vehicle to avoid damage to the valves and their coatings. Valves shall not be allowed to rest directly against each other.

3) All stainless-steel valves are to be kept free of contamination by incompatible materials such as carbon steel grindings, etc. Should valves become contaminated, the *Contractor* shall clean the valves at his own expense. If this is unsuccessful, the *Contractor* shall replace the valves at his own expense.

4) Valves shall be supplied with plastic end caps on both ends.

5) Valves shall be supplied in sealed wooden containers with plastic linings. A plastic lining shall be wrapped around each individual item. Flange faces and mating surfaces shall be protected during transport and handling.

6) Valves shall be separated so as not to bear against each other and shall be firmly secured by suitable padded lashings to prevent movement and damage in transit. The valves shall not be dropped, bumped or subjected to shock or rough handling and any valve damaged during transport or handling may be rejected by the *Employer*.

7) The *Contractor* shall make allowance for and comply with all the *Employers* Health Safety Security and Environmental (HSSE) requirements at the delivery point.

8) The *Contractor* shall allow for off-loading to a location on site as directed by the *Employers* representative. An off-loading method statement in compliance with the *Employers* HSE policy shall be supplied for approval prior to delivery.

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14 INSTALLATION AND COMMISSIONING REQUIREMENTS

The *Contractor* shall allow for the following as a minimum for the supply, installation and commissioning of the :

1) The certification documentation shall accompany the valves which shall be suitably tagged as required by this specification

2) All valves shall be supplied complete and ready for installation including any special fittings or fixtures required i.e. extended studs for wafer installation of long valve.

3) All valves shall undergo an on-site in-situ hydro-static test at 1.5 x the design pressure during hydro-static testing of the piping system. The valves will not be removed during testing of the piping system.

4) The *Employer* shall be advised of all factory testing and allowed the opportunity to observe factory acceptance tests if required by the *Employer*.

5) The *Contractor* shall notify the OEM equipment supplier two weeks in advance of the first on-site commissioning date of the system and shall make provision to mobilise a suitable technician to site for the duration of the commissioning of the valves. The *Contractor* shall make provision for the supply of all tools and equipment necessary for on-site commissioning. The *Contractor* shall not assume that all valves will be commissioned on the same day as the system will be commissioned in parts and as a result, several trips to site to commission the system will be required. During commissioning, the *Contractor* shall assist the *Employer* with commissioning of the system by adjusting the final set pressure of the valves to meet the *Employer's* requirements and also by actively participating in the arrival at any solutions to any problems that may arise during commissioning.

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15 DOCUMENTATION SUPPLY

Documents to be supplied upon award of the supply contract shall include:

1) Installation, operation and maintenance manual

2) Spare parts list

3) IA certificate as required by SANS 10108

4) Valve data sheets for *Employers* acceptance

5) 3D model for integration into the plant model

6) A general arrangement.

7) Equipment design and construction information for each piece of equipment (sales documents)

8) Approval documents (and indication of equivalency if required in section 11 and 12)

9) Performance data to indicate the hydraulic performance of the valve including the pressure drop at all flow rates (may be graph, chart or equations).

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FIRE SYSTEM SPECIFICATION

GATE VALVE

Document number	PL 900
Version number	3
Classification	Unclassified
Effective date	1 July 2025
Review date	1 July 2028

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SUMMARY VERSION CONTROL

VERSION NO.	NATURE OF AMENDMENT	PAGE NO.	DATE REVISED
0	New Specification	ALL	1 July 2025
1	Comments during review between TPL and GreyJones included	ALL	11 July 2025
2	Comments and review from TPL	ALL	27 August 2025
3	Correction on actuator design	ALL	01 October 2025

Note: Only latest amendments and/or additions are reflected in italics in the body of the document.

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DOCUMENTATION SIGN-OFF SHEET

I, the undersigned hereby approve this procedure.

ROLE	CAPACITY/ FUNCTION	SIGNATURE	DATE
Compiled by:	**Pieter Jacobs**		
Approved by:	**Papa Moratwe**		

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TECHNICAL SPECIFICATION – GATE VALVE

1 INTRODUCTION

This specification covers the design, fabrication, manufacture, procurement, supply, delivery to site and handover documentation of the gate valves to be used as isolation valves within Transnet Pipelines fire protection systems.

Where the terms ‘valve’ and ‘equipment’ are used in this specification, they shall be interpreted to mean Plant and Materials as defined in NEC3 Clause 11.2(12).

This specification is not site specific but has been prepared as a generic project specification. Site specific valve summary sheets and valve data sheets specifying the site-specific data pertaining to the valves are to be developed by the *Contractor* and submitted to the *Employer* for acceptance.

The process fluid for the valves will be potable water (supplied by the municipality for the respective site).

The importance of correctly tagging the valve is underscored as the *Employer* relies on the *Contractor* to provide the valves as specified on the approved P&ID’s, with the correct corresponding tag number. The installation *Contractor* will receive the valves on site and will install the valves after pairing the valve tag number with the valve number indicated on the construction drawings.

A selection of valves are located on pump suction lines and will permit or prevent the supply of water to the pumps. The function of the valves are primarily for isolation for maintenance and therefore will be subjected to intermittent usage with long idle periods of the valve being maintained within the open or the closed condition.

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2 DEFINITIONS

The following definitions shall apply when reading this specification;

Term	Definition
^{0}C	Degrees Celsius
ASME	American Society of Mechanical Engineers
ASTM	American Society for Testing & Materials and its successor ASTM International
API	American Petroleum Institute
BS	British Standard
cP	Centipoise
EN	European Norm
DFT	Dry Film Thickness
IA	Intrinsic Approval
ISO	International Standards Organisation
kg/m^3	Kilograms per cubic metre
OEM	Original Equipment Manufacturer
OS&Y	Outside Stem and Yoke
PTFE	Polytetrafluoroethylene
SANS	South African National Standards
SOQ	Schedule of Quantities
Contractor	The successful tenderer
Employer	Transnet Pipelines
UV	Ultra-violet

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3 ENGINEERING STANDARDS

Although not bound in nor issued with this document, the following standardized specifications shall form part of the contract document:

ASME B16.10	Face-to-Face and End-to-End Dimensions of Valves
ASME B16.5	Pipe Flanges and Flange Fittings
BS EN 1074-1	Valves for water supply. Fitness for purpose requirements and appropriate verification tests
BS EN 1074-2	Valves for water supply. Fitness for purpose requirements and appropriate verification tests – Isolating valves.
EN10204	Metallic products - Types of inspection documents
FM 1130	Gate valves for Fire Protection Services
SANS 10089-1	The Petroleum Industry Part 1: Storage and distribution of petroleum products in above-ground bulk installations
SANS 10140-2	Identification Colour Marking Part 2: Identification of Hazards and Equipment in Work.
SANS 1700	Fasteners
SANS 1091	National colour standard
UL 262	Gate valves for Fire Protection Services

4 LOCATION

The *Contractor* shall take cognizance of the following data of the valve location when preparing the offer;

City	*Contractor* to indicate on data sheet.
Depot	Transnet Pipelines – *Contractor* to indicate on data sheet.
Area	*Contractor* to indicate on data sheet.
Hazardous Area Classification (SANS10089 Part 2 and SANS 10108)	*Contractor* to indicate on data sheet.

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5 PROCESS FLUID DATA

The *Contractor* shall take cognizance of the following process fluid data for the valve when preparing the offer;

Process Fluid	Water
Temperature @ Operating Point	5 - 50 °C
Density @ Operating Point	997 kg/m³ @ 25°C
Viscosity @ Operating Point	0.9 cP at 25°C

Process fluid data shown to be confirmed by the *Contractor* during the detailed design.

6 PROCESS DATA

The *Contractor* shall take cognizance of the following process data for the valve when preparing the offer;

Maximum Flow Rate	*Contractor* to indicate on data sheet.
Minimum Flow Rate	*Contractor* to indicate on data sheet.
Flow Direction	To be indicated on valve body if applicable
Maximum Operating Temperature	60°C
Maximum Operating Temperature	50°C
Minimum Operating Temperature	0°C
Design Pressure	16 barg
Maximum Upstream Operating Pressure	*Contractor* to indicate on data sheet.
Minimum Upstream Operating Pressure	*Contractor* to indicate on data sheet.
Maximum Downstream Operating Pressure	*Contractor* to indicate on data sheet.
Minimum Downstream Operating Pressure	*Contractor* to indicate on data sheet.
Maximum Valve Differential Pressure	To be the same as the design pressure
Minimum Valve Differential Pressure	To be the differential between the minimum upstream and the minimum downstream pressures. *Contractor* to indicate on data sheet.

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7 VALVE DESIGN

The *Contractor* shall take cognizance of the following physical properties of each valve when preparing the offer;

Design	OS&Y Type with rising stem
End Connections	50NB ≤ Valves ≤ 500NB ANSI Class 125 raised face to ASME B16.5 25NB ≤ Valves < 50NB Threaded NPT
Face to Face Length	EN 558-2 Series 14/DIN F4 or approved equivalent
FM Approval and/or UL Listing	Required
Size Range	25NB – 500NB
Bore	Full bore unless otherwise specified on valve data sheet
By-pass Valve	Not required
Actuation	Manual
Actuator	Valves ≤150NB – Operated with handwheel Valves >150NB – Gear operated with handwheel
Gearbox Orientation	*Contractor* to indicate on data sheet.
Handwheel Orientation	*Contractor* to indicate on data sheet.
Position Indicators	Not required (rising stem)
Special Fasteners	Bolts and nuts other than those used for the flange class shall be supplied with the valve. Metric bolts and nuts shall be used at all times.
Test Pressure	Typically, 1.5 x design pressure
Liquid Tightness	Yes, to ISO 5208 Rate A

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8 MATERIALS OF CONSTRUCTION

The *Contractor* shall take cognizance of the following physical properties of each valve when preparing the offer;

Body and bonnet	Ductile Iron or Carbon Steel. Cast iron is not acceptable
Stem	Stainless steel 316
Wedge	Ductile Iron or Carbon steel encapsulated in vulcanized EPDM
Stem Nut	Manufacturers standard – exact specification to be submitted by the *Contractor* with offer for review by the *Employer*
Valve Trim (studs, nuts etc.)	Stainless steel 316
Nameplate	Stainless steel

9 CORROSION PROTECTION

Mild steel units shall be shot blasted and epoxy coated or painted to prevent corrosion. The *Contractor* shall supply their coating specification as a part of the tender.

Corrosion protection specification for all equipment supplied shall be as per the *Contractor's* recommendation and in accordance with international standards specified for installations in normal industrial non-coastal environments.

Each valve shall be provided with the minimum corrosion protection system as specified in the table below;

External	Minimum 200 microns DFT epoxy or paint coating to colour Signal Red A11 (SANS 1091, SANS 10140-2(4.4)) preferred
Internal	Minimum 200 microns DFT epoxy or Enamel coating Wedge fully vulcanised

The external corrosion protection of all equipment shall be UV resistant and the colour of the equipment shall not fade or degrade over time with exposure to the elements.

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10 QUALITY CONTROL

The valve shall be provided with the following minimum quality control documentation;

EN10204 Type Certificate	Type 3.2 (3rd party validation)
Material Certification	Required
Valve Certification	Indicating compliance with this specification
Valve Data Sheet Approvals	To be prepared by the *Contractor* and submitted to the *Employer* for acceptance prior to procurement of valves
Drawing Approvals	Submission of General Arrangement (GA) drawings to the *Employer* for acceptance during the design stage
Factory Pressure Test Certificate	Required
Site Hydrostatic Pressure Test	Required

11 DOCUMENTATION

The certificates shall have the valve serial number on them for traceability between documents.

Each valve shall be provided with the following documentation;

At tender stage	• OEM valve data sheet with dimensioned drawing • Applicable design standards • Certificates from authoritative bodies (such as API, ISO9001, UL, FM, etc)
Design stage	• Valve data sheets for *Employers* acceptance • General Arrangement (GA) drawing for *Employers* approval. • IA Certificates (if applicable)
Delivery to site	• Design standard certificate. • Certificate of manufacture. • Material certificates. • Factory pressure test certificate. • Installation and maintenance manual. • Spare parts list. • A general arrangement. • Maintenance and operation manuals. • Performance data to indicate the hydraulic performance of the valve including the pressure drop at all flow rates (may be graph, chart, or equations).

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Material, design standard, Pressure Test and Manufacturing certificates shall be supplied with all valves.

12 GENERAL

The valve selection, supply and delivery shall adhere to the following specific requirements;

12.1 Equipment:

1) The valves shall be of the Ainsworth, Rapid Drop or AVK make or approved equivalent.

2) The direction of flow shall be cast or stamped on the valve body where applicable. Riveted tags are acceptable.

3) Unless otherwise stated in the specification, each valve shall be capable of sealing with design pressure applied from either end of the valve.

4) All valves shall be new and manufactured from all new materials unless otherwise specified in the enquiry.

5) Valves shall:
   - Be lockable in the open and closed position.
   - Be suitable for use under suction conditions such that air is not entrained through the valve.
   - Be provided with polypropylene valve lock seals for each valve.
   - All valves shall be right-handed / open through clockwise motion of input.
   - Valves shall be suitable for outdoor use and shall not be adversely affected by rainfall or exposure to sunlight.
   - Valves shall reliably open and close even after extended periods in open or closed position.
   - Valves shall comply with ISO 5211:2010 for actuator mounting.

6) All valves must be of high quality and suitable for a long service life of occasional use. Valves should provide at least 20 years of service, subject to the *Contractors'* specified maintenance regime.

7) Each valve shall be tagged and permanently attached with a minimum 16-gauge stainless steel plate of minimum dimensions 15mm high by 50 mm long. The tags shall be attached with 16-gauge stainless steel wire to the valve and shall not be attached to the valve handles or in a way that interferes with installation or operation of the valves. Tags shall not be attached through bolt holes. The valve's tag number as specified on the approved P&IDs shall be permanently hammer stamped on the tag. The height of the text on the tag shall be a minimum of 10 mm high.

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12.2 Supply:

1) The *Contractor* shall provide installation instructions detailing the labor, equipment and any special procedures, tools, equipment or personnel required for the installation.

2) The *Contractor* shall include the provision of all specialist tools, equipment and services necessary for the installation and / or maintenance of the valves.

3) The material of manufacture of all parts shall be specified on the equipment drawings or data sheets. Submission of this information does not in any way negate the *Contractor's* responsibility to ensure that the specified materials are suitable for the service required by this or any other documents pertaining to the enquiry.

4) The *Contractor* is to provide full operating and maintenance and overhaul manuals including detailed section and exploded diagrams of the valves, parts lists, typical spares lists and pricing.

5) The *Contractor* is to provide drawings indicating all relevant dimensions affecting the installation including space required to perform maintenance; this information is to be clearly indicated for all required valve sizes.

6) The *Contractor* shall provide a copy of all manufacturers coating specifications relevant to the products specified.

12.3 Storage:

Storage of the valves shall be:

- Undercover
- On dunnage, made of inert material, at least 150mm above ground level
- All openings shall be sealed

The valves shall be stored in an area away from regular vehicle movements and contamination by incompatible materials (e.g. carbon steel and stainless steel).

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12.4 Delivery:

1) Prior to delivery, the *Contractor* shall invite the *Employer* to the OEM's premises for an inspection of the valves to ensure conformance to this specification. The *Contractor* shall only deliver the equipment to site once a release certificate for each item of equipment shown on the datasheet issued.

2) The valves shall be loaded and transported on suitable transport arranged by the *Contractor*. All items shall be secured on the transport vehicle to avoid damage to the valves and their coatings. Valves shall not be allowed to rest directly against each other.

3) All stainless-steel valves are to be kept free of contamination by incompatible materials such as carbon steel grindings, etc. Should valves become contaminated, the *Contractor* shall clean the valves at his own expense. If this is unsuccessful, the *Contractor* shall replace the valves at his own expense.

4) Valves shall be supplied with plastic end caps on both ends.

5) Valves shall be supplied in sealed wooden containers with plastic linings. A plastic lining shall be wrapped around each individual item. Flange faces and mating surfaces shall be protected during transport and handling.

6) Valves shall be separated so as not to bear against each other and shall be firmly secured by suitable padded lashings to prevent movement and damage in transit. The valves shall not be dropped, bumped or subjected to shock or rough handling and any valve damaged during transport or handling may be rejected by the *Employer*.

7) The *Contractor* shall make allowance for and comply with all the *Employers* Health Safety Security and Environmental (HSSE) requirements at the delivery point.

8) The *Contractor* shall allow for off-loading to a location on site as directed by the *Employers* representative. An off-loading method statement in compliance with the *Employers* HSE policy shall be supplied for approval prior to delivery.

13 INSTALLATION AND COMMISSIONING REQUIREMENTS

The *Contractor* shall allow for the following as a minimum for the supply, installation and commissioning of the valves:

1) All valves shall be supplied complete and ready for installation including any special fittings or fixtures required i.e. extended studs for wafer installation of long valve.

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2) All valves shall undergo an on-site in-situ (in place) hydro-static test at 1.5 x the design pressure during hydro-static testing of the piping system. The valves will not be removed during testing of the piping system.

3) During the installation of all Flanged Ball valves with ANSI Class 125 raised face to ASME B16.5, the *Contractor* must ensure the torque is adjusted to the appropriate value as per Class 125. As per ASME B16.42 (6.2), it is recommended that low-strength bolting is used within its Limitations. The Torque sequence applied shall be as per the OEM recommendation.

   (High strength bolting is used when mating flanges are flat faced and the full-face gasket extended to the outer diameter of the flanged is used, or Class 150 flange pairs are to be joined.)

4) The *Employer* shall be advised of all Factory testing and allowed the opportunity to observe Factory Acceptance Tests if required by the *Employer.*

14 DOCUMENTATION SUPPLY

Documents to be supplied upon award of the supply contract shall include:

1) Installation, operation and maintenance manual

2) Spare parts list

3) IA certificate as required by SANS 10108 (if applicable)

4) 3D model for integration into the plant model

5) Valve data sheets for *Employers* acceptance.

6) A general arrangement.

7) Equipment design and construction information for each piece of equipment (sales documents)

8) Approval documents (and indication of equivalency if required in section 10 and 11)

9) Performance data to indicate the hydraulic performance of the valve including the pressure drop at all flow rates (maybe graph, chart or equations)

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FIRE SYSTEM SPECIFICATION

FIRE PUMP-SET SPECIFICATION

Document number	PL 901
Version number	2
Classification	Unclassified
Effective date	1 February 2026
Review date	1 July 2029

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SUMMARY VERSION CONTROL

VERSION NO.	NATURE OF AMENDMENT	PAGE NO.	DATE REVISED
0	New Specification	ALL	1 July 2025
1	Comments during review between TPL and GreyJones included	ALL	24 July 2025
2	Updated pre-heater power supply from ECP to Essential DB	ALL	18 February 2026

Note: Only latest amendments and/or additions are reflected in italics in the body of the document.

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DOCUMENTATION SIGN-OFF SHEET

I, the undersigned hereby approve this procedure.

ROLE	CAPACITY/ FUNCTION	SIGNATURE	DATE
Compiled by:	**Pieter Jacobs**		
Approved by:	**Papa Moratwe**		

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1 INTRODUCTION

The *Employer* does not solely rely on the available municipal water supply to meet the performance requirements of the firefighting equipment that has been selected to operate in the event of a fire and have therefore opted to include in the firefighting system two fire pump-sets ,connected with its corresponding water tanks, each with identical performance specifications and duty points. The pump-sets will be arranged in a duty stand-by configuration to provide the system with a suitable level of redundancy.

In addition to the discharge of water during a fire event, the deployment of foam pre-mix is also required. Foam concentrate pumps will be provided on each of the pump-sets to provide the required foam concentrate to the system.

In summary, each pump-set (one assigned as a duty pump-set and the second as a stand-by pump-set) will comprise of the following major equipment components;

- An engine control panel (ECP)
- The diesel engine is the shared driver for the fire water pump and the foam concentrate pump
- A fire water pump
- A foam concentrate pump

Where the terms ‘Pump-set’ and ‘equipment ’ are used in this specification, they shall be interpreted to mean Plant and Materials as defined in NEC3 Clause 11.2(12).

It is important to note from the outset that *Employer* has elected to design the firefighting system to introduce foam into the water system at an induction ratio of 3%.

Properties of the foam concentrate can be found in the Foam Concentrate Specification, document PL915. The *Contractor* shall review the properties of the foam concentrate when determining the suitability with the equipment.

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2 OVERVIEW OF SPECIFICATION

The Contractor is responsible for the design, procurement, supply, fabrication, assembly, pre-delivery testing, delivery to site, installation, final assembly, on-site testing, quality assurance (QA) documentation and commissioning of one duty and one stand-by firefighting pump-set and all auxiliary and associated equipment in accordance with this specification and to the satisfaction of the Employer or his designated representative(s).

The total number of pump-sets called for under this specification is two.

This specification is divided into several sections that provide individual specifications of each of the major equipment components i.e. the primary driver, the fire water pump, the foam concentrate pump and the ECP.

A separate section also provides the specifications and performance testing criteria for the fire pump-set as a complete unit.

The design and specifications listed under each section applies in its entirety to each pump-set. A summary of selected sections is provided below;

- Section 5 - External and supplementary applicable standards and specifications.
- Section 7 - General information about the arrangement and how the duty and stand-by pump-sets will interface with one another. Also, within this section will be site specific information and information regarding the nature of the installation and installation constraints.
- Section 8 - Specifications of the primary driver for the fire water pump and foam concentrate pump.
- Section 9 - Specifications applicable only to the fire water pump.
- Section 10 - Specifications applicable only to the foam concentrate pump.
- Section 11 - Specifications applicable to the ECP.
- Section 12 – Specifications and performance requirements applicable to the complete pump-set i.e. tolerances, testing and commissioning.

The remaining sections within this document do not require further explanation and additional details can be found within the respective section.

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3 BATTERY LIMITS

The battery limits of this specification are outlined below.

- The battery limit of this specification will start at the fuel supply and return line flanges as elaborated further in section 8.11.
- The firewater pump suction and discharge flanges
- The foam concentrate pump suction and discharge flanges
- The battery limit for the electrical scope called for under this specification includes the supply of suitable battery chargers. The supply and termination of power to the battery chargers is covered elsewhere.
- The battery limit for the instrumentation scope called for under this specification shall be within the Engine Control Panel (ECP) that will include the output and input signals that exist between the Fire Control Panel (FCP) and the ECP.

4 DEFINITIONS

Where acronyms and/or the below terms are used in this specification, the following definitions shall apply;

Abbreviation	**Definition**
AC	Alternating Current
AFC	Approved for Construction
ANSI	American National Standards Institute
AR-SFFF	Alcohol Resistant Synthetic Film-Forming Foam
BOQ	Bill of Quantities
CAD	Computer Aided Design
CD	Compact Disc
DB	Distribution Board
DOL	Direct Online
DWG	Drawings
ECP	Engine Control Panel
ECM	Engine Control Module
EHDP	Equipment Handover and Document Procedure
FAT	Factory Acceptance Test
FCP	Fire Control Panel
GA	General Arrangement
hr	Hour

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Abbreviation	Definition
HSSE	Health, Safety, Security and Environmental Plan
IP	Ingress Protection
ISO	International Standards Organisation
kPa	Kilopascal
kW	Kilowatt
L/min	Litres per minute
m^3	Cubic metres
MCC	Motor Control Centre
MSL	Mean Sea Level
MWT	Medium Wall Thickness
NFPA	National Fire Protection Association
NPSH	Net Positive Suction Head
O&M	Operating and Maintenance Manual
OEM	Original Equipment Manufacturer
PDF	Portable Document Format
PLC	Programmable Logic Controller
PQR	Procedure Qualification Record
QA	Quality Assurance
WPS	Weld Procedure Specification
RF	Raised Face
RFSO	Raised Face Slip-on
RPM	Revolutions Per Minute
SABS	South Africa Bureau of Standards
SANS	South African National Standards
SLD	Single Line Diagram
STD	Standard
Transnet Pipelines	*The Employer*
UL	Underwriters Laboratory
WPQ	Welder Performance Qualifications
Employer	The *Employer* is the *Employer* as defined in the *Contract Data*
Contractor	The *Contractor* is the *Contractor* as defined in the *Contract Data*

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5 ENGINEERING STANDARDS

Although not bound in nor issued with this document, the following standardised specifications as amended shall form part of this specification;

5.1.1 Applicable Standards

ASME Section IX Boiler and Pressure Vessel Code	Qualification Standard for Welding and Brazing Procedures, Welders, Brazers, and Welding and Brazing Operators
ISO 1940-1	Mechanical Vibration – Balance Quality Requirements for Rotors in a Constant (Rigid) State – Part 1: Specifications and Verification of Balance Tolerances
ISO 9906	Rotodynamic Pumps – Hydraulic Performance Acceptance Tests – Grades 1, 2 and 3
PL100	Transnet Pipelines Drawing Office Standard (PL100)
PL101	Transnet Pipelines Drawing Office Standard (PL101)
PL102	Transnet Pipelines Drawing Office Standard (PL102)
PL103	Transnet Pipelines Drawing Office Standard (PL103)
PL631	Transnet Pipelines Specification for Low Voltage Switchgear and Distribution Boards
PL 647	Requirements for the Supply of 110VDC Battery Charger
PL 648	Requirements for the Supply of 50VDC Battery Charger
PL666	Transnet Pipelines Electrical Design Criteria
PL711	Transnet Pipelines Specification for Equipment Cabinets to House Electronic Equipment
PL727	Transnet Pipelines Cabling, Racking, Trenching and Earthing Installation Codes of Practice
TPL-TECH-DO-WI-001	Transnet Pipelines Handover of As-built and Other Documents from Technical Projects to Drawing Office Work Instruction
SANS 455	Covered Electrodes for the Manual Arc Welding of Carbon and Carbon Manganese Steels
SABS 1200 A	General

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SABS 1200 L	Medium Pressure Pipelines
SANS 10400	The application of National Building Regulations
SANS 121	Hot Dip Galvanised Coatings on Fabricated Iron and Steel Articles – Specifications and Test Methods
SANS12944	Paints and varnishes — Corrosion protection of steel structures by protective paint systems
SANS 50025	Hot Rolled Products of Structural Steel
OSHAct 85 of 1993	Occupational Health and Safety Act.
SABS 086-1	Installation, inspection and maintenance of equipment used in explosive atmospheres
SABS 0142	The Wiring of Premises
SANS 10131	Above-ground Storage Tanks for Petroleum Products
SANS 10142-1	The wiring of premises Part 1: Low-voltage installations
SANS 10139 – 2007	Fire Detection and Alarm Systems for Buildings – System Design, Installation and Servicing
SANS 9906 - 2016	Rotodynamic Pumps – Hydraulic Performance Tests – Grades 1,2 and 3

5.1.2 Referenced Standards

PL909	Pressure Gauge Specification
PL 912	Piping Supplying and Installation Specification.
PL 913	Control System Specification
PL 915	Foam Concentrate
PL 916	ECP FCP Control Narrative
PL 917	Equipment Handover and Document Procedure

6 LOCATION

The *Contractor* shall take cognizance of the following data of the equipment location when preparing the offer;

City	*Contractor* to indicate on data sheet.
Depot	*Employer – Contractor* to indicate on data sheet.
Area	*Contractor* to indicate on data sheet.

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Hazardous Area Classification (SANS10089 Part 2 and SANS 10108)	*Contractor* to indicate on data sheet.

6.1 Equipment Numbering

The *Contractor* shall provide two pump-sets that meet or exceed the minimum requirements of this specification.

The pumps shall be labelled in accordance with the *Employers* site location depot number in conjunction with the approved P&ID's with this specification as follows;

Duty Fire Water Pump:	XX-P181A
Duty Foam Concentrate Pump:	XX-P181B
Stand-by Fire Water Pump:	XX-P182A
Stand-by Foam Concentrate Pump:	XX-P182B

Where the XX represents the *Employers* depot number. The pump-sets ECP shall be labelled in accordance with this specification as follows;

Duty Pump-set:	XX-P181-C-3
Stand-by Pump-set:	XX-P182-C-4

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7 GENERAL

The *Contractor* shall take cognisance of the following information during the pricing and execution of the scope of work, and the *Contractor* shall make provision for costs associated with meeting all the requirements of this specification, whether implicitly or explicitly implied.

7.1 Common Baseplate

The primary driver and associated starting and cooling systems, flexible couplings, fire water pump, foam concentrate pump and auxiliary drive unit as well as the ECP shall all be mounted on a common baseplate.

The baseplate shall be fabricated from mild steel to SANS 50025 with minimal bolt on sections. Bolt-on sections shall only be permitted where essential to ensure practical assembly and dis-assembly of major equipment components.

All welding shall be fully continuous fillet with a minimum weld size of 6mm. All welding shall be in accordance with the American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code Section IX, and welding electrodes shall be to SANS 455:2005.

All welding on the baseplate shall be done in accordance with an approved WPS and the procedure shall be qualified by a Procedure Qualification Record (PQR). All welders shall be qualified to the weld procedure. Copies of the WPS, PQR and welder performance qualifications (WPQ's) shall be included in the project QA file.

All equipment mountings shall be secured to the baseplate with castle nuts and brass split pins. Loctite must also be applied to the threads of all equipment mount bolts.

All structural steel and the baseplate shall be hot-dipped galvanised to SANS 121. No fabrication or modification to the structural steel and the baseplate shall take place once galvanised.

Defects that arise due to damage to the baseplate shall be prepared in accordance with the following procedure;

- Zincfix two pack, solvent free, zinc rich amine cured epoxy coating or similar approved shall be used
- All surfaces to be coated shall be dry, clean and free from contamination
- The surface shall be mechanically abraded using grinding or flapper discs to achieve a 40–50-micron blast profile as an alternative to achieving this profile using abrasive blast cleaning

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- Surfaces shall be abraded by a minimum radius of 25mm around the defect using 180 grit abrasive water paper and water as a lubricant. The defect shall be exposed to bare metal, but the size should be kept as small as possible.

- Immediately after abrasion, the surface shall be wiped clean, and the premixed repair material shall be applied within the abraded area. The repair 'patch' shall not overlap the unabraded galvanizing.

The *Contractor* shall submit drawings of the baseplate to the *Employer* for review, comment and acceptance prior to fabrication.

The baseplate shall be designed to prevent the accumulation and pooling of liquids. The baseplate shall be designed and sized to provide suitable access to the mounted equipment for maintenance.

Each baseplate shall be provided with an easily accessible earth lug. The earth lug shall be welded to the baseplate, and the lug material shall be austenitic stainless steel and shall not be painted. The lug shall be minimum 6mm thick, 80mm long by 60mm wide with radiused corners and shall have a 15mm diameter threaded hole drilled in the centre of the lug.

The baseplate shall also be designed with no modifications required to accommodate the speed modification to the foam concentrate pump when foam concentrate induction ratios of 3% are introduced.

The baseplate shall be provided with lifting lugs designed to carry the maximum load of the entire baseplate complete with all equipment called for under this specification when mounted and filled with all initial fill requirements.

After commissioning, the entire baseplate will be filled with grout, and the *Contractor* shall design the baseplate with consideration given to filling of the baseplate with grout to ensure that no air pockets can form within the baseplate. The supply and filling of the baseplate with grout will be done by the *Contractor*.

The baseplate shall be designed to prevent the accumulation and pooling of liquids.

The *Contractor* shall indicate on the AFC GA pump-set drawing the maximum grout filling level for the baseplate.

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7.2 Rigging and Lifting Equipment

During the design of the pump house by the *Contractor*, provision shall be made by the *Contractor* for the installation and removal of all equipment mounted on the pump-set baseplate using an overhead crawl beam.

The pump house needs only to be designed to lift the mass of the heaviest item of equipment mounted on the pump-set baseplate, not the mass of the assembled pump-set.

The *Contractor* shall be responsible for the design, procurement, supply, fabrication, delivery to site, marking, testing and installation of all permanent rigging and lifting equipment to be installed within the pump house between the pump-sets and the crawl beams to meet the requirements of this specification and the Driven Machinery Regulations of the OSHAct. The crawl beam shall be designed to enable testing and certification as required by the OSHAct, without any disruption or modification to any equipment.

Included in the *Contractors* scope for the permanent rigging and lifting equipment shall be included but not limited to the following;

- The straight chain slings and all hooks
- The block and chain
- The crawl beam trolley

When not in use, the Lifting and Rigging equipment must be positioned and held out of the way so as not to contact other piping and equipment, and out the way of the operational area.

The *Contractor* shall design, supply and install a crawl beam system for each pump-set that will project along the length of the pump-set foundation to the exterior of the pump house access doors, that will allow the lowering and placement of the largest and heaviest item from the pump-set on a suitable vehicle that is parked outside the pump-house. The rating of the crawl beam and rigging equipment must match.

One complete set of rigging equipment, for each pump-set, shall be designed, supplied, fabricated, tested, delivered to site and installed by *the Contractor*, and issued to *the Employer* for maintenance use.

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7.3 Atmospheric Conditions

The pump-set will be installed within an enclosed pump house. The *Contractor* shall familiarise themselves with the design atmospheric conditions for the site as specified in the Works Information and shall indicate accordingly on the data sheet submitted to *the Employer* for acceptance. *The Contractor* shall include with their datasheet the following conditions that were used during the design of the pump-set:

- The maximum air temperature.
- The minimum air temperature.
- The minimum air pressure.
- The maximum relative humidity.
- Any other relevant factors.

7.4 Corrosive Environment

In accordance with SANS 12944, the corrosivity category for the pump-sets is described using the atmospheric-corrosivity categories. Six categories used to classify the environment is given in the table below. The *Contractor* shall indicate on the data sheet the corrosivity category that will be complied with when submitting to the *Employer* for acceptance.

All sites shall be generally classified as C2 except for sites that are within 20 km of the coast that shall be classified as C5-M, and the Witbank site that shall be classified as C5-I.

Category of corrosivity	**Exterior**	**Interior**
C1 Very low		Buildings with heating and clean atmospheres.
C2 Low	Atmospheres with low levels of contamination. Rural areas.	Unheated buildings with possible condensation.
C3 Medium	Urban and industrial atmospheres, with moderate SO2 contamination. Coastal areas with low salinity.	Manufacturing plants with high humidity and some contamination.
C4 High	Industrial areas and coastal areas with moderate salinity.	Chemical industries, swimming pools.
C5-I Very high (industrial)	Industrial areas with high humidity and with an aggressive atmosphere.	Buildings or areas with almost permanent condensation and high levels of contamination.
C5-M Very high (marine)	Coastal and marine areas with high salinity.	Buildings or areas with permanent condensation and high levels of contamination.

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7.5 Pump House and Foundation Design

The pump house will comprise of structural steel load bearing columns and beams with brick in-fill and will be fully enclosed to limit ingress of foreign matter.

Two access doors will be provided for equipment access. An access door will be positioned opposite each of the pump-set foundations.

Each pump-set will be placed on a concrete foundation with cast-in holding down bolts.

7.6 Pump House Ventilation

The *Contractor* shall acknowledge that the pump house access doors will not be open during operation of the pump-set and shall compensate for additional ventilation within the pump house to meet the operational requirements of the pump-set OEM.

Any ventilation provided for the pump house shall be selected to prevent the ingress of foreign matter and shall be easily accessible and maintainable. A forced mechanical ventilation system to meet the ventilation requirements for the fire pump will not be considered, unless the *Contractor* is able to provide the electrical power supply requirements from the pump-set or ECP. A system of natural ventilation for the pump house is preferred.

The pump house ventilation shall be designed to limit the maximum internal temperature at any given time to the least of 49^0C, as required by the OSHAct, or as required by the equipment OEMs.

7.7 Access to the Site

The *Contractor* shall familiarise themselves with the physical, administrative and logistical site access constraints prior to submission of their offer, and all costs associated with overcoming these constraints for the installation of the pump-set shall be deemed to be included in the offer.

7.8 Delivery of Equipment to the Site and Installation

The *Contractor* shall make provision in their offer for the delivery, offloading to a safe location on site as required and approved by the *Employer*, and installation into the final position of all equipment called for under this specification.

The *Contractor* shall take cognisance of the fact that there is no space available on site to temporarily store the equipment called for under this specification. It is the responsibility of the *Contractor* to arrange a temporary storage location in the event the equipment cannot be delivered to site after release from the OEM's premises. The temporary storage location arranged by the *Contractor* must be approved by

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the *Employer* and would require the *Employer* to be present at the location of both delivery and temporary storage. The costs incurred for storage and insurances shall be covered by the *Contractor*.

The *Contractor* shall make provision for safe storage and insurances for the pump-sets at the OEM or *Contractor*s facilities from the issue date of the Shop Release Certificate (SRC) that is issued by the *Employer* to the *Contractor* before it is delivered to site. During storage of the pump-set at the *Contractors* facilities, the pump-set shall be housed within a weatherproof enclosure and shall be protected against damage.

The SRC will only be issued by the *Employer* to the *Contractor* upon deemed completion of all Factory Acceptance Test (FAT) punch items. The *Employer* shall determine when punch items are deemed complete.

The delivery address of all equipment shall be the site address as contained within the Works Information.

The *Contractor* shall make provision for all Plant, Equipment , Insurances, Personnel, Materials and Costs required to load at the OEM's facilities, transport to site, offload at the destination, handle, and install into final position all equipment called for under this specification.

The *Contractor* shall verify the position of the duty and stand-by pump-set with the *Employer* prior to installation.

Upon final installation of the equipment , The *Employer* will then be invited by the *Contractor* to inspect the installation to ensure that the final installation meets with the *Employers* requirements.

7.9 Health, Safety, Security and Environmental

The *Contractor* shall make provision for compliance with the *Employer's* Health, Safety, Security and Environmental (HSSE) requirements whilst working on the site.

7.10 Language

All documentation and correspondence communicated under this specification shall be in the English language, including the reading material of equipment that is procured from international suppliers.

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8 PRIMARY DRIVER

The primary driver called for under this specification is a diesel engine. The diesel engine shall be the primary driver for the fire water pump and foam concentrate pump.

The driver shall be started automatically by the engine control module upon receipt of a signal from the Fire Control Panel (FCP) or started manually at the ECP.

8.1 Type of Driver

The driver shall be a diesel engine of the four or two stroke, compression ignition mechanical injection type capable of being started without the use of wicks, cartridges, heater plugs or ether, with inclined (Vee) or straight vertical multi-cylinders.

The driver shall be naturally aspirated, turbocharged or supercharged or both. Preference will be given to turbocharged drivers with intercoolers.

Preference will also be given to diesel engines manufactured by Mitsubishi or Volvo Penta; alternatives will be considered but are subject to approval by the *Employer*.

8.2 Materials of Construction

The driver shall be designed for intermittent starts after idle periods without starting of approximately two weeks.

The design life of the driver shall be 30 years.

The materials of construction of the driver shall be designed and selected to operate for a minimum of 7000 intermittent hours throughout the design life expectancy.

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8.3 Corrosion Protection System

The following corrosion protection system shall be applied to the driver in accordance with the deemed corrosivity categorisation for the site as specified in Section 7.4.

Category of corrosivity	Corrosion Protection System
C1 Very low	Vendors normal external corrosion protection system acceptable
C2 Low	Vendors normal external corrosion protection system acceptable
C3 Medium	Vendors normal external corrosion protection system to be submitted for *Employers* acceptance
C4 High	Corrosion protection system to be applied as per Section 8.3.1.
C5-I Very high (industrial)	Corrosion protection system to be applied as per Section 8.3.1.
C5-M Very high (marine)	Corrosion protection system to be applied as per Section 8.3.1.

8.3.1 Project Corrosion Protection System

Provided that the OEM's normal external corrosion system meets or exceeds the below corrosion protection system, the following specification (or equal approved) for external protection shall be followed;

- Sandblast to SIS SA 2½ (near white metal blast).
- Apply twin pack ethyl based inorganic zinc silicate-based primer with minimum dry film thickness 75 microns.
- Apply polyamide cured high build epoxy undercoat with minimum dry film thickness 60 microns.
- Apply twin pack polyurethane enamel finishing coat with minimum dry film thickness 35 microns
- Total minimum dry film thickness 170 microns.

Notwithstanding the above minimum requirements, the corrosion protection system shall be guaranteed by the OEM's for a minimum life of 20 years.

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8.4 Direction of Rotation

The direction of rotation of the primary driver shall be anti-clockwise when viewed from the flywheel end of the crankshaft.

8.5 Power Output

The driver shall be sized to meet the power output requirements of this specification whilst driving the foam concentrate pump at the design speed to introduce 3% foam concentrate into the water system.

The driver shall have sufficient power to drive the fire water pump and foam concentrate pump continuously at full load at the site elevation for a continuous period of minimum 6 hours.

During operation, the power output of the driver shall not be limited, reduced or conditioned in any way to conform to any emission control standards or for any reason whatsoever.

Power available shall be understood as the net power at the drive shaft after de-rating for speed, altitude and temperature and for engines and auxiliary drives such as fans and cooling water pumps.

8.6 De-rating

The driver shall be de-rated for both altitude and temperature

The *Contractor* shall use the following design information during de-rating of the driver;

Pump-set Installed Altitude above MSL	*Contractor* to indicate on datasheet
Maximum External Air Temperature	Evidence to be provided from the South African weather service for location. *Contractor* to indicate on datasheet
Maximum Pump House Room Internal Temperature	*Contractor* to indicate on datasheet. Refer to Section 7.7

Type of Engine	**Altitude Deration**
Naturally Aspirated	3.5% every 300 metres above 150 metres above sea level
Turbo Charged	1.5% every 300 metres above 150 metres above sea level
Inter-cooled Turbo Charged	1.0% every 300 metres above 150 metres above sea level
	Temperature Deration
Naturally Aspirated	2.0% every 5.5 ^{0}C above 30 ^{0}C ambient
Turbo Charged	3.0% every 5.5 ^{0}C above 30 ^{0}C ambient
Inter-cooled Turbo Charged	1.0% every 5.5 ^{0}C above 30 ^{0}C ambient

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Notwithstanding the above altitude and temperature de-rating requirements, the OEM's altitude and temperature de-rating requirements shall take precedence provided that the calculated driver power output after de-rating is less when compared to the above requirements.

The driver shall have 10% power in excess of that absorbed by the foam concentrate pump and the fire water pump at 110% of both of the pump duty points after deductions for altitude, temperature and ancillary components using the continuously rated curve at the engine selected speed which shall not exceed the maximum speed as specified in Section 8.7.

8.7 Rotational Speed

The maximum speed of the driver shall not exceed the RPM values for the engine size and type as per the table below;

Engine Size	**Maximum Speed**
Two or Three Cylinder	2600 RPM
Four Cylinder Naturally Aspirated	2400 RPM
Four Cylinder Turbocharged	2200 RPM
Six Cylinder Naturally Aspirated	2400 RPM
Six Cylinder Turbocharged	2200 RPM
8 Cylinder	1800 RPM

The rotational speed of the driver shall match that of the fire water pump. The driver shall accept full load within 15 seconds from the receipt of the signal to start.

8.8 Governor

The speed of the engine shall be controlled by the engine control module located within the ECP. Refer to Section 11 for more details.

Notwithstanding this requirement, the engine shall also be fitted with an overspeed shut down device that will be arranged to shut down the engine at 20% above the rated engine speed. This overspeed device shall be manually reset to normal operation position and shall be clearly marked on the engine.

8.9 Fuel System

The fuel injection equipment shall be suitable for operation with the commercial brands of diesel fuel available in South Africa.

The *Contractor* shall provide all fuel filters and water separators as required by the OEM. The fuel filters and water separators shall be readily available within South Africa.

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The driver shall not have any manual device fitted which could prevent the engine starting. Where any device is fitted, it shall automatically return to the rest position for automatic starting.

8.10 Fuel Tank

A dedicated fuel tank and fuel supply and return lines will be provided for each driver in accordance with SANS 10131. The fuel tank will be located outdoors at a location determined by the *Employer*.

The fuel tank will be designed, supplied and installed by the *Contractor* and is included under the scope of *works* to be executed under this specification. The design and drawings of the fuel tank are to be presented to the *Employer* for acceptance prior to fabrication.

The fuel tank shall be rectangular and constructed of 3mm mild steel and supported by four steel legs at a height and respective dimensions approved by the *Employer*. The tank, fittings and all components (excluding drum pump) shall be externally powder coated black in colour. The *Contractor* shall submit to the *Employer* the proposed corrosion protection specification for acceptance and the *Contractor* shall update the corrosion protection specification with the comments received from the *Employer*.

The usable capacity of each tank shall be sufficient to accommodate 150 minutes of continuous operation (calculated by 60 minutes continuous operation with 2 x 45 minute weekly tests) at the OEM specified fuel consumption rate with the driver operating at the specified speed.

5% additional volume shall be provided for sump (i.e. the outlet nozzle of the fuel tank shall be set above the sump volume but at a minimum bottom of pipe to tank floor height of 50mm) and 5% additional volume shall be provided for breathing.

The diesel tank shall be provided with the following ANSI Class 150 RFSO nozzles;

- 25NB (minimum size) Outlet
- 25NB (minimum size) Return Inlet
- 15NB sump outlet complete with a diesel water trap filter with sight bowl.
- 25NB Filling nozzle flange for outlet of drum pump
- Nozzle for instrument level switch

The fuel tank shall be filled using a manual hand operated drum pump (K1 Pattern Semi Rotary Hand pump with 20mm connection or approved equivalent) supplied and installed by the *Contractor*.

The drum pump shall be permanently fixed to the diesel tank and the inlet to the pump shall be provided with a 1.5 metre long flexible rubber hose suitable for use with diesel. The rubber hose shall be provided with stow away clip or bracket that fixes onto the diesel tank.

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The outlet of the drum pump shall be fitted with a carbon steel pipe to ASTM A106 Gr B and socket welded 3000LB fittings to ANSI B16.11 to match the drum pump outlet size.

A suitable Rochester type or similar approved fuel gauge shall be provided that indicates the empty level (top of tank sump level) and the tank full level (150 minutes fuel storage as specified above)

Threaded connections shall be kept to a minimum and shall only be used where approved by the *Employer*.

A suitably sized goose neck breather that is fitted with wire mesh to prevent ingress of foreign material shall be provided on the tank.

The usable volume of the tank shall be indicated on a label with the following information as follows;

DUTY (STAND-BY) PUMP-SET XX-P181(2)	
Fuel Gauge Reading	**Firefighting Duration**
100%	150 minutes
70%	105 minutes
40%	60 minutes
0%	At top of sump height (tank outlet nozzle centreline)

The face of the gauge must be marked to match the % level shown in the table.

All labels shall be submitted to the *Employer* for acceptance.

All labels shall be of the Traffolyte engraved type that are permanently fixed to the panel with stainless steel screws. The use of adhesive to attach the labels to the panel shall not be permitted.

All label text shall be in uppercase Arial font.

The tank label title representing the pump-set numbering shall be in accordance with Section 6.1. The label must be located above the fuel gauge with a white background with black text of height 12 mm.

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8.11 Fuel Lines

Dedicated fuel supply and return lines of minimum 25NB diameter will be provided for each driver.

The fuel tank supply and return lines will be designed, supplied and installed by the *Contractor*.

The pipelines will be routed from each of the fuel tanks to a point near the diesel engine.

The *Contractor* shall supply and install a flame resistant re-enforced stainless steel braided flexible hose, that shall not extend past the base plate, from each driver as well as provide and install a suitable connection to connect the flexible hose to an ANSI Class 150 flange that will be the termination point for the fuel supply and return lines for each pump-set.

8.12 Pre-heaters

Thermostatically controlled 240 volt heaters shall be fitted to the cooling water manifold to enable the engine to start and run under load as required by this specification.

The engine shall be capable of being started from cold against no load at a pump room temperature of 4 ^{0}C.

Power for the heaters shall be taken from the normal electrical power DB within the pump house and shall be protected by a suitable circuit breaker.

The cooling water jacket heater is to be provided to control the engine jacket temperature at 49°C (or at a temperature as specified by the OEM).

The OEM's recommendations for engine oil heaters shall be followed to ensure the requirements of this specification are met.

The *Contractor* shall provide full details of any arrangements to ensure easy starting in cold weather.

8.13 Oil Circulation Pump

If required by the OEM to meet the starting requirements of this specification, the oil circulation pump shall be driven off the mains power supply from the ECP.

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8.14 Starter Motor

The type of starter motor shall be electric. The starter motor shall be powered by batteries that comply with the requirements of this specification.

The starter motor shall be of the axial displacement type having no retaining catches or inertial features.

The pinion must rotate at reduced speed during the process of engagement with the flywheel gear ring, but during the initial engagement the pinion and armature shaft assembly must mesh by moving axially towards the gear ring.

Repeat engagement facilities must be provided and controlled by the engine control module should the starter pinion fail to engage with the engine flywheel ring.

Battery charging, voltage generators, alternators and pressure switches on the engine lubricating system or water pump outlet, as a means of de-energising the starter motor are not permitted.

The starter motor in combination with each battery power supply shall have a design capability to rotate the engine for at least 12 cycles of not less than 15 seconds cranking and not more than 15 seconds rest.

8.15 Air Filtration

A two stage chassis mounted industrial air filter, with the initial stage a pre-cleaner of the cyclonic type shall be provided unless qualified accordingly prior to contract award. The unit shall include replacement paper elements and a restriction indicator.

8.16 Cooling System

The driver shall be radiator cooled, and the radiator shall be mounted on the common baseplate.

The heat from the primary circuit of the radiator shall be dissipated by air movement through the radiator created by a fan included with and driven by the engine. The fan shall be guarded for personnel protection.

The fan shall displace the air through the radiator to be exhausted from the room via louvers built into the pump house doors when the pump-set access door of the pump house is closed, or through the pump-set access door of the pump house when opened. The radiator will not be ducted to discharge externally from the building.

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The radiator shall be suitably sized for the cooling required after consideration is given to the inlet air temperature within the pump house and the provided pump house ventilation and shall be made of suitable corrosion resistant materials for the location specified.

Each engine shall be provided with a temperature gauge to indicate the cooling water temperature, as well as a cooling water level sensor to provide low cooling water alarm.

The fluid level within the radiator shall be clearly visible and fillable from ground level.

8.17 Exhaust System

Each driver shall have an independent exhaust system.

Provision shall be made on the exhaust manifold, exhaust piping and the silencer to avoid hazard to all operating personnel or to flammable material adjacent to the engine. Exhaust pipes shall be installed with clearances of at least 250 mm to combustible materials.

The exhaust pipe shall be covered with high temperature insulation or otherwise guarded to protect personnel from injury.

The exhaust pipe shall be flexibly connected to the engine to take up any vibrations that may cause failure. The exhaust back pressure shall not exceed the OEM's recommendations.

The exhaust pipe shall not be any smaller in diameter than the engine exhaust outlet and shall be as short as possible.

The exhaust piping and silencer shall be manufactured from stainless steel grade 316.

It is required that the noise level be kept to a minimum and an effective silencing system of the residential type shall be provided to limit noise to 85 dBa when measured 1 metre from the engine or exhaust.

The exhaust silencer shall be mounted horizontally and arranged to exclude water with the tail pipe external to the building, pointing horizontally at a height above natural ground level to be approved by the *Employer* (minimum 3.5 m), away from all occupied buildings and fitted with a flap and internal bird proofing mesh.

The silencer shall be mounted above the primary driver and fitted to a support frame with a stainless steel removable strap. The silencer shall not be welded to the support frame.

Provision shall be made to neatly seal the exhaust penetrations through the pump house wall.

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8.18 Guards

All exposed moving parts including the flexible coupling shall be protected by suitable guards which comply with the Occupational Health and Safety Act (as amended) and shall be easily removable.

Inspection areas constructed of a suitable mesh, grating or covering with holes shall be provided for and built into the guards to facilitate inspection without the need to completely remove the guard.

8.19 Oil Filtering System

An oil filtering system shall be provided as per the OEM's recommendations. The oil filter shall be easily accessible for maintenance.

8.20 Oil Change Pump

The engine shall be fitted with a manual two-way reversible oil change pump to facilitate easy emptying and filling of oil from the engine sump. The pump shall be permanently fixed into position and shall be easily accessible and operable when the engine is hot. Oil will be deposited from the discharge of the pump into a separate container provided by the *Employer*, it is not necessary to provide containment for the discharged oil.

8.21 Nameplate

The engine supplier shall provide a nameplate made of grade 316 stainless steel, securely fixed to the engine in a prominent position with the following information embossed onto the nameplate in 5mm high Arial font text:

- Make or Manufacturer
- Model
- Type
- Serial Number
- Power Available to drive the fire water pump and foam concentrate pump (kW)
- Direction of Driver Rotation
- Rotational Speed (RPM)
- Max Torque (Nm) at the stated rotational speed
- Fuel Consumption at Maximum Load
- Date of Manufacture
- Grade of fuel

The information on the nameplate shall not be engraved.

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8.22 Stop Signal

The engine shall only be stopped by the following conditions;

- Activation of a stop button located on the ECP
- Activation of an emergency stop button located on the ECP
- Engine overspeed during any run condition
- Any engine alarm conditions (high water temperature, low oil pressure etc.) when the engine is run with engine protection enabled (refer Section 11)

8.23 Dismantling and Assembly

All wearing parts that require replacement shall be easily removed and replaced with the engine in position.

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9 FIRE WATER PUMP

9.1 Type of Driver

The details of the fire water pump driver are specified in Section 8.

9.2 Type of Pump

The fire water pump called for under this specification is a separately coupled horizontal split case centrifugal pump.

The suction inlet and discharge outlet shall both be in the horizontal plane.

Preference will be given to pumps manufactured by SPP and KSB amongst the Contractor. Alternatives will be considered but are subject to approval by the *Employer*.

9.3 Balance Tolerances

The pump shaft and impeller shall be dynamically balanced to ISO 1940-1 with balance quality grade G6.3 and shall be supplied with a balancing certificate.

The permissible residual specific unbalance based on the specified quality grade and service speed shall be in accordance with the 'white area' of Figure 2 of ISO 1940-1.

9.4 Materials of Construction

The pump shall be designed for intermittent starts.

The design life of the pump shall be 30 years.

The materials of construction of the pump shall be designed and selected to operate for a minimum of 7000 intermittent hours throughout the design life expectancy.

Fire Pump Materials of Construction	
Part	**Material**
Bearings	Stainless steel
Casing	Ductile Cast iron
Case wear rings	Bronze
Gland	Bronze
Gland packing	High grade graphite cotton
Impeller	Bronze

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Fire Pump Materials of Construction	
Part	**Material**
Lantern rings	Bronze or stainless steel
Mechanical seals	Carbon ceramic
Shaft	EN8 steel
Shaft sleeves	Bronze
Stuffing box bushes	Bronze

9.5 Corrosion Protection System

The following corrosion protection system shall be applied to the pump in accordance with the deemed corrosivity categorisation for the site as specified in Section 7.4.

Category of corrosivity	**Corrosion Protection System**
C1 Very low	Vendors normal external corrosion protection system acceptable
C2 Low	Vendors normal external corrosion protection system acceptable
C3 Medium	Vendors normal external corrosion protection system to be submitted for *Employers* acceptance
C4 High	Corrosion protection system to be applied as per Section 10.5.1.
C5-I Very high (industrial)	Corrosion protection system to be applied as per Section 10.5.1.
C5-M Very high (marine)	Corrosion protection system to be applied as per Section 10.5.1.

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9.5.1 Project Corrosion Protection System

Provided that the vendors normal external corrosion system meets or exceeds the below corrosion protection system, the following specification (or equal approved) for external protection shall be followed;

- Sandblast to SIS SA 2½ (near white metal blast).
- Apply twin pack ethyl based inorganic zinc silicate based primer with minimum dry film thickness 75 microns.
- Apply polyamide cured high build epoxy undercoat with minimum dry film thickness 60 microns.
- Apply twin pack polyurethane enamel finishing coat with minimum dry film thickness 35 microns
- Total minimum dry film thickness 170 microns.

Notwithstanding the above minimum requirements, the corrosion protection system shall be guaranteed by the manufacturer for a minimum life of 20 years.

9.6 Direction of Rotation

The two horizontal split case water pumps shall rotate in the opposite direction relative to one another to achieve the layout of the equipment as shown on the pump house drawings. This shall be accomplished by use of a gearbox (Refer to Section 9.16).

The duty pump-set shall rotate in the same direction as the driver and the stand-by pump-set shall rotate in the opposite direction to the driver.

The direction of pump rotation shall be indicated on a stainless steel plate that is permanently secured to the casing of the pump.

The directional arrow shall be embossed onto the plate and shall not be engraved or etched.

9.7 End Connections

The suction and discharge pipeline sizes will be determined by the *Contractor.*

To accommodate discrepancies in pipeline suction sizes and pump flange sizes, reducers will be installed. Pump suction and discharge flanges that are larger than the pump suction and discharge pipeline sizes will not be accepted.

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The preferred flange connections design specification is ANSI Class 150 RF, but others will be considered to suit availability and cost.

The inlet and outlet of the pump end connections shall be indicated as such on a stainless steel plate that is permanently secured to the pump casing.

The text ‘INLET’ or ‘OUTLET’ shall be embossed onto the plate with a minimum text height of 5mm in Arial font and shall not be engraved or etched.

9.8 Process Fluid Characteristics

The process fluid will be potable water at standard temperature.

The following fluid characteristics were used in the hydraulic analysis.

Temperature (°C)	Density (kg/m³)	Dynamic Viscosity (cP)
25	997	0.89
35	994	0.72
45	990	0.59

9.9 Pump Duty Points

The *Contractor* shall determine the pump rated capacity and the total rated head that are to be indicated on the datasheet.

The pump shall provide a pressure of at least 50 kPa higher than the required pump duty point specified on the pump data sheet.

9.10 Strainer Specification

A strainer will not be positioned on the pump suction line. The *Contractor* shall ensure that the water tank and piping systems are free from any foreign objects that could cause damage to the pump.

9.11 Suction Conditions

Where required, reducers will be provided for and installed by the *Contractor* to match the pipeline sizes to the pump suction and discharge flanges.

The small end of the reducer will be welded to the pump connection flanges and the large end of the reducer will be welded to the discharge and suction piping system. i.e. if reducers are required, they will be fitted immediately upstream of the pump suction inlet flange.

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The pump will take suction from shared atmospheric water reservoirs.

A vortex inhibitor will be installed on the pump suction that will draw water from the bottom of the reservoir. The design of the vortex inhibitor will be generally in accordance with NFPA 20. The pump-set shall operate satisfactorily when the reservoir is at its lowest operating level.

Full bore isolation gate valves will be installed on the pump suction pipeline.

The *Contractor* shall determine the minimum required straight line pipeline length upstream of the pump inlet.

9.12 Net Positive Suction Head (NPSH)

The *Contractor* shall specify the NPSH available and the NPSH required on the pump data sheet. The NPSH available shall be calculated on the basis that the reservoir is at the minimum operating level.

The pump required NPSH shall always be a minimum of 1.0 m below the available NPSH.

9.13 Pump Discharge Operating Conditions

The pump will not start up against a closed head, however, under normal start-up and running conditions, the pump discharge pressure shall be maintained by a pressure control valve. The pressure control valve will be designed, supplied and installed by the *Contractor*.

The pressure control valve will enable the circulation of water from the water pump casing back to the water tank during weekly testing where the pump is run against a closed head, and during normal operation of the fire system. During the weekly testing of approximately 45 minute duration, the pump will recirculate water to the water tank at the minimum required pump flow rate. The recirculation control valve will be sized to match the minimum required pump flow rate.

9.14 Guards

All external rotating or moving components shall be suitably covered with guards in compliance with the requirements of the OSHAct.

The guards shall be fixed in position and shall be easily removable during maintenance and inspection. Each guard shall contain a suitably sized viewing port fabricated of a mesh or grid that will facilitate visual inspection of the moving component without the need to remove the guard.

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9.15 Coupling

An elastomeric flexible coupling shall be provided between the driver and the water pump. The selected elastomer shall be compatible with the fuel of the primary driver.

The coupling between the driver and the pump must allow each unit to be removed without disturbing the other.

The flexible coupling shall not be selected to compensate for misalignment.

9.16 Gearbox

Speed reduction gearboxes between the driver and pump will only be considered under exceptional circumstances and when the benefit of using a gearbox is suitably motivated such as to accommodate the layout of the pump-sets. Preference will be given to technical offers that do not require gearboxes.

Where gearboxes are required to reverse the direction of rotation of the primary driver to accommodate the direction of rotation of horizontal split case centrifugal pumps, they shall not be speed reduction gearboxes. The rotational speed of the fire water pump shall match the specified speed of the primary driver at all times.

9.17 Shaft Sealing System

Rotating shafts through the pump casing shall be gland packed using a minimum of five packing rings with a lantern ring. The lantern ring shall take cooling water from the pump discharge or via an internal bore. An external fluid supply will not be provided.

The leakage from the gland packing shall be piped by the *Contractor* to a point external to the pump house or to a sump within the pump house as directed by the *Employer*.

The drainage piping shall be fabricated from 25NB galvanised SABS 62 medium wall thickness (MWT) screwed piping and galvanised fittings that shall be joined using hemp and stag only. PTFE tape as a joint sealing method shall not be accepted. The drainage piping shall have a fall of minimum 1:100 from the gland packing drip collection point to the discharge point and shall be supported off existing steel structures using galvanised u-bolts with a maximum support span of 3.5 m.

9.18 Pressure Gauges

Pressure gauges mounted to the pump casing are not required. Pressure gauges will be fitted on the pump suction and discharge piping. All pressure gauges in the auxiliary system shall be in accordance with the Pressure Gauge Specification, PL 909.

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9.19 Bearing Thermometers

Bearing thermometers are not required under this specification. The *Contractor* shall specify the expected normal operating bearing housing temperature as well as the maximum permissible bearing housing temperature during pump operation.

9.20 Nameplate

The supplier shall provide a nameplate made of grade 316 stainless steel, securely fixed by rivets or pins to the pump in a prominent position with the following information embossed onto the nameplate:

- Supplier Name
- Make or manufacturer
- Model
- Serial number
- Design Process Medium
- Impeller diameter (mm)
- Rated capacity in (m^3/hr or l/min) at speed (RPM)
- Rated discharge pressure (kPa) at speed (RPM)
- NPSH required
- Direction of rotation
- Date of manufacture

9.21 Dismantling and Assembly

The pump shall be easily dismantled and assembled without the need to remove other components of the pump-set. Common wearing parts shall be maintainable with the pump in position.

9.22 OEM Performance Test

The specified pump duty point of the fire water pumps shall be tested at the OEM's shop in accordance with SANS 9906-2016 Accuracy Grade 2U (ISO 9906-2012) and shall be supplied with a test certificate.

The OEM performance test shall be a signed factory test as defined by SANS 9906-2016 and shall be non-witnessed.

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10 FOAM CONCENTRATE PUMP

10.1 Type of Driver

The details of the foam concentrate pump driver are specified in Section 8.

The foam concentrate pump shall be connected to the driver by a system of v-belts and pulleys designed by the *Contractor* to satisfy the rotational speed requirement of the foam concentrate pump.

10.2 Type of Pump

The foam concentrate pump called for under this specification is a separately coupled progressive cavity screw pump of the single or multiple helical screw design.

The suction inlet shall be in the horizontal plane on the non-driven end of the pump, and the discharge shall be in the vertical plane towards the ceiling of the pump house on the driven end of the pump. The suction inlet shall be kept as low as possible to the baseplate at all time to minimise the suction height outlet of the foam concentrate pump.

10.3 Balance Tolerances

The pump rotor and belt and pulley system shall be dynamically balanced to ISO 1940-1 with balance quality grade G6.3 and shall be supplied with a balancing certificate.

The pulleys shall also be statically balanced.

The permissible residual specific unbalance based on the specified quality grade and service speed shall be in accordance with the ‘white area’ of Figure 2 of ISO 1940-1.

10.4 Materials of Construction

The pump shall be designed for intermittent starts.

The rotor and stator materials of construction shall be selected to be compatible with the process fluid.

The design life of the pump shall be 30 years.

The materials of construction of the pump shall be designed and selected to operate for a minimum of 7000 intermittent hours throughout the design life expectancy.

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10.5 Corrosion Protection System

The following corrosion protection system shall be applied to the pump in accordance with the deemed corrosivity categorisation for the site as specified in Section 7.4.

Category of corrosivity	**Corrosion Protection System**
C1 Very low	Vendors normal external corrosion protection system acceptable
C2 Low	Vendors normal external corrosion protection system acceptable
C3 Medium	Vendors normal external corrosion protection system to be submitted for *Employers* acceptance
C4 High	Corrosion protection system to be applied as per Section 10.5.1.
C5-I Very high (industrial)	Corrosion protection system to be applied as per Section 10.5.1.
C5-M Very high (marine)	Corrosion protection system to be applied as per Section 10.5.1.

10.5.1 Project Corrosion Protection System

Provided that the vendors normal external corrosion system meets or exceeds the below corrosion protection system, the following specification (or equal approved) for external protection shall be followed;

- Sandblast to SIS SA 2½ (near white metal blast).
- Apply twin pack ethyl based inorganic zinc silicate based primer with minimum dry film thickness 75 microns.
- Apply polyamide cured high build epoxy undercoat with minimum dry film thickness 60 microns.
- Apply twin pack polyurethane enamel finishing coat with minimum dry film thickness 35 microns
- Total minimum dry film thickness 170 microns.

Notwithstanding the above minimum requirements, the corrosion protection system shall be guaranteed by the manufacturer for a minimum life of 20 years.

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10.6 Direction of Rotation

The direction of rotation of the pump shall suit the suction inlet and discharge outlet arrangement as specified in Section 10.2, as well as the location of the foam concentrate pump with reference to the driver.

Cognisance shall also be given to the direction of rotation of the respective duty and stand-by driver.

The direction of pump rotation shall be indicated on a stainless-steel plate that is permanently secured to the pump casing above either end of the pump shaft.

The directional arrow shall be embossed onto the plate and shall not be engraved or etched.

10.7 End Connections

The suction and discharge pipeline sizes will be determined by the *Contractor*.

To accommodate discrepancies in pipeline suction sizes and pump flange sizes, reducers will be installed. Pump suction and discharge flanges that are larger than the pump suction and discharge pipeline sizes will not be accepted.

The preferred flange connections design specification is ANSI Class 150 RF.

The inlet and outlet of the pump end connections shall be indicated on a stainless-steel plate that is permanently secured to the pump casing.

The text ‘INLET’ or ‘OUTLET’ shall be embossed onto the plate with a minimum text height of 5mm and shall not be engraved or etched.

10.8 Process Fluid Characteristics

The process fluid is foam concentrate at ambient temperature.

The *Contractor* shall size the foam concentrate pump for the foam concentrate that will be supplied in accordance with the Foam Concentrate Specification, document PL915.

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10.9 Pump Duty Points

The *Contractor* shall determine the pump rated capacity and the total rated head that are to be indicated on the datasheet.

The foam concentrate pump shall be sized and selected to operate at one duty point with the v-belt and pulley system configured to operate at 3% when delivered to site.

It is permissible for the pump to provide a flow rate that is a maximum of 10% higher than the stated design flow rate. Flow rates lower than the design flow rates will not be acceptable.

10.10 Strainer Specification

A strainer will not be installed on the pump suction. The *Contractor* shall ensure that the foam concentrate tank and piping systems are free from any foreign objects that could cause damage to the pump.

A suction strainer will be fitted on the foam concentrate pump that is used to fill the foam concentrate tank and it is therefore assumed that the process fluid will contain no abnormal particles.

The supply and installation of the foam concentrate tank filling pump is not included in the scope of supply as called for under this specification.

10.11 Suction Conditions

Where required, reducers will be provided for and installed by the *Contractor* to match the pipeline sizes to the pump suction and discharge flanges.

The small end of the reducer will be welded to the pump connection flanges and the large end of the reducer will be welded to the discharge and suction piping system. i.e. if reducers are required they will be fitted immediately upstream of the pump suction inlet flange.

The pump will take suction from a dedicated foam concentrate tank.

A vortex inhibitor will be installed on the pump suction that will draw water from the bottom of the foam tank. The design of the vortex inhibitor will be generally in accordance with NFPA 20. The pump shall operate satisfactorily when the tank is at its lowest operating level.

Full bore isolation ball valves will be installed on the pump suction pipeline.

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10.12 Net Positive Suction Head (NPSH)

The *Contractor* shall specify the NPSH available and the NPSH required on the pump data sheet. The NPSH available shall be calculated on the basis that the tank is at the minimum operating level.

The pump required NPSH shall always be a minimum of 1.0 m below the available NPSH.

10.13 Pump Discharge Operating Conditions

The pump will start up against a pressure control valve. Under normal start-up and running conditions, the pump discharge pressure shall be maintained at the pump duty point by a pressure control valve that will recirculate foam concentrate to the foam storage tank.

The pressure control valve will be designed, supplied and installed by the *Contractor*.

10.14 Guards

All external rotating or moving components shall be suitably covered with guards in compliance with the requirements of the OSH Act.

The guards shall be fixed in position and shall be easily removable during maintenance and inspection. Each guard shall contain a suitably sized viewing port fabricated of a mesh or grid that will facilitate visual inspection of the moving component without the need to remove the guard.

10.15 Belt Pulley System

The *Contractor* shall design the belt pulley system that will transmit power from the shaft of the primary driver to the shaft of the foam concentrate pump to obtain the required rotational design speed of the foam concentrate pump. Only v-belts will be considered, and the engines OEM pulley system shall not be modified. Timing belts and flat belts will not be accepted.

All mounted pulleys shall be easily removable without causing damage to the connecting shaft. The *Contractor* shall provide the pulley diameter that will be required to achieve the pump speed.

10.16 Shaft Sealing System

Rotating shafts through the pump casing shall be sealed by a mechanical seal. The process fluid shall be used as the lubricating fluid between seal faces. An external fluid supply will not be provided.

A stainless-steel drip box shall be provided below the seal to contain any leakage from the seal under abnormal operating conditions or seal failure.

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10.17 Pressure Gauges

Pressure gauges mounted to the pump casing are not required. Pressure gauges will be fitted on the pump suction and discharge piping by the *Contractor*.

10.18 Bearing Thermometers

Bearing thermometers are not required under this specification. The *Contractor* shall specify the expected normal operating bearing housing temperature as well as the maximum permissible bearing housing temperature during pump operation.

10.19 Nameplate

The supplier shall provide a nameplate made of grade 316 stainless steel, securely fixed by rivets or pins to the pump in a prominent position with the following information embossed onto the nameplate:

- Supplier Name
- Make or manufacturer
- Model
- Serial number
- Design Process Medium
- Rotor Length (mm)
- Rated capacity in (m^3/hr or l/min) at speed 1 (RPM)
- Rated discharge pressure (kPa) at speed 1 (RPM)
- Rated capacity in (m^3/hr or l/min) at speed 2 (RPM)
- Rated discharge pressure (kPa) at speed 2 (RPM)
- NPSH required
- Date of manufacture

10.20 Dismantling and Assembly

The pump and belt pulley system shall be easily dismantled and assembled without the need to remove other components of the pump-set. Common wearing parts shall be maintainable with the pump in position.

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11 ENGINE CONTROL PANEL

The duty and stand-by pump-set shall each be provided with a dedicated Engine Control Panel (ECP) mounted on the respective pump-set frame.

Each ECP shall comprise of a fully enclosed panel with a mounted engine control module (ECM), lamps, key switches, labels, components, gauges, buttons, batteries, battery chargers and any other equipment as required by this section of the specification.

11.1 System Design

The system shall be designed and constructed as a hard-wired system with the exception of the engine control module (ECM) that will be supplied as an OEM unit. All other functions/aspects of control shall be performed by individual components to fulfil the control requirements, separately mounted in the ECP.

The *Contractor* shall supply a suitable engine control module (Deep Sea Electronics controller module DSE-E800 or approved equivalent by the *Employer*) for each pump-set to meet the requirements of this specification.

The ECP of each pump-set will interface with the Fire Control Panel (FCP) via suitable terminations as per the *Employers* approved vendor list. The FCP will be designed and installed in accordance with PL 913, Fire Control System and Instrumentation Design, Supply and Installation Specification and Scope of Works, the scope of which is excluded from this specification.

The *Contractor* shall ensure successful integration between the FCP and ECP.

The wiring and cabling will be completed as per SANS 10142-2 and TPL Specifications PL727.

All electrical isolators shall be lockable.

An emergency switch shall be provided to shut down the engine in all events and is to be hard wired. The emergency switch when activated shall not reduce the speed of the engine in stages.

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11.2 FCP and ECP Interface

The FCP and ECP interface that includes the engine protection philosophy, start and stop signal and starting arrangement shall be designed and constructed as per the requirements defined in the ECP FCP Control Narrative document, document PL 916.

All signals from FCP to ECP will be via potential free contacts in the FCP.

All signals from ECP to FCP will be via potential free contacts in the ECP.

11.3 Engine Running and Crank Termination Control

Engines shall be provided with a speed-sensitive switch to signal engine running and crank termination.

An engine run event will be transmitted to the FCP if an engine run condition is satisfied.

11.4 ECP Power Supply

The ECP will source its power from the battery charging system.

The ECP shall incorporate over-voltage protection to prevent any malfunction or damage which might occur from source power surges.

A circuit breaker shall be provided between the battery units and the ECP to allow for electrical isolation of the ECP. The circuit shall be lockable.

11.5 ECP Battery Chargers

The battery chargers will source their power from the *Employers* Essential Power DB which in turn sources its power from the mains power or a back-up generator supply.

The diesel engine located on the firefighting pump-set is also equipped with an alternator that will provide alternative power to the battery chargers.

Each individual ECP shall be provided with two individual battery chargers and battery banks separated with a suitably sized quint. The ECP will draw power from both systems equally.

The specification of battery chargers shall be Blue Ginger or equivalent approved by the *Employer*.

The means of charging the batteries must be by a fully automatic continuously connected constant voltage, variable current charge having automatic trickle and boost charge facilities.

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The mains supply voltage, battery voltage and charging current shall be indicated via a suitable panel mounted indicator (panel meter with an accuracy of +-2%)

The charger alarms for each battery charger and battery unit set should indicate as a minimum mains voltage or battery failure.

The battery charger shall restore to the battery 100% of the batteries reserve capacity or ampere-hour rating within 2 hours.

The charger shall be so designed that it will not be damaged or blow fuses during the cranking of the engine.

The type of the batteries shall be furnished according to the battery charging unit OEM's requirements, however sealed maintenance-free batteries shall be supplied and be suitable for use in an occupied building.

The circuits of the batteries must not be linked so that power may be transferred from one to the other.

The charger shall operate even when the battery is totally flat. The battery charger must be short circuited protected.

The charge shall float a fully charged battery continuously.

The charger shall be designed to be protected against damage when an attempt is made to charge a reverse connected battery.

The battery charger at its rated voltage shall be capable of recharging a completely discharged battery at a maximum rate without damaging the battery.

The battery charger specifications shall be clearly identified.

11.6 Battery Starting

All batteries shall be engraved with the date of installation.

The batteries shall be provided with a non-conductive cover to prevent objects falling onto the battery terminals or other inadvertent damage. The battery cover must be mechanically secured.

Each engine shall have two storage battery units. Each battery unit shall be marked and clearly identified as "Battery Unit 1" and "Battery Unit 2" in accordance with the labelling requirements of Section 11.7.

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Each battery unit shall have twice the capacity at 4 ºC to maintain the cranking speed recommended by the OEM of the primary driver through a 3 minute cycle in accordance with the starting sequence and arrangement specified in Section 8.14 (i.e. six 15 second start attempts for each pump-set with 15 seconds rest in between each start attempt) without AC power being available for battery charging. Over and above this, each battery unit shall also be sized to maintain power to the ECP for a duration of 15 minutes.

The *Contractor* shall provide a certificate confirming that each battery complies with this requirement.

Storage batteries shall be supported above the floor on stillage's, located side by side and not stacked, secured against displacement, and located where they will not be subject to excessive temperature, vibration, mechanical damage or flooding with water. They shall be readily accessible for servicing.

Non-essential loads shall not be powered from the batteries.

The main battery contactors supplying current to the starter motor shall be capable of manual mechanical operation in the event of control circuit failure.

11.7 Labels

All labels shall be of the Traffolyte engraved type that are permanently fixed to the panel with stainless steel screws. The use of adhesive to attach the labels to the panel shall not be permitted.

All label text shall be in uppercase Arial font.

Each Engine Control Panel shall have a label representing the label numbering in accordance with Section 6.1 and located at the top centre of the control panel door with a white background with black text of height 12 mm.

All components, lamps, key switches and buttons shall have labels with a white background with black text of height 6 mm.

All cautionary labels shall have a red background with white text of height 12 mm.

A cautionary label shall be provided that bears the following text;

"IMPORTANT NOTICE: THIS MACHINE SHOULD ALWAYS BE LEFT IN AUTO MODE WITH THE KEY REMOVED".

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11.8 Instrument and Cable Tagging and Numbering

All instrument and cables shall be suitably tagged.

The instrument and cable tags must be permanently fixed, may not be fixed by adhesive and must not be susceptible to degradation in the environment in which it is installed.

Tags may not be hand written and may not be of paper or cardboard construction.

Cables shall be tagged with Grafoplast TRASP® or similar approved identification system.

Cables must be identified in accordance with the *Employers* specifications.

11.9 Panel Construction

Except as modified by the requirements or concessions in this document, the panel design and construction must comply with the requirements of the *Employer's* standards including PL631 and PL711.

Components, pilot lights, push buttons and any other equipment fitted to the panel shall not reduce the IP rating of the panel.

The panels shall be signal red, powder coated carbon steel to colour RAL 3001 with a minimum IP rating of 66 and shall be lockable. The panel may be subject to discharge from water sprinkler systems within the pump house.

The panel shall have sealed gland plates on the bottom of the panel.

Cable glands shall be used for entry of cables into all panels via gland plates. Cable glands shall be suitable for the service, cable type and size and not compromise on IP rating. Cable glands shall be located in such a way so as to allow the tightening and loosening of any gland at any time.

All equipment installed in panels, with the exception of face mounted items on the operator panels, shall be installed on a backing plate mounted to but separate from the back or sides of the panel.

The panels shall have 20% additional space for the installation of relays and terminals.

No trunking run shall have a cable loading of more than 80% for the completed design and installation.

All wiring connections outside of dedicated equipment connections shall be made in accordance with the *Employers* specification.

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All components shall be DIN rail, if components are panel mounted they shall not compromise the IP rating of the panel.

The two battery chargers shall be housed within the panel together with all components.

Two spare 10A fuse-dis-connectors must be provided in the panel from which outgoing 24 VDC supply feeds can easily be terminated.

Side access panels are not permitted.

During ECP start attempt and run an amber flashing beacon on the respective ECP shall be active.

11.10 Location

The location of the Engine Control Panel shall be suitably mounted off the pump-set baseplate where heat is at a minimum. The Engine Control Panel shall be protected against vibration and shall be positioned adjacent to the pump-set in accordance with the model approved by the *Employer*.

As the pump-sets may not be identical in their arrangement (i.e. position of Engine Control Panel and foam concentrate pump), the *Contractor* shall confirm with the *Employer* which pump-set arrangement shall be assigned as the duty pump-set.

11.11 Engine Over speed

The engine over speed shall be designed and implemented as per the requirements defined in the ECP FCP Control Narrative document, document PL 916.

The engine control module shall stop the engine in the event of over speed under all running conditions. The over speed trip setting shall be 10% above rated engine speed. The ECM shall be manually reset to clear the over speed condition prior to permitting subsequent engine starting.

During normal start-up of the engine, the speed of the engine shall not reach the over speed setting.

11.12 Two Stage Engine Shutdown

The two stage engine shutdown shall be designed and implemented as per the requirements defined in PL 916 (ECP FCP Control Narrative document).

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11.13 Panel Face Mounted Instruments

The following components shall be face mounted on the Engine Control Panel;

- Emergency Stop Push Button of the self-latching and twist to reset type
- Battery Charger Number 1 Alarms
- Engine control module with integrated start and stop push buttons
- Battery Charger Number 2 Alarms
- Oil Pressure Gauge
- Oil Temperature Gauge
- Water Temperature Gauge
- Alternator charger rate ammeter Gauge
- Battery Charger 1 Charging Rate Ammeter
- Battery Charger 2 Charging Rate Ammeter
- Battery Charger 1 Voltage Meter
- Battery Charger 2 Voltage Meter
- Key Operated ‘Auto/Maintenance’ Switch
- Low Oil Pressure Pilot Light
- High Oil Temperature Pilot Light
- High Water Temperature Pilot Light
- Low Coolant Level Pilot Light
- Start Failure Pilot Light
- Lamp test push button

11.14 Gauges, Push Buttons and Pilot Lights

All indicating gauges shall be red lined to show alarm levels and shall be minimum 60 mm in diameter.

Gauges of different sizes will not be accepted. Display units of all gauges shall be degrees Celsius, amperes (Amps), volts (V) and kilopascal (kPa) for the selected application.

All pilot lights and push buttons shall be 22 mm in diameter incorporating LED indication in the required colour and the indicating colour shall be evident without the LED lit. The push buttons shall only illuminate when pressed or when the Lamp test push button is pressed.

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12 PUMP-SETS

The *Contractor* shall read the below requirements in conjunction with the PL 917 Document, Equipment Handover and Document Procedure (EHDP).

12.1 Tolerances

12.1.1 Alignment Tolerances

During the installation of the pump-set, the *Contractor* shall line and level each pump-set using brass shims and steel wedges.

Once the pump-sets have been installed onto the prepared foundations, and prior to the connection of any pipework, the *Contractor* shall perform and include in the QA file, a laser alignment certificate of the fire water pump. The *Employer* must be invited to witness the laser alignment of the water pump.

Installation and alignment shall be as per the OEM's recommendations.

During installation and connection of the pipework to the fire water pump and foam concentrate pump flanges, the OEM shall make themselves available on site as necessary to witness the pipe-on and pipe-off exercises that shall be performed by the *Contractor*, and at the end of the pipe-on pipe-off exercise, the OEM shall be satisfied and issue a certificate in this regard, that the suction and discharge pipework for both the foam concentrate pump as well as the fire water pump has not imposed any undue stresses and forces on the pump.

Prior to the commencement of on-site commissioning, the *Contractor* shall perform and include in the QA file a second on-site laser alignment certificate of the fire water pump to confirm that the alignment of the fire water pump has not be displaced during the installation of the pipework. The *Employer* shall be invited to witness the second laser alignment test as well.

12.1.2 Baseplate and Equipment

The dimensions of the pump-set baseplate and location of the HD bolt holes shall be fabricated within a tolerance of ±1 mm to the dimensions as shown on the AFC pump-set drawing.

The centreline and elevations of all pump inlet and outlet nozzles shall be located within a tolerance of ±0.5 mm to the dimensions as shown on the AFC pump-set drawing.

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12.2 Static Tests

Notwithstanding the OEM's hydrostatic test of the firewater pump and the foam concentrate pump, the *Contractor* shall perform for each pump called for under this specification, a 30-minute hydro-static test that is witnessed by the *Employer*.

The test pressure shall be no less than the greater of 1.5 times the pump shut-off head or the OEM's hydrostatic test pressure.

Once the test pressure has stabilised, the pump casings shall maintain the test pressure for the duration of the test and during the test there shall be no leakage from the pump.

The hydrostatic test shall be performed and witnessed during the FAT of the pump-sets and shall be performed with the pumps assembled as a part of the pump-set and not in isolation on a test bench prior to final assembly.

12.3 Equipment Handover and Document Procedure

The *Contractor* shall comply with the *Employer's* Equipment Handover and Document Procedure, document PL 917, during the testing and handover of the pump-sets.

12.3.1 Shop Performance Test

Each pump-set called for under this specification shall be simultaneously subject to a shop performance test that is arranged and performed by the *Contractor* and witnessed by the *Employer* or the *Employers* designated representative at an approved pump test facility.

The fire water pump, foam concentrate pump and primary driver shall be tested as a unit and the site suction and discharge pipework conditions of the fire water pump shall be simulated during the shop performance test, with the use of flow conditioners and straighteners where necessary to obtain a good velocity distribution at the pressure measuring points.

The duty point (guarantee point) of the fire water pump will be tested during the shop performance test and the pump-set shall be subject to an endurance test.

It is acceptable to use water as the process medium during testing of the foam concentrate pump.

The shop performance test shall only take place upon completion of the factory acceptance test (FAT).

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12.3.1.1 Guarantee Point

In order to verify the specified duty point is being delivered by the pump-set, as an assembled pump-set the fire water pump shall be subject to a performance test in accordance with SANS 9906-2016.

The test shall be conducted at the specified speed of the fire water pump.

The acceptance grade and corresponding tolerance for the duty point (the guarantee point) of the fire water pump shall be determined in accordance with SANS 9906-2016 Accuracy Grade 2U.

The following test curves shall be provided to the *Employer* after the test for each fire water pump and foam concentrate pump for all stated flows and pressures:

- Total pumping head (metres) vs discharge (m^3/hr or L/min).
- NPSH required (metres) vs discharge (m^3/hr or L/min).
- Pump efficiency (%) vs discharge (m^3/hr or L/min).
- Shaft power (kW) vs discharge (m^3/hr or L/min).

12.3.1.2 Endurance Test

Over and above the guarantee point test above, each pump-set shall be subject to an endurance test. Prior to the endurance test, *the Contractor* shall mark targets on the equipment in locations as directed by *the Employer*. Repeated measurements during the test shall be taken from the target locations.

The pump-set shall be run at the fire water and foam concentrate duty points for a duration of 6 continuous hours, where the following hourly records shall be made;

- Ambient temperature
- Lubricating oil temperature
- Cooling water temperature
- Engine speed
- Foam concentrate pump speed
- Pump gland temperature
- Water pump bearing temperatures
- Foam concentrate bearing temperatures
- Miscellaneous spot temperatures as required by the *Employer*
- Vibration measurements

Equipment and spot temperatures shall be done using a dual infra-red laser thermometer.

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After 6 hours of continuous operation, the engine speed, foam concentrate pump speed, the suction and delivery pressure of both the foam concentrate pump and the fire water pump must be recorded at 0%, 25%, 50%, 75%, 100% and 110% of the fire water pump duty point.

12.3.2 Factory Acceptance Tests

Each pump-set called for under this specification shall be simultaneously subject to a FAT that is arranged and performed by the *Contractor* and witnessed by the *Employer*.

The FAT shall be a test of the pump-sets to ensure compliance before delivery of the pump-sets to site. A mock test of the duty stand-by starting sequence shall also be performed.

The minimum information that will be reviewed by the *Employer* at the FAT for each pump-set is as follows;

- Pump-set dimensional checks and equipment arrangement conformance to the AFC drawings
- Fire water pump direction of rotation (the fire water pump will not be run)
- Foam concentrate pump direction of rotation (the foam concentrate pump will not be run)
- Pump alignment certificates
- Quality Assurance Files
- Design and operation of Engine Control Panel and all associated logic and emergency stops against the ECP FCP Control Narrative
- Instrument hook-ups and calibration ranges
- DFT of corrosion protection systems
- Speed of diesel engines
- Cable rack routing
- Other requirements of this specification not specifically listed above

12.3.3 Site Acceptance Testing and Commissioning

Upon successful completion of the pump-set installation, the pump-sets shall be subject to a site acceptance test (SAT). The SAT will be arranged and performed by the *Contractor* and witnessed by the *Employer*.

Immediately after receipt of the Ready for Start-up Certificate as defined in PL 917, the *Contractor* shall house the pump-set within a closed fixed timber crate to avoid damage to the pump-set whilst ongoing adjacent construction activities are taking place.

The predominant focus of the SAT will be of the Engine Control Panel and to establish readiness for final commissioning.

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The requirements for commissioning and handover of the pump-sets are documented in the Works Information.

13 DOCUMENTATION

All drawings shall have the title block unique for the project included on the drawing, located at the lower right hand side of the drawing.

For drawings the minimum size is A3 and the maximum size is A1. A4 may only be used for parts lists and similar documents.

Individual dimensioned General Arrangement (GA) drawings for the following items shall be included in the QA file;

- Fire water pump
- Foam concentrate pump
- Primary driver
- Belt pulley system
- Baseplate
- Coupler
- Engine Control Panel
- Engine Control Module
- Pump-set arrangement

Individual detail drawings for the following items shall be included in the QA file;

- Fire water pump
- Foam concentrate pump
- Mechanical seal
- Primary driver
- Belt pulley system
- Couplers

The *Contractor* shall submit to the *Employer* an Approved for Construction (AFC) General Arrangement drawing. The drawing shall be stamped or clearly marked in red, ‘Approved for Construction’.

The AFC GA drawing shall contain the following information as a minimum;

- Dimensioned plan view on assembled pump-set including suitable dimensioned sections and elevations

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- Section through baseplate showing belt and pulley assembly
- Location of water jacket heater
- Grout fill level
- Holding down bolt details
- Mass of the following equipment ;
    - Primary driver
    - Fire water pump
    - Foam concentrate pump
    - Engine Control Panel
    - Baseplate
    - Miscellaneous
    - Total
- Exhaust details
- Location of Engine Control Panel
- Dimensioned location of all suction and discharge flanges including elevations
- Inlet and outlet flanges of both pumps
- Baseplate centrelines
- Location of earthing points
- Location of lifting lugs
- The technical specifications of each of the following items of equipment;
    - Primary driver showing manufacturer, model number, RPM and kW rating
    - Fire water pump showing equipment number, manufacturer, model number and duty point
    - Foam concentrate pump showing equipment number, manufacturer, model number, duty point, RPM, rotation direction and coupling specification
    - Mechanical seals showing seal design, manufacturer and model number
    - Belt pulley system showing belt and pulley manufacturer, model number, plumber block specification
    - Engine control module showing manufacturer and model number
    - Batteries
    - Drive coupling showing manufacturer, design and model number
    - Radiator showing design, manufacturer and model number
- Allowable forces and moments for the fire water pump and foam concentrate pump

The AFC GA shall be updated to as-built status with all changes incorporated upon successful completion of commissioning.

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Native final drawings shall be submitted in AutoCAD format with the final handover documentation. Electronic copies in PDF format shall also be submitted on CD.

All electronic drawings must be searchable, and hard/scanned copies must be clear and legible.

14 PROJECT QUAILTY REQUIREMENT

14.1 Quality Control Plan

The *Contractor* shall prepare a quality control plan (QCP) for the design, approval, installation and commissioning of the pump-sets.

The QCP shall be submitted to the *Employer* for Acceptance. The *Employer* will apply hold, surveillance and witness points as deemed necessary. Hold points will require the signature of the *Employer* before proceeding to the subsequent activity on the QCP.

The *Contractor* shall make provision for a duration of 2 weeks as an approval/review period for the *Employer*.

A selection of the *Contractors* scope shall be submitted to the *Employer* for review, approval, construction and comment in accordance with the below table.

Information to be Provided by the *Contractor*	**Issue Status**
AFC GA drawing of pump-set	Initially for *Employer* acceptance but ultimately as Approved for Construction
Primary driver kW de-rating calculations	For acceptance
Foam and water pump system, power and NPSH curves showing the duty points	For acceptance
Project Quality Control Plan	For acceptance
Engine Control Panel internal and external layout and GA drawings	For acceptance
Electrical schematic drawings of the Engine Control Panel	For acceptance
Power distribution diagrams	For acceptance
Cable schedules	For acceptance
Internal wiring diagrams of the Engine Control Panel	For acceptance
Belt and pulley system calculations	For review and comment

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14.2 Quality Assurance File

The *Contractor* shall also prepare at the beginning of the project and keep up to date through the project lifecycle a Quality Assurance (QA) file with the following minimum sections;

- Pump-set Specification
- Quality Control Plan
- Design
    - Belt Pulley System
    - Lifting equipment
    - Primary driver kW de-rating calculations
    - Instrument hook-up diagrams
- Purchase Orders
- Equipment Specifications and data sheets
    - Belt and pulley design data
    - Fire water pump curves
    - Foam concentrate pump curves
    - Primary driver data sheets
    - Engine control module data sheets
    - Instrument data sheets
    - Process instrument data sheets
- Baseplate design
    - Weld Procedure Specification
    - Procedure Qualification Records
    - Material certificates for all structural steel
    - Galvanising Certificates
- Drawings
    - Baseplate
    - Primary driver
    - Coupler
    - Belt pulley system
    - Fire water pump
    - Foam concentrate pump
    - Mechanical seal
    - Engine Control Panel
    - Pump-set
    - Cable rack routing and sizing diagrams
- Electrical, Control and Instrumentation

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    - Cable test certificates (continuity and earth testing)
    - Instrument installation verification against hook-up diagrams
- Equipment and Handover Documentation in accordance with the Equipment and Handover Document *Procedure*, document PL 917.
- *Employer Contractor* Correspondence

The *Contractor* shall prepare and issue to the *Employer* the approved original QA file plus one hard copy. The contents of the approved QA file shall also be submitted on a CD.

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15 EQUIPMENT WARRANTY

The warranty period for all equipment called for under this specification shall be twelve months from the date of the Completion Certificate signed by the *Project Manager*.

The responsibility of the *Contractor* concerning his equipment is in no way alleviated by the issue of the *Completion* Certificate.

Maintenance by the *Employer* during the warranty period shall be limited to cleaning and necessary lubrication only as included in the operating and maintenance manuals submitted by the *Contractor*. All other maintenance or adjustments shall be carried out by the *Contractor*.

Should any component part of any main or ancillary equipment fail to perform in accordance with its intended function during the warranty period, the *Employer* shall reserve the right to reject the component part and order its replacement with a more reliable part at the *Contractors* expense. The replacement part shall be guaranteed for a further 12 months.

16 OPERATING AND MAINTENANCE MANUALS

An operating and maintenance (O&M) manual for each pump-set shall be prepared and submitted by the *Contractor* and shall be separate from the QA documentation.

The *Contractor* shall prepare and issue to the *Employer* the approved original O&M file plus one hard copy. The contents of the approved O&M file shall also be submitted on a CD.

The O&M manual shall contain the following information as a minimum;

- Numbered spare parts list and associated diagram for the following equipment;
    - Foam concentrate pump
    - Fire water pump
    - Gearbox (if applicable)
    - Coupler
    - Belt and pulley system
    - Primary driver
- Recommended spare parts list with OEM part number and local equivalent part number for the following equipment;
    - Foam concentrate pump
    - Fire water pump
    - Gearbox (if applicable)
    - Coupler
    - Belt and pulley system

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    - Primary driver
- Operating and Maintenance manuals for the following equipment;
    - Foam concentrate pump
    - Fire water pump
    - Gearbox (if applicable)
    - Coupler
    - Belt and pulley system
    - Primary driver
- Service manuals
- Primary driver workshop manual

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FIRE SYSTEM SPECIFICATION

WATER TANK SPECIFICATION

Document number	PL 902
Version number	2
Classification	Unclassified
Effective date	1 July 2025
Review date	1 July 2028

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SUMMARY VERSION CONTROL

VERSION NO.	NATURE OF AMENDMENT	PAGE NO.	DATE REVISED
0	New Specification	ALL	1 July 2025
1	Comments during review between TPL and GreyJones included	ALL	23 July 2025
2	Comments and review from TPL	ALL	27 August 2025

Note: Only latest amendments and/or additions are reflected in italics in the body of the document.

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DOCUMENTATION SIGN-OFF SHEET

I, the undersigned hereby approve this procedure.

ROLE	CAPACITY/ FUNCTION	SIGNATURE	DATE
Compiled by:	**Pieter Jacobs**		
Approved by:	**Papa Moratwe**		

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TECHNICAL SPECIFICATION – WATER TANK (CIRCULAR)

1 INTRODUCTION

This specification covers the design, fabrication, manufacture, procurement, supply, delivery to site, erection, installation, commissioning and handover documentation of the water tank(s) to be used within the Transnet Pipelines fire protection systems.

Where the terms ‘water tank’ and ‘equipment’ are used in this specification, they shall be interpreted to mean Plant and Materials as defined in NEC3 Clause 11.2(12).

This specification is not site specific but has been prepared as a generic project specification. Site specific water tank summary data sheets specifying the site-specific data pertaining to the water tank(s) are to be developed by the *Contractor* and submitted to the *Employer* for acceptance.

The Process Fluid for the water tank will be potable water (supplied by the municipality for the respective site).

The water tank will be used as the primary water supply to the firefighting water pumps and will be filled by the municipal water supply.

The gross water storage volume that is required shall be site specific and will be distributed into one or two tanks as per the site and *Employers* discretion.

Each tank will be provided with a separate water supply and tank level control valve, separate pump suction and pump recirculation lines. The battery limit of the water tank will terminate at the water tank flanges.

The supply and installation of valves and tank external equipment will be done by the *Contractor*. All tank internal equipment is included in the scope of the *Contractor*.

The tank will be required to operate at times with either one of the tanks full or with the remaining tank empty to enable maintenance.

Where the specification refers to a data sheet, the *Contractor* shall refer to the data sheet within the applicable Appendix attached to this specification.

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2 DEFINITIONS

The following definitions shall apply when reading this specification;

Term	Definition
^{0}C	Degrees Celsius
AFC	Approved for Construction
ASME	American Society of Mechanical Engineers
ASTM	American Society for Testing & Materials and its successor ASTM International
cP	Centipoise
DFT	Dry Film Thickness
ISO	International Standards Organisation
kg/m^3	Kilograms per cubic metre
mm	Millimetre
m/s	Metres per second
NB	Nominal Bore
OEM	Original Equipment Manufacturer
RFSO	Raised Face Slip-on
SANS	South African National Standards
SOQ	Schedule of Quantities
Contractor	The successful tenderer
Employer	Transnet Pipelines

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3 ENGINEERING STANDARDS

Although not bound in nor issued with this document, the following standardized specifications as amended shall form part of the contract document:

3.1 Applicable Standards

ASME 16.42	Ductile Iron Pipe Flanges and Flanged Fittings: Classes 150 and 300
ASME B16.5	Pipe Flanges and Flange Fittings
ASTM A105	Standard Specification for Carbon Steel Forgings for Piping Applications
ASTM A106	Standard Specification for Seamless Carbon Steel Pipe for High-Temperature Service
ASTM A234	Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service
NFPA 20	Standard for the Installation of Stationary Pumps for Fire Protection
OSHAct	Occupational Health and Safety Act 85 of 1993
SANS 121	Hot dip galvanized coatings on fabricated iron and steel articles - Specifications and test methods
SANS 1091	National colour standard
SANS 10140-2	Identification Colour Marking Part 2: Identification of Hazards and Equipment in Work
SANS 1700	Fasteners
SANS 9364	Continuous hot-dip aluminium/zinc coated steel sheet
SANS 10089-1	The Petroleum Industry Part 1: Storage and distribution of petroleum products in above-ground bulk installations
SANS 10108	The classification of hazardous locations and the selection of apparatus for use in such locations
SANS 10160	Basis of Structural Design & Actions for Buildings and Industrial Structures
SANS 10162	Structural Steelwork
SANS 10162 - 2	Cold-formed Steel

3.2 Referenced Standards

PL 913	Control System Specification
PL 917	Equipment Handover and Document Procedure

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4 LOCATION

The *Contractor* shall take cognizance of the following data of the equipment location when preparing the offer;

City	*Contractor* to indicate on data sheet.
Depot	Transnet Pipelines *Contractor* to indicate on data sheet.
Hazardous Area Classification (SANS10089 Part 2 and SANS 10108)	*Contractor* to indicate on data sheet.

5 PROCESS FLUID DATA

The *Contractor* shall take cognizance of the following process fluid data for the water tanks(s) when preparing the offer;

Process Fluid 1	Water
Temperature @ Operating	5 – 50 °C
Density @ Operating	997 kg/m³ @ 25°C
Viscosity @ Operating	0.9 cP at 25°C

Process fluid data shown to be confirmed by the *Contractor* during the detailed design.

6 PROCESS DATA

The *Contractor* shall take cognizance of the following process data for the tank when preparing the offer;

Maximum Flow Rate In (to be designed for one tank)	*Contractor* to indicate on data sheet.
Maximum Flow Rate Out (to be designed for one tank)	*Contractor* to indicate on data sheet.
Maximum Site Temperature	*Contractor* to obtain and indicate on data sheet.
Minimum Site Temperature	*Contractor* to obtain and indicate on data sheet.
Design Pressure	Atmospheric Tank
Design Vacuum	If required, *Contractor* to determine
Maximum Tank Operating Level	*Contractor* to indicate on data sheet.
Minimum Tank Operating Level	*Contractor* to indicate on data sheet.

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7 TANK DESIGN DATA

The *Contractor* shall take cognizance of the following tank design data for the tank when preparing the offer;

Tank Design	Steel panel tank with internal liner
Tank Design Form Factor	Circular
Total Design Volume Required	*Contractor* to indicate on data sheet.
Number of Tanks	Site-Specific. *Contractor* to indicate on data sheet.
Tank Design Height for Sump	*Contractor* to indicate on data sheet.
Tank Design Height for Design Volume	*Contractor* to indicate on data sheet.
Tank Design Height for Overflow Pipe	*Contractor* to indicate on data sheet.
Tank Design Height for Breathing Volume	*Contractor* to indicate on data sheet.
Total Tank Design Height	*Contractor* to indicate on data sheet.
Design Diameter of Tank	*Contractor* to indicate on data sheet.
Set point of Full Water Level (from tank floor level)	*Contractor* to indicate on data sheet.
Centreline of Overflow Pipe (from tank floor level)	*Contractor* to indicate on data sheet.
Water Tank Level Indicator	Yes – float and pointer type. One for each tank. See Section 10 for marking of levels.

8 NOZZLE DATA

All nozzles shall be ANSI Class 150 raised face slip on (RFSO) in accordance with ASME B16.5 and shall be located on the tank shell.

The *Contractor* shall submit to the *Employer* a drawing of the water tank showing the nozzle and equipment positions, sizes and elevations to be fitted on the water tank.

The *Contractor* shall not proceed with the fabrication and installation of the nozzles until the *Employer* has accepted the drawing indicating the locations of the nozzles, internal bladder and other relevant equipment.

A selection of the nozzles will be double sided.

The *Contractor* will be required to verify on site the exact location of the nozzles for water pump suction outlet lines prior to fabrication, galvanizing and installation.

The *Contractor* shall take cognizance of the following nozzle data for the tank when preparing the offer;

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The nozzle shell projections shall generally be in accordance with API 650 or another standard approved by the *Employer*. Shell and Roof nozzle projection distances are required to be increased by a distance of 50mm for nozzle sizes that are 50NB and below, to account for insulation and lagging.

Tank Filling Line	*Contractor* to indicate on data sheet.
Breather/Gooseneck	Size and quantity to be determined by *Contractor*
Roof Manhole/Access Hatch	Yes – minimum size 600NB circular
Side Manhole/Access Hatch	Yes
Overflow Pipe	100NB – Galvanised carbon steel to ground level and to be flanged both ends. *Contractor* to confirm sizing.
Fire Department Water Tank Connection	*Contractor* to indicate on data sheet.
Water Pump Recirculation Line Inlet	*Contractor* to indicate on data sheet. Double sided nozzle.
Water Pump Suction Line Outlet	*Contractor* to indicate on data sheet. Double sided nozzle.
Tank Drain Valve	80NB
Tank Balancing Line	*Contractor* to indicate on data sheet.
Level Switch	*Contractor* to indicate on data sheet.

9 TANK PIPING ANCILLARIES

The *Contractor* will be required to manufacture and install the following equipment into each tank;

1) An inlet diffuser on the water pump recirculation line inlet(s)
2) An anti-vortex device on the water pump suction line outlet(s)

The inlet diffuser and the anti-vortex device will be designed by the *Contractor* and will be issued to the *Employer* for acceptance prior to procurement and fabrication.

The inlet diffuser will be a slotted pipe with a quantity and number of slots designed to limit the velocity of the discharge water below 1 m/s.

The anti-vortex device will generally conform to the NFPA 20 design for anti-vortex devices.

The inlet diffuser and the anti-vortex device will each be flanged on one end and will be bolted to the tank internal side of the respective double-sided flange.

The inlet diffuser will be supported from the floor on the inside of the tank. The *Contractor* will be required to design the connection between the inlet diffuser supports and the tank floor.

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The anti-vortex device will be supported from the floor on the inside of the tank. The *Contractor* will be required to design the connection between the underside of the anti-vortex device and the tank floor.

10 TANK ACCESSORIES

The *Contractor* will be required to supply, manufacture and install the following equipment for each tank;

1) Caged tank external access ladder for access to the roof and OSHAct compliance guard rails where necessary

2) Hinged lockable manhole

3) Float and pointer type water level indicator

4) Screened tank vent (sized by the *Contractor* to accommodate the maximum filling and emptying rate)

5) Four stainless steel earthing bosses to be equally spaced at low level and welded to tank shell. The *Contractor* shall submit their standard earthing boss detail to the *Employer* for acceptance.

6) Instrument tubing will be affixed to a dedicated galvanized cable tray along the entire length of the tank and will be permanently fixed to the tank.

7) Galvanized pipe supports for the following sizes of carbon steel pipe;

    - 40NB and less at a maximum support spacing of 2.4 metres
    - 50NB and greater at a maximum support spacing of 4.8 metres

The float and pointer type water level indicator shall indicate the percentage full volume of the tank as well as the corresponding tank volume, and not the height of the water tank level.

The usable volume of the tank shall be indicated as follows;

Tank Mark	**Setting**
100%	At set point of full water level
90%	90% of set point height
30%	30% of set point height
0%	At top of sump height
Tank Bottom	At bottom level of tank

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11 MATERIALS OF CONSTRUCTION

The *Contractor* shall take cognizance of the following materials of construction when preparing the offer;

Piping	ASTM A106 Gr. B Galvanised
Fittings	ASTM A234WPB Galvanised
Flanges	ASTM A105 RFSO 150LB Galvanised (all flanges to be centrifuged post galvanising)
Bolting	Hot dipped galvanized Grade 8.8 bolts and nuts with galvanized washers
Flange Gaskets	3mm KlingerSIL C-4400 or similar approved
Panels	To be determined by OEM with a +50 year guarantee for the application
Miscellaneous Steel Components	To be determined by OEM – to be hot dipped galvanised
Liner	PVC coated high-density polyester yarn
Sealants	Manufacturers standard

12 CORROSION PROTECTION AND TANK NUMBERING

All carbon steel components shall be hot-dipped galvanized. The tank will not require painting.

The *Contractor* shall paint the tank number on each compartment of the tank at a location as determined by the *Employer* on site.

The tank number and design water storage volume shall be painted on each compartment in accordance with the following specifications;

1) The number and volume painted on in two positions at high-level, one that is visible from the fire service access route and the other opposite it. The position shall be approved by the *Employer*.

2) Numerals and letters shall be in colours that contrast with that of the tank shell and approved by the *Employer*.

3) Characters shall be of such size as to be clearly visible and identifiable

4) Characters shall be of minimum height 290 mm and of minimum width 25 mm.

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13 TANK FOUNDATION

The tank foundation will be designed by the *Contractor.* The design of the foundation is to account for the existing geotechnical conditions of the site as well as the self-weight of the tank and imposed water and wind loads. The *Contractor* shall obtain all the necessary design information from the tank OEM that is to be considered during the design of the foundations.

14 QUALITY CONTROL

14.1 Documentation

The tanks shall be provided with the following minimum quality control documentation;

Galvanising Certificates	Required
Material Certificates	Required – panels, plate, piping, fittings, gaskets, flanges
Tank Data Sheet Approvals	To be prepared by the *Contractor* and submitted to the *Employer* for acceptance prior to procurement of Tanks
Drawing Approvals	Submission of General Arrangement (GA) drawings to the *Employer* for acceptance during the design stage
Punch Lists and Handover Certificates	Required
Site Fill Test	Required – water will be supplied by the *Employer.*

14.2 Tank Foundation

Prior to the erection of the water tank, the *Contractor* shall inspect the foundation to ensure that the foundation construction, levels and spacing is acceptable and ready for erection of the water tank. All bedding and preparation requirements are to be inspected, signed and accepted on a handover document by both the *Contractor* and tank OEM prior to erection. The *Employer* shall be invited to witness the handover procedure.

15 INSTALLATION, HANDOVER AND COMMISSIONING REQUIREMENTS

The *Contractor* shall comply with the *Employer's* Equipment Handover and Document Procedure, document PL 917.

Prior to delivery, the *Contractor* shall invite the *Employer* to the OEM's premises for an inspection of the equipment to ensure conformance to this specification. The *Contractor* shall only deliver the equipment to site once a release certificate for each item of equipment shown on the datasheet issued.

Prior to filling the water tank, the *Contractor* shall invite the *Employer* to perform a punch of the water tank. The *Contractor* shall complete all punch items prior to being issued with a 'Ready for Fill' certificate

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by the *Employer*. The punching of the water tank will not be construed as a handover or completion date in terms of the contract.

16 TANK LEVELS AND FIRE-FIGHTING DURATIONS

The tank levels as indicated in section 10 will be indicated as alarms on the Main Operator Panel interface as described in the Control System Specification, document PL 913.

Each tank will be equipped with a two-point level switch that shall be used to indicate the water level in the tank with its respective fire-firefighting duration. The information can be summarized as seen in the table below.

Tank Level	**Duration**
90%	60 mins
30 %	20 mins

17 DOCUMENTATION SUPPLY

Documents to be supplied upon award of the supply contract shall include:

1) Installation and maintenance manual

2) Spare parts list

3) A general arrangement.

4) Equipment design and construction information for each piece of equipment (sales documents)

5) Tank data sheet for *Employers* acceptance.

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FIRE SYSTEM SPECIFICATION

ACTUATING EXPANDING PLUG VALVE

Document number	PL 903
Version number	2
Classification	Unclassified
Effective date	1 July 2025
Review date	1 July 2028

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SUMMARY VERSION CONTROL

VERSION NO.	NATURE OF AMENDMENT	PAGE NO.	DATE REVISED
0	New Specification	ALL	1 July 2025
1	Comments during review between TPL and GreyJones included	ALL	11 July 2025

Note: Only latest amendments and/or additions are reflected in italics in the body of the document.

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DOCUMENTATION SIGN-OFF SHEET

I, the undersigned hereby approve this procedure.

ROLE	CAPACITY/ FUNCTION	SIGNATURE	DATE
Compiled by:	**Pieter Jacobs**		
Recommended by:	**Papa Moratwe**		

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TECHNICAL SPECIFICATION – ACTUATING EXPANDING PLUG VALVE

1 INTRODUCTION

This specification covers the design, fabrication, manufacture, procurement, supply, delivery to site and handover documentation of the electrically actuated expanding plug valves to be used within Transnet Pipelines fire protection systems.

Where the terms 'Valve' and 'equipment' are used in this specification, they shall be interpreted to mean Plant and Materials as defined in NEC3 Clause 11.2(12).

This specification is not site specific but has been prepared as a generic project specification. Site specific valve summary sheets and valve data sheets specifying the site-specific data pertaining to the valves are to be developed by the *Contractor* and submitted to the *Employer* for acceptance.

The function of the valves will be to provide positive isolation between the fire water process and the foam concentrate process during periods when foam concentrate is not proportioned into the fire water system.

Properties of the foam concentrate can be found in the Foam Concentrate Specification, document PL915. The *Contractor* shall review the properties of the foam concentrate when determining the suitability with the equipment.

The valves will be subject to intermittent usage with long idle periods of the valve being maintained within the closed conditions.

A selection of valves may be installed in Zone 0, Zone 1 or Zone 2 areas as defined in SANS 10108. The importance of correctly tagging the valve is underscored as the *Employer* relies on the *Contractor* to provide the valves as specified and with the correct corresponding tag number as shown on the approved P&ID's. The installation *Contractor* will receive the valves on site and will install the valves after pairing the valve tag number with the valve number indicated on the construction drawings.

The fire system is pressurized up to the valves and will normally remain closed against constant upstream or downstream pressure for long periods.

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2 DEFINITIONS

The following definitions shall apply when reading this specification;

Term	Definition
^0C	Degrees Celsius
ASME	American Society of Mechanical Engineers
ASTM	American Society for Testing & Materials and its successor ASTM International
API	American Petroleum Institute
cP	Centipoise
cSt	Centistoke
DFT	Dry Film Thickness
IA	Intrinsic Approval
ISO	International Standards Organisation
kg/m^3	Kilograms per cubic metre
OEM	Original Equipment Manufacturer
SANS	South African National Standards
SOQ	Schedule of Quantities
Contractor	The successful tenderer
Employer	Transnet Pipelines
Fail Safe Open (FSO)	The valve will open to allow fluid to flow through the valve body when the electrical power supply to the valve is interrupted.
Fail Safe Closed (FSC)	The valve will close and prevent fluid from flowing through the valve body when the electrical power supply to the valve is interrupted.
UV	Ultra-violet

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3 ENGINEERING STANDARDS

Although not bound in nor issued with this document, the following standardized specifications shall form part of the contract document:

3.1 Applicable Standards

ASME B16.5	Pipe Flanges and Flange Fittings
API 6D	Specification for Pipeline Valves
API 598	Valve Inspection and Testing
API 599	Metal Plug Valves—Flanged, Threaded, and Welding Ends
SANS 10089-1	The Petroleum Industry Part 1: Storage and distribution of petroleum products in above-ground bulk installations
SANS10089-2	The Petroleum Industry Part 2: Electrical and other installations in the distribution and marketing sector
SANS 10108	The classification of hazardous locations and the selection of apparatus for use in such locations
SANS 1700	Fasteners
SANS 1091	National colour standard
SANS 10140-2	Identification Colour Marking Part 2: Identification of Hazards and Equipment in Work.

3.2 Referenced Standards

PL 619C	Transnet Pipelines Specification for Three Phase Electric Actuators
PL 915	Foam Concentrate

4 LOCATION

The *Contractor* shall take cognizance of the following data of the valve location when preparing the offer;

City	*Contractor* to indicate on data sheet
Depot	Transnet Pipelines – *Contractor* to indicate on data sheet
Area	Indoors/outdoors - *Contractor* to indicate on data sheet
Hazardous Area Classification (SANS10089 Part 2 and SANS 10108)	*Contractor* to indicate on data sheet

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5 PROCESS FLUID DATA

The *Contractor* shall take cognizance of the following process fluid data for the valve when preparing the offer;

Process Fluid 1	Foam Concentrate
Temperature @ Operating Point	5 – 35 °C
Density @ Operating Point	1000 – 1100 kg/m³
Viscosity @ Operating Point	2625 cP at 20°C

Process fluid data shown to be confirmed by the *Contractor* during the detailed design.

6 PROCESS DATA

The *Contractor* shall take cognizance of the following process data for the valve when preparing the offer;

Maximum Flow Rate	*Contractor* to indicate on data sheet
Minimum Flow Rate	*Contractor* to indicate on data sheet
Flow Direction	To be indicated on valve body if applicable
Maximum Design Temperature	60°C
Maximum Operating Temperature	50°C
Minimum Operating Temperature	0°C
Design Pressure	16 barg. *Contractor* to indicate on data sheet
Maximum Upstream Operating Pressure	*Contractor* to indicate on data sheet
Minimum Upstream Operating Pressure	*Contractor* to indicate on data sheet
Maximum Downstream Operating Pressure	*Contractor* to indicate on data sheet
Minimum Downstream Operating Pressure	*Contractor* to indicate on data sheet
Maximum Valve Differential Pressure	To be the differential between the minimum upstream and the minimum downstream pressures. *Contractor* to indicate on data sheet.

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7 VALVE DESIGN

The *Contractor* shall take cognizance of the following physical properties and design of each valve when preparing the offer;

Valve Design Specifications	API Spec 6D, API 598, API 599
End Connections	ANSI Class 150 raised face to ASME B16.5 Dimensions to ASME B16.10
Valve Body	Flanged
Type	Expanding Plug Valve, Double Block and Bleed
Pattern	Short Pattern
FM Approval and/or UL Listing	Not required
Body Drain Valve	No
Size Range	50NB – 100NB
Bore	Full
Actuation	Electric
Actuator	400V AC to TPL Spec PL 619C. Fed from on-site essential power (back-up generator power)
Control Signals	24V DC inputs for Open and Close commands
Opening and Closing Time	15 seconds
Position Indicators	Yes - Refer TPL Spec 619C. Potential free contacts required for valve Open and valve Closed status
Limit and Pressure Switches	As required
Failure Mode	Fail state *Contractor* to indicate on data sheet
Special Fasteners	Fasteners will be supplied by others for flanged valves Metric bolts and nuts shall be used at all times.
Manual Override	Yes – local electrical operation and hand wheel to manually override to open and close valve
Test Pressure	Typically, 1.5 x design pressure
Liquid Tightness	Zero leakage across valve when closed

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8 MATERIALS OF CONSTRUCTION

The *Contractor* shall take cognizance of the following physical properties of each valve when preparing the offer;

Body	Ductile Iron or Carbon Steel. Cast iron is not acceptable. OEM to confirm suitability with process media and propose alternatives if necessary.
Valve trim	Stainless steel 316
Valve tubing and fittings	Stainless steel
Valve Internals	Suitable for process medium
Nameplate	Stainless steel

9 CORROSION PROTECTION

All valves shall be externally and internally protected. The *Contractor* shall refer to the approved P&ID's for each valve when preparing the offer for the corrosion protection system.

Corrosion protection specification for all equipment supplied shall be as per the *Contractor's* recommendation and in accordance with international standards specified for installations in normal industrial non-coastal environments.

Notwithstanding the *Contractors,* recommendation, each ductile iron/carbon steel valve shall be provided with the minimum corrosion protection system as specified in the table below;

External	Minimum 200 microns DFT epoxy or paint coating to colour Signal Red A11 ,preferred If a Bronze body is used, no external corrosion coating is required
Internal	Epoxy or Enamel coating (if in contact with aggressive fluids) – *Contractor* to indicate on data sheet

The preferred colour for all valves shall be manufactured according to standard colour specifications of the SANS 1091 and SANS 10140 – 2 (4.4). The *Contractors* standard red or similar valve colour will be considered subject to approval by the *Employer*. The external corrosion protection of all valves shall be UV resistant and the colour of the valve shall not fade or degrade over time with exposure to the elements.

Equipment made from Brass, Bronze and stainless steel do not require corrosion protection.

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10 QUALITY CONTROL

The valve shall be provided with the following minimum quality control documentation;

EN10204 Type Certificate	Type 3.2 (3rd party validation)
Material Certification	Required
Valve Certification	Indicating compliance with this specification
Valve Data Sheet Approvals	To be prepared by the *Contractor* and submitted to the *Employer* for acceptance prior to procurement of valves
Drawing Approvals	Submission of General Arrangement (GA) drawings to the *Employer* for acceptance during the design stage
Factory Pressure Test Certificate	Required
Site Hydrostatic Pressure Test	Required

11 DOCUMENTATION

The certificates shall have the valve serial number on them for traceability between documents.

Each valve shall be provided with the following documentation

At tender stage	• OEM valve data sheet with dimensioned drawing • Applicable design standards • Certificates from authoritative bodies (such as API, ISO9001, UL, FM, etc.)
Design phase	• Valve data sheets for *Employers* acceptance • General Arrangement (GA) drawing for *Employers* approval. The GA shall indicate the location of gearboxes, hand wheels etc. to be reviewed and accepted by the *Employer.* • IA Certificates
Delivery to site	• Design standard certificate • Certificate of manufacture • Material certificates • Factory pressure test certificate • Installation and maintenance manual • Spare parts list • A general arrangement. • Maintenance and operation manuals • Performance data to indicate the hydraulic performance of the valve including the pressure drop at all flow rates (may be graph, chart or equations)

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Material, design standard, Pressure Test and Manufacturing certificates shall be supplied with all valves.

12 GENERAL

The valve design, selection and supply shall adhere to the following specific requirements:

12.1 Equipment:

1) The EPV shall be of the TwinSeal make or approved equivalent.

2) The actuator shall be of the Rotork make or approved equivalent.

3) All valves shall be new and manufactured from all new materials unless otherwise specified in the enquiry.

4) All valves shall be suitable for mounting in the horizontal or vertical position with a flow direction up or down through the valve.

5) Reliably open with no outside intervention even after extended periods of closure

6) All valves must be of high quality and suitable for a long service life of occasional use. Valves should provide at least 20 years of service, subject to the OEM specified maintenance regime.

7) The direction of flow shall be cast or stamped on the valve body where applicable. Riveted tags are acceptable.

8) Each valve shall be tagged and permanently attached with a minimum 16-gauge stainless steel plate of minimum dimensions 15mm high by 50 mm long. The tags shall be attached with 16-gauge stainless steel wire to the valve and shall not be attached to the valve handles or in a way that interferes with installation or operation of the valves. Tags shall not be attached through bolt holes. The valve tag number as specified on the P&ID's, shall be permanently hammer stamped on the tag. The height of the text on the tag shall be a minimum of 10 mm high.

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12.2 Supply:

1) The *Contractor* shall provide installation instructions detailing the labor, equipment and any special procedures, tools, equipment or personnel required for the installation.

2) The *Contractor* shall include the provision of all specialist tools, equipment and services necessary for the installation and / or maintenance of the valves.

3) The material of manufacture of all parts shall be specified on the equipment drawings or data sheets. Submission of this information does not in any way negate the *Contractors* responsibility to ensure that the specified materials are suitable for the service required by this or any other documents pertaining to the enquiry.

4) Material certificates are to be provided for every supplied valve. Typical certificates are to be supplied with the tender return for each valve type.

5) The *Contractor* is to provide full operating and maintenance and overhaul manuals including detailed section and exploded diagrams of the valves, parts lists, typical spares lists and pricing.

6) The *Contractor* is to provide drawings indicating all relevant dimensions affecting the installation including space required to perform maintenance; this information is to be clearly indicated for all required valve sizes.

12.3 Storage:

Storage of the valves shall be:

- Undercover
- On dunnage, made of inert material, at least 150mm above ground level
- All openings shall be sealed

The valves shall be stored in an area away from regular vehicle movements and contamination by incompatible materials (e.g. carbon steel and stainless steel).

12.4 Delivery:

1) Prior to delivery, the *Contractor* shall invite the *Employer* to the OEM premises for an inspection of the valves to ensure conformance to this specification. The *Contractor* shall only deliver the equipment to site once a release certificate for each item of equipment shown on the datasheet issued.

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2) The valves shall be loaded and transported on suitable transport arranged by the *Contractor*. All items shall be secured on the transport vehicle to avoid damage to the valves and their coatings. Valves shall not be allowed to rest directly against each other.

3) All stainless-steel valves are to be kept free of contamination by incompatible materials such as carbon steel grindings, etc. Should valves become contaminated, the *Contractor* shall clean the valves at his own expense. If this is unsuccessful, the *Contractor* shall replace the valves at his own expense.

4) Valves shall be supplied with plastic end caps on both ends.

5) Valves shall be supplied in sealed wooden containers with plastic linings. A plastic lining shall be wrapped around each individual item. Flange faces and mating surfaces shall be protected during transport and handling.

6) Valves shall be separated so as not to bear against each other and shall be firmly secured by suitable padded lashings to prevent movement and damage in transit. The valves shall not be dropped, bumped or subjected to shock or rough handling and any valve damaged during transport or handling may be rejected by the *Employer*.

7) The *Contractor* shall make allowance for and comply with all the *Employers* Health Safety Security and Environmental (HSSE) requirements at the delivery point.

8) The *Contractor* shall allow for off-loading to a location on site as directed by the *Employers* representative. An off-loading method statement in compliance with the *Employers* HSE policy shall be supplied for approval prior to delivery.

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13 INSTALLATION AND COMMISSIONING REQUIREMENTS

The *Contractor* shall allow for the following as a minimum for the supply, installation and commissioning of the valves:

1) The certification documentation shall accompany the valves which shall be suitably tagged as required by this specification

2) All valves shall be supplied complete and ready for installation including any special fittings or fixtures required i.e. extended studs for wafer installation of long valve.

3) All valves shall undergo an on-site in-situ (in place) hydro-static test at 1.5 x the design pressure during hydro-static testing of the piping system. The valves will not be removed during testing of the piping system.

4) The *Employer* shall be advised of all factory testing and allowed the opportunity to observe factory acceptance tests if required by the *Employer*.

5) The *Contractor* shall be notified two weeks in advance of the first on-site commissioning date of the system and shall make provision to deploy a suitable technician to site for the duration of the commissioning of the valves. The *Contractor* shall make provision for the supply of all tools and equipment necessary for on-site commissioning. The *Contractor* shall not assume that all valves will be commissioned on the same day as the system will be commissioned in parts and as a result, several trips to site to commission the system will be required. During commissioning, the *Contractor* shall assist the *Employer* with commissioning of the system to meet the *Employers* requirements and by also actively participating in the arrival at any solutions to any problems that may arise during commissioning.

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14 DOCUMENTATION SUPPLY

Documents to be supplied upon award of the supply contract shall include:

1) Installation, operation manuals and maintenance manual
2) Spare parts list
3) 3D model for integration into the plant model
4) IA certificate as required by SANS 10108 (if applicable)
5) A general arrangement.
6) Equipment design and construction information for each piece of equipment (sales documents)
7) Valve data sheets for *Employer* acceptance
8) Approval documents (and indication of equivalency if required in section 10 and 11)
9) Performance data to indicate the hydraulic performance of the valve including the pressure drop at all flow rates (maybe graph, chart or equations)

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FIRE SYSTEM SPECIFICATION

FOAM GENERATING EQUIPMENT

Document number	PL 904
Version number	4
Effective date	1 December 2025
Review date	1 July 2028

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SUMMARY VERSION CONTROL

VERSION NO.	NATURE OF AMENDMENT	PAGE NO.	DATE REVISED
0	New Specification	ALL	1 July 2025
1	Comments during review between TPL and GreyJones included	ALL	23 July 2025
2	Comments and review from TPL	ALL	27 August 2025
3	Foam/Water Deluge nozzles added	ALL	22 September 2025
4	Specification for foam monitor blabber mouth cannons and foam premix deluge nozzles added	ALL	17 December 2025

Note: Only latest amendments and/or additions are reflected in italics in the body of the document.

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DOCUMENTATION SIGN-OFF SHEET

I, the undersigned hereby approve this procedure.

ROLE	CAPACITY/ FUNCTION	SIGNATURE	DATE
Compiled by:	**Pieter Jacobs**		
Approved by:	**Papa Moratwe**		

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TECHNICAL SPECIFICATION – FOAM GENERATING EQUIPMENT

1 INTRODUCTION

This specification covers the design, fabrication, manufacture, procurement, supply, delivery to site, handover documentation and spares for the top pourers, bund pourers, foam monitors, foam deluge nozzles, balanced pressure proportioners and balance valves which will be used as foam generating equipment within Transnet Pipelines systems.

Where the term 'equipment' are used in this specification, they shall be interpreted to mean Plant and Materials as defined in NEC3 Clause 11.2(12).

This specification is not site specific but has been prepared as a generic project specification. Site specific equipment data sheets specifying the site-specific data pertaining to each item of equipment are to be developed by the *Contractor* and submitted to the *Employer* for acceptance.

The process fluids for the equipment will be potable water (supplied by the municipality for the respective site), foam concentrate and foam pre-mix (a 1% or 3% mixture of foam concentrate and potable water).

Properties of the foam concentrate can be found in the Foam Concentrate Specification, document PL915. The *Contractor* shall review the properties of the foam concentrate when determining the suitability with the equipment.

The importance of correctly tagging equipment is underscored as the *Employer* relies on the *Contractor* to provide the equipment as specified on the data sheet and with the correct corresponding tag number. The installation *Contractor* will receive the equipment on site and will install the equipment after pairing the equipment tag number with the equipment number indicated on the construction drawings.

The *Contractor* shall review the equipment specific data sheet for each item of equipment to become familiar with the operating conditions of the equipment prior to submission of the offer.

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2 DEFINITIONS

The following definitions shall apply when reading this specification;

Term	Definition
^{0}C	Degrees Celsius
ASME	American Society of Mechanical Engineers
ASTM	American Society for Testing & Materials and its successor ASTM International
API	American Petroleum Institute
BS	British Standard
cP	Centipoise
cSt	Centistoke
EN	European Norm
DFT	Dry Film Thickness
IA	Intrinsic Approval
ISO	International Standards Organisation
kg/m^3	Kilograms per cubic metre
OEM	Original Equipment Manufacturer
SANS	South African National Standards
SOQ	Schedule of Quantities
Contractor	The successful tenderer
Employer	Transnet Pipelines
UV	Ultra-violet

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3 ENGINEERING STANDARDS

Although not bound in nor issued with this document, the following standardized specifications shall form part of the contract document:

3.1 Applicable Standards

BS EN ISO 9001	Quality Management System
ISO 14001	Environmental Management standards
EN 10025	Hot rolled products of structural steels
NFPA 16	Installation of Foam-Water Sprinkler and Foam-Water Spray Systems
SANS 10089-1	The Petroleum Industry Part 1: Storage and distribution of petroleum products in above-ground bulk installations
SANS10089-2	The Petroleum Industry Part 2: Electrical and other installations in the distribution and marketing sector
SANS 1091	National colour standard
SANS 10140-2	Identification Colour Marking Part 2: Identification of Hazards and Equipment in Work.
UL 162	Standard for Foam Equipment and Liquid Concentrates
FM 5511	Firefighting Nozzles for Use with Hose, Monitor Assemblies and Other Firefighting Equipment

3.2 Referenced Standards

PL 915	Foam Concentrate

4 LOCATION

The *Contractor* shall take cognizance of the following data of the equipment location when preparing the offer;

City	*Contractor* to indicate on data sheet.
Depot	Transnet Pipelines – *Contractor* to indicate on data sheet. for depot
Area	*Contractor* to indicate on data sheet.

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5 PROCESS FLUID DATA

The Contractor shall take cognizance of the following process fluid data for the equipment when preparing the offer;

Process Fluid 1	Water
Temperature @ Operating Point	5 - 50 °C
Density @ Operating Point	997 kg/m³ @ 25°C
Viscosity @ Operating Point	0.9 cP at 25°C
Process Fluid 2	Foam Concentrate
Temperature @ Operating Point	5 - 35 °C
Density @ Operating Point	1000 - 1100 kg/m³
Viscosity @ Operating Point	2625 cP at 20°C (Non-Newtonian)
Process Fluid 3	Foam Pre-mix
Temperature @ Operating Point	5 - 50 °C
Density @ Operating Point	997 kg/m³ @ 25°C
Viscosity @ Operating Point	0.9 cP at 25°C

Process fluid data shown to be confirmed by the *Contractor* during the detailed design.

6 PROCESS DATA

The *Contractor* shall take cognizance of the following process data for the equipment when preparing the offer;

Maximum Flow Rate	*Contractor* to indicate on data sheet.
Minimum Flow Rate	*Contractor* to indicate on data sheet.
Flow Direction	To be indicated on equipment body if applicable
Maximum Design Temperature	60°C
Maximum Operating Temperature	50°C
Minimum Operating Temperature	0°C
Design Pressure	16 barg
Maximum Expected Pressure	*Contractor* to indicate on data sheet.
Minimum Expected Pressure	*Contractor* to indicate on data sheet.

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7 EQUIPMENT DESIGN

The *Contractor* shall take cognizance of the following physical properties of each item of equipment when preparing the offer;

7.1 Balanced Pressure Foam Proportioner

Design	*Contractor* to indicate on data sheet.
End Connections	Wafer between ANSI Class 150 Raised Face flanges
Foam inlet size and connection	40NB – 80NB BSP
Minimum Flow Rate	220 l/min – 2200l/min
Maximum Flow Rate	2200l/min – 22000 l/min
Minimum Working Pressure	4 barg
Maximum Working Pressure	16 barg
Pressure loss across unit	< 1.25 barg
Special Fasteners	Bolts and nuts other than those used for the flange class shall be supplied with the equipment. Metric bolts and nuts shall be used at all times.
Test Pressure	Typically, 1.5 x design pressure

7.2 Bund Pourers

Design	*Contractor* to indicate on data sheet.
End Connections	Male BSP Taper
Size Range (inlet connection)	50NB – 80NB
Operation Pressure Range	1.5barg -3.5barg
Min. Inlet Pressure	As per OEM's optimum working conditions
Expansion Ratio	*Contractor* to indicate on data sheet.
Special Fasteners	Metric bolts and nuts shall be used at all times.
Test Pressure	Typically, 1.5 x design pressure

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7.3 Balance Valve for BPP

Design	*Contractor* to indicate on data sheet.
End Connections	BSP threaded Female
Size Range	40NB – 80NB
Minimum Operating Pressure	5bar
Maximum Operating Pressure	16bar
Special Fasteners	Bolts and nuts other than those used for the flange class shall be supplied with the equipment. Metric bolts and nuts shall be used at all times.
Test Pressure	Typically, 1.5 x design pressure

7.4 Foam Monitor

Design	*Contractor* to indicate on data sheet.
End Connections	ANSI class 150 Raised Face
Water Way Size Range	40NB – 80NB
Actuation	*Contractor* to indicate on data sheet.
Oscillating Actuator	Pelton wheel motor
Sweep angle	Automatic : 45˚ to 120˚ Manual : 360˚continous
Release lever	Yes
Cam – lock mechanism	Yes
Special Fasteners	Bolts and nuts other than those used for the flange class shall be supplied with the equipment. Metric bolts and nuts shall be used at all times.
Test Pressure	Typically, 1.5 x design pressure

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7.4.1 Foam Monitor Spinning Tooth Nozzles

Design	*Contractor* to indicate on data sheet.
End Connections	NPT
Size Range	*Contractor* to indicate on data sheet.
Operating Pressure	To be minimised while achieving the throw requirement and flow rate 7 bar inlet pressures will be considered only with acceptable justification
Spray patterns	Both fog and jet spray, adjustable online *Contractor* to indicate on data sheet.
Horizontal Reach	Minimum of 45m for a straight stream flow. *Contractor* to indicate on data sheet.
Vertical Reach	*Contractor* to indicate on data sheet.
Special Fasteners	Bolts and nuts other than those used for the flange class shall be supplied with the equipment. Metric bolts and nuts shall be used at all times.
Test Pressure	Typically, 1.5 x design pressure

7.4.2 Foam Monitor Cannons

Design	*Contractor* to indicate on data sheet
End connections	Flanged
Operating Pressure	To be minimised while achieving the throw requirement and flow rate 5 bar inlet pressures will be considered only, otherwise, acceptable justification is required
Blabbermouth	Yes
Horizontal Reach	Minimum of 33m. *Contractor* to indicate on data sheet.
Vertical Reach	*Contractor* to indicate on data sheet.
Special Fasteners	Bolts and nuts other than those used for the flange class shall be supplied with the equipment. Metric bolts and nuts shall be used at all times.
Test Pressure	Typically, 1.5 x design pressure

Note: See section 12.1.4 for guidelines on the use of foam monitor cannons.

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7.5 Top Foam Pourers

Design	*Contractor* to indicate on data sheet.
End Connections	ANSI Class 150 raised face flange
Size Range	Refer to data sheet
Inlet Connection	50NB - 150NB
Outlet Connection	100NB – 250NB
Inlet Pressure Range	3 bar - 5 barg
Minimum Flow Rate	200 l/min
Maximum Standard Length of the Foam dispersal tube	10mm
Graphite Disc Pressure tolerance	±0.05 bar
Special Fasteners	Bolts and nuts other than those used for the flange class shall be supplied with the equipment. Metric bolts and nuts shall be used at all times.
Test Pressure	Typically, 1.5 x design pressure

7.6 Foam/ Water Nozzles

7.6.1 High-level nozzle

Design	*Contractor* to indicate on data sheet.
End Connections	BSP Female
Size Range	*Contractor* to indicate on data sheet.
Operating Pressure	3 – 4 bar
Expansion Ratio	5:1 to 7:1
Spray patterns	Solid cone discharge pattern *Contractor* to indicate on data sheet.
Radial Reach	1.5m – 2m *Contractor* to indicate on data sheet.
Vertical mount	Must be able to provide substantial coverage when mounted 3m above ground. *Contractor* to indicate on data sheet.
Test Pressure	Typically, 1.5 x design pressure

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7.6.2 Low-level nozzle

Design	*Contractor* to indicate on data sheet.
End Connections	BSP Female
Size Range	*Contractor* to indicate on data sheet.
Operating Pressure	3 - 5 bar
Expansion Ratio	5:1 to 7:1
Spray patterns	Truncated triangular shaped discharge pattern *Contractor* to indicate on data sheet.
Radial Reach	5m – 5.5m *Contractor* to indicate on data sheet.
Horizontal reach	4m - 5m *Contractor* to indicate on data sheet.
Vertical reach	1.2 – 1.5m

Note: During the design review stage and prior to design equipment assembly, the *Contractor* shall submit to the *Employer* for acceptance of the dimensioned General Arrangement (GA) drawings.

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8 MATERIALS OF CONSTRUCTION

The *Contractor* shall refer to the specific equipment data sheet of each item of equipment when preparing the offer. The *Contractor* shall take note that all wetted internal components of the equipment shall not be made of Zinc, Brass, Bronze, Carbon Steel, or Ductile Iron.

Balanced Pressure Foam Proportioner	
Body	Bronze alloy
Improver	Copper OEM recommendation
Bund Pourers	
Nozzles	Brass
Pourer tube	Stainless steel 316
Internals	Stainless steel 316
Balance Valve	
Body	Bronze alloy OEM recommendation. Cast iron is not acceptable
Diaphragm	Neoprene rubber lined with nylon
Piston Valve	Stainless steel 316
Water pressure balance pipe	Stainless steel 316
Foam Monitor	
Body	Bronze alloy
Gearbox	Brass
Seals	Nitrile synthetic rubber
Fasteners	Stainless steel 316
Grab handle	OEM recommendation
Foam Monitor Spinning Tooth Nozzle	
Body and Diffuser Sleeve	Brass
Internals	OEM recommendation
Foam Monitor Cannons	
Barrel	Stainless steel 316
Internals	Stainless steel 316
Spreader	Stainless steel 316
Flange	Gunmetal
Top Foam Pourers	
Body And Foam Generator Tube	Carbon steel to EN10025
Flow Controller	Stainless steel 316
Bursting Disc	Graphite

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Bursting Disc Holder	Stainless Steel 316
O-Ring Seal	Nitrile Rubber
Outlet Flange Gasket	PTFE
Foam/ water Deluge Nozzles (High level and low- level nozzles)	
Body	Stainless Steel 316
Internals	Stainless Steel 316

9 CORROSION PROTECTION

All equipment shall be externally and internally protected. The *Contractor* shall refer to the approved P&ID's for each equipment when preparing the offer for the corrosion protection system.

Corrosion protection specification for all equipment supplied shall be as per the *Contractor's* recommendation and in accordance with international standards specified for installations in normal industrial non-coastal environments.

Notwithstanding the *Contractors* recommendation, each ductile iron/carbon steel equipment shall be provided with the minimum corrosion protection system as specified in the table below;

External	Minimum 200 microns DFT epoxy or paint coating to colour Signal Red A11 ,preferred If a Bronze body is used, no external corrosion coating is required
Internal	Epoxy or Enamel coating (if in contact with aggressive fluids) – *Contractor* to indicate on data sheet

The preferred colour for all equipment shall be manufactured according to standard colour specifications of the SANS 1091 and SANS 10140 – 2 (4.4). The *Contractors* standard red or similar equipment colour will be considered subject to approval by the *Employer*. The external corrosion protection of all equipment shall be UV resistant, and the colour of the equipment shall not fade or degrade over time with exposure to the elements.

Equipment made from Brass, Bronze and stainless steel do not require corrosion protection.

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10 QUALITY CONTROL

The equipment shall be provided with the following minimum quality control documentation;

Material Certification	Required
EN10204 Type Certificate	Type 3.2 (3rd party validation)
Equipment Certification	Indicating compliance with this specification
Equipment Data Sheet Approvals	To be prepared by the *Contractor* and submitted to the *Employer* for acceptance prior to procurement of equipment.
Drawing Approvals	Submission of General Arrangement (GA) drawings to the *Employer* for acceptance during the design stage
Factory Pressure Test Certificate	Required
Site Hydrostatic Pressure Test	Required

11 DOCUMENTATION

The certificates shall have the equipment serial number on them for traceability between documents.

Each item of equipment shall be provided with the following documentation;

At tender stage	• OEM Equipment data sheet with dimensioned drawing. • Applicable design standards. • Certificates from authoritative bodies (such as API, ISO9001, UL, FM, etc.)
Design stage	• Equipment data sheets for *Employers* acceptance. • General Arrangement (GA) drawing for *Employers* approval. The GA shall indicate the location of gearboxes, handwheels etc. to be reviewed and accepted by the *Employer.* • IA Certificates (if applicable)
Delivery to site	• Design standard certificate. • Certificate of manufacture. • Material certificates. • Factory pressure test certificate. • Installation and maintenance manual. • Spare parts list. • A general arrangement. • Maintenance and operation manuals. • Performance data to indicate the hydraulic performance of the equipment including the pressure drop at all flow rates (may be graph, chart, or equations).

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12 GENERAL

The equipment selection, supply, delivery, and spare parts shall adhere to the following specific requirements;

12.1 Equipment:

1) The top pourers shall be of the Angus make or approved equivalent.

2) The bund pourers shall be of the Angus make or approved equivalent.

3) The foam monitors shall be a combination of the oscillating function, monitor and nozzle and shall be purchased from the same OEM.

4) The foam/water nozzles shall be of Angus make or approved equivalent.

5) The balanced pressure proportioners shall be of the Angus make or approved equivalent.

6) The balance valves shall be of the Angus make or approved equivalent.

7) The direction of flow shall be cast or stamped on the equipment where applicable. Riveted tags are acceptable.

12.1.1 Balanced Pressure Foam Proportioner

1) This piece of equipment shall be installed with an Improver that is of the same manufacturer.

12.1.2 Bund Pourers

1) The selection of bund pourers by the *Contractor* must ensure appropriate flow rates are achieved with low or optimal operating pressures as per the OEM.

2) The bund pourers must deliver optimal foam at the foam induction ratio and for the foam concentrate specification detailed in sub-section 1.1.

12.1.3 Balance Valve for BPP

1) It is the responsibility of the *Contractor* to understand the operating conditions of the foam concentrate system when selecting the balance valve.

2) Balance valves are to be installed in upright orientation to minimize the risk of drying out.

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12.1.4 Foam Monitor

1) The foam monitor must have a release lever that overrides the automatic oscillation of the monitor to allow for the manual use of the equipment during operation.

2) The *Contractor* must supply and install a galvanized discharge pipe from the drain outlet towards a free draining surface area to prevent the process fluid from coming into contact with the Operator during operation.

3) Foam monitors with cannons and blabber mouths will be considered only if they do not increase maximum flow rate or system pressure for the credible event.

12.1.5 Foam Monitor Spinning Tooth Nozzles

1) It is the responsibility of the *Contractor* to ensure that the nozzle is compatible with the foam monitor and shall be procured from the same OEM.

2) The nozzles must be fitted with turn control bars allowing the Operator to change the spray pattern during application.

12.1.6 Foam Monitor Cannons

1) It is the responsibility of the Contractor to ensure that the cannon is compatible with the foam monitor and shall be procured from the same OEM.

12.1.7 Foam/Water Nozzles

1) It is the responsibility of the *Contractor* to ensure that the selection of the nozzles is designed to meet the NFPA flow rate based on the application of the nozzle.

2) The low-level nozzles must be suitable to be fitted 0.3m above ground

12.1.8 Top Foam Pourers

1) The Top Foam Pourer box lid (captive lid) needs to be accessible from the spiral stair landing or top of tank without a need for the installation of scaffolding. During the commissioning the top foam pourer must be positively isolated from the tank shell, the use of the rupture disc to prevent foam pre-mix entering the tank will not be accepted.

2) A deflector plate must be included in the design of the Top Foam Pourer.

3) It is recommended that the distance between the Pourer opening and the inside of the Tank shell is within 10mm to ensure maximized foam delivery to the internal wall of the tank shell.

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12.2 Supply:

1) The *Contractor* shall provide installation instructions detailing the labour, equipment and any special procedures, tools, equipment, or personnel required for the installation.

2) The *Contractor* shall include the provision of all specialist tools, equipment, and services necessary for the installation and / or maintenance of the equipment.

3) The material of manufacture of all parts shall be specified on the equipment drawings or data sheets. Submission of this information does not in any way negate the *Contractor's* responsibility to ensure that the specified materials are suitable for the service required by this or any other documents pertaining to the enquiry.

4) The *Contractor* is to provide full operating and maintenance and overhaul manuals including detailed section and exploded diagrams of the equipment, parts lists, typical spares lists and pricing.

5) The *Contractor* is to provide drawings indicating all relevant dimensions affecting the installation including space required to perform maintenance.

6) The *Contractor* shall provide a copy of all manufacturers coating specifications relevant to the products specified.

12.3 Storage:

Storage of the equipment shall be:

- Undercover
- On dunnage, made of inert material, at least 150mm above ground level.
- All openings shall be sealed.

The equipment shall be stored in an area away from regular vehicle movements and contamination by incompatible materials (e.g. carbon steel and stainless steel).

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12.4 Delivery:

1) Prior to delivery, the *Contractor* shall invite the *Employer* to the Suppliers premises for an inspection of the equipment to ensure conformance to this specification. The *Contractor* shall only deliver the equipment to site once a release certificate for each item of equipment shown on the datasheet issued.

2) The equipment shall be loaded and transported on suitable transport arranged by the *Contractor*. All items shall be secured on the transport vehicle to avoid damage to the equipment and their coatings. Equipment shall not be allowed to rest directly against each other.

3) Equipment shall be supplied in sealed wooden containers with plastic linings. A plastic lining shall be wrapped around each individual item. Flange faces and mating surfaces shall be protected during transport and handling.

4) Equipment shall be separated so as not to bear against each other and shall be firmly secured by suitable padded lashings to prevent movement and damage in transit. The equipment shall not be dropped, bumped, or subjected to shock or rough handling and any equipment damaged during transport or handling may be rejected by the *Employer*.

5) The *Contractor* shall make allowance for and comply with all the *Employers* Health Safety Security and Environmental (HSSE) requirements at the delivery point.

6) The *Contractor* shall allow for off-loading to a location on site as directed by the *Employers* representative. An off-loading method statement in compliance with the *Employers* HSE policy shall be supplied for approval prior to delivery.

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12.5 Spare Parts:

All spare parts should be stored in wooden crates and clearly and permanently marked to aid with future identification.

1) It is prohibited for any equipment spare parts to be stored in environments that can result in degradation of the equipment in any form and manner such as contamination and corrosion.

2) The *Contractor* shall provide one of each of the following spare parts per equipment type and size, (should a change in equipment size require a different part):

12.5.1 Top Pourers

- Bursting Disc

12.5.2 Foam Monitors

- One full-set of parts to fulfil the first maintenance requirement of the oscillating flange (water drive turbine, etc.)
- One full-set of parts to fulfil the first maintenance requirement of the foam monitor nozzles

12.5.3 Balance Valve

- A spare gasket for the balance valve

Equivalent alternatives should also be provided that specifies product numbers and suppliers.

13 INSTALLATION AND COMMISSIONING REQUIREMENTS

The *Contractor* shall allow for the following as a minimum for the supply, installation, and commissioning of the equipment:

1) All equipment shall be supplied completely or ready to be assembled on site and ready for installation including any special fittings or fixtures required.

2) The *Employer* shall be advised of all Factory testing and allowed the opportunity to observe Factory Acceptance Tests if required by the *Employer*.

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14 DOCUMENTATION SUPPLY

Documents to be supplied upon award of the supply contract shall include:

1) Installation, operation, and maintenance manual

2) Spare parts list.

3) IA certificate as required by SANS 10108 (if applicable)

4) 3D model for integration into the plant model

5) Equipment data sheets for *Employers* acceptance

6) A general arrangement.

7) Equipment design and construction information for each item of equipment (sales documents)

8) Approval documents (and indication of equivalency if required in section 10 and 11.

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FIRE SYSTEM SPECIFICATION

TANK COOLING PROTECTION

Document number	PL 905
Version number	2
Classification	Unclassified
Effective date	1 July 2025
Review date	1 July 2028

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SUMMARY VERSION CONTROL

VERSION NO.	NATURE OF AMENDMENT	PAGE NO.	DATE REVISED
0	New Specification	ALL	1 July 2025
1	Comments during review between TPL and GreyJones included	ALL	24 July 2025
2	Comments and review from TPL	ALL	27 August 2025

Note: Only latest amendments and/or additions are reflected in italics in the body of the document.

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DOCUMENTATION SIGN-OFF SHEET

I, the undersigned hereby approve this procedure.

ROLE	CAPACITY/ FUNCTION	SIGNATURE	DATE
Compiled by:	**Pieter Jacobs**		
Approved by:	**Papa Moratwe**		

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TECHNICAL SPECIFICATION – TANK COOLING PROTECTION

1. INTRODUCTION

This specification covers the design, fabrication, manufacture, procurement, supply, delivery to site and handover documentation of the sprinkler nozzles to be used as tank cooling protection equipment within Transnet Pipelines fire protection systems.

Where the terms ‘nozzle’ and ‘equipment’ are used in this specification, they shall be interpreted to mean Plant and Materials as defined in NEC3 Clause 11.2(12).

This specification is not site specific but has been prepared as a generic project specification. Site specific equipment summary sheets and equipment data sheets specifying the site-specific data pertaining to the equipment are to be developed by the *Contractor* and submitted to the *Employer* for acceptance.

The process fluid for the equipment will be potable water (supplied by the municipality for the respective site).

The importance of correctly tagging the Nozzle is underscored as the *Employer* relies on the *Contractor* to provide the nozzles as specified on the approved P&IDs and with the correct corresponding tag number. Nozzles shall be grouped and stored by design type to facilitate organized handling and prevent misidentification of the nozzle types. The labelling and bagging of the nozzles shall also be done, and it must include the corresponding tank number and nozzle number as per the approved P&IDs. The installation *C*ontractor will receive the nozzles on site and will install the nozzles after pairing the Nozzle tag number with the number indicated on the P&ID drawings.

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2. DEFINITIONS

The following definitions shall apply when reading this specification;

Term	Definition
^0C	Degrees Celsius
BS	British Standard
cP	Centipoise
EN	European Norm
ISO	International Standards Organisation
kg/m^3	Kilograms per cubic metre
OEM	Original Equipment Manufacturer
QCP	Quality Control Plan
SANS	South African National Standards
SOQ	Schedule of Quantities
Contractor	The successful tenderer
Employer	Transnet Pipelines

3. ENGINEERING STANDARDS

Although not bound in nor issued with this document, the following standardized specifications shall form part of the contract document:

FM 5560	Water Spray nozzles
NFPA 15	Standard for Water Spray Fixed Systems for Fire Protection
NFPA 25	Standard for the Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems
UL 2351	VNIV – Spray Nozzles for Fire-Protection Service.
SANS 10089-1	The Petroleum Industry Part 1: Storage and distribution of petroleum products in above-ground bulk installations

4. LOCATION

The *Contractor* shall take cognizance of the following data of the nozzle location when preparing the offer;

City	*Contractor* to indicate on data sheet
Depot	Transnet Pipelines – *Contractor* to indicate on data sheet
Area	*Contractor* to indicate on data sheet

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5. PROCESS FLUID DATA

The *Contractor* shall take cognizance of the following process fluid data for the nozzle when preparing the offer;

Process Fluid	Water
Temperature @ Operating Point	5 - 50 °C
Density @ Operating Point	997 kg/m³ @ 25°C
Viscosity @ Operating Point	0.9 cP at 25°C

Process fluid data shown to be confirmed by the *Contractor* during the detailed design.

6. PROCESS DATA

Maximum Flow Rate In	*Contractor* to indicate on data sheet.
Maximum Flow Rate Out	*Contractor* to indicate on data sheet.
Maximum Design Temperature	60°C
Maximum Operating Temperature	50°C
Minimum Operating Temperature	0°C
Design Pressure	*Contractor* to obtain and indicate on data sheet.
Maximum working pressure	*Contractor* to obtain and indicate on data sheet.
Minimum working pressure	*Contractor* to obtain and indicate on data sheet.

7. NOZZLE DESIGN

The *Contractor* shall take cognizance of the following physical properties and design of each nozzle when preparing the offer;

7.1 Shell cooling nozzles

End Connections	Threaded ½" NPTM
FM or UL approval	Preferred
Fitment torque	*Contractor* to obtain and indicate on data sheet.
K- Factor	*Contractor* to obtain and indicate on data sheet.
Spray angle	*Contractor* to obtain and indicate on data sheet.
Strainer	*Contractor* to obtain and indicate on data sheet.
Material	Stainless Steel 316
Distance of nozzle from Tank shell	300mm – 650mm but within the range specified by the OEM

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Nozzle spacing	1500mm – 3000mm but within the range specified by the OEM
Minimum water loss from tank wall	15%

7.2 Roof Cooling nozzles

End Connections	Threaded ½" NPTM
FM or UL approval	Preferred
Fitment torque	*Contractor* to obtain and indicate on data sheet.
K- Factor	*Contractor* to obtain and indicate on data sheet.
Spray angle	*Contractor* to obtain and indicate on data sheet.
Strainer	*Contractor* to obtain and indicate on data sheet.
Material	Stainless Steel 316
Nozzle spacing	Within the range specified by the OEM
Minimum water loss from tank wall	15%

The minimum water loss from tank wall is the loss design factor allowance indicated by the OEM, that must be included in the flow rate requirement during the cooling ring sizing calculations.

The material of the shell and roof nozzles must strictly be stainless steel 316. Any other material will be unacceptable.

8. QUALITY CONTROL

The equipment shall be provided with the following minimum quality control documentation;

Material Certification	Required
EN10204 Type Certificate	Type 3.1
FM and/or UL Certification	Required
Equipment data sheet approvals	To be prepared by the *Contractor* and submitted to the *Employer* for acceptance prior to procurement of nozzles
Factory Pressure Test Certificate	Required
Site Hydrostatic Pressure Test	Required

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9. DOCUMENTATION

The certificates shall have the original equipment serial/batch number on them for traceability between the documents.

At tender stage	• OEM nozzle data sheet with dimensioned drawing. • Applicable design standards. • Certificates from authoritative bodies (such as API, ISO9001, UL, FM, etc.) • K-factor vs pressure • Spray patterns
Design phase	• Equipment data sheets for *Employers* acceptance • General Arrangement (GA) drawing for *Employers* approval. IA Certificates (if applicable)
Delivery to site	• Design standard certificate. • Certificate of manufacture. • Material certificates. • Factory pressure test certificate. • Installation and maintenance manual. • A general arrangement. • Maintenance and operation manuals.

10. GENERAL

The nozzle design, selection and supply shall adhere to the following specific requirements:

10.1 Equipment:

1) The Nozzles shall be of GW, HD Fire Protect make or approved equivalent.

2) All nozzles shall be new and manufactured from all new materials unless otherwise specified in the enquiry.

3) Nozzles shall be supplied with a strainer when the orifice diameter is less than 8.7mm or when the K factor is less than K27. Integral strainers must be used for each nozzle when water ways are less than 5mm.

4) Protective coatings are not required. All nozzles supplied by the OEM must be stainless steel.

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10.2 Supply

1) It is the responsibility of the *Contractor* to ensure that the nozzles are of the correct quantity and design.

2) The *Contractor* shall provide installation instructions detailing the labour, equipment and any special procedures, tools, equipment or personnel required for the installation.

3) The *Contractor* shall include the provision of all specialist tools, equipment and services necessary for the installation and / or maintenance of the nozzles.

4) The material of manufacture of all parts shall be specified on the nozzle drawings or data sheets. Submission of this information does not in any way negate the Contractor's responsibility to ensure that the specified materials are suitable for the service required by this or any other documents pertaining to the enquiry.

5) The *Contractor* is to provide full operating and maintenance and overhaul manuals including detailed sections of the nozzles, parts lists, typical spares lists and pricing.

6) The *Contractor* is to provide drawings indicating all relevant dimensions affecting the installation including space required to perform maintenance; this information is to be clearly indicated for all required nozzle sizes.

10.3 Storage

Storage of the nozzles shall be:

- Undercover
- On dunnage, made of inert material, at least 150mm above ground level.
- All openings shall be sealed.

The equipment shall be stored in an area away from regular vehicle movements and contamination by incompatible materials (e.g. carbon steel and stainless steel).

The nozzles must be stored away from heat, moist and dusty conditions prior to installation.

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10.4 Delivery

1) Prior to delivery, the *Contractor* shall invite the *Employer* to the OEM's premises for an inspection of the equipment to ensure conformance to this specification. The *Contractor* shall only deliver the equipment to site once a release certificate for each item of equipment shown on the datasheet issued.

2) The nozzles shall be loaded and transported on suitable transport arranged by the Contractor. All items shall be secured on the transport vehicle to avoid damage to the nozzles.

3) All nozzles are to be kept free of contamination by incompatible materials such as carbon steel grindings, etc. Should nozzles become contaminated, the *Contractor* shall clean the nozzles at his own expense. If this is unsuccessful, the *Contractor* shall replace the nozzles at his own expense.

4) Nozzles shall be supplied with the original packaging provided by the OEM.

5) Nozzles shall be supplied in sealed wooden containers with plastic linings. A plastic lining shall be wrapped around each individual item.

6) The nozzles shall not be dropped, bumped or subjected to shock or rough handling and any nozzle damaged during transport or handling may be rejected by the *Employer*.

7) The *Contractor* shall make allowance for and comply with all the *Employers* Health Safety Security and Environmental (HSSE) requirements at the delivery point.

8) The *Contractor* shall allow for off-loading to a location on site as directed by the *Employers* representative. An off-loading method statement in compliance with the *Employers* HSE policy shall be supplied for approval prior to delivery.

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11. INSTALLATION REQUIREMENTS

1) Any nozzles that shows any visibility of damage to threads, deflector or strainer (if utilized), on site prior to installation and post installation during the inspection process done by the *Employer*, must be discarded and replaced by the *Contractor* at his own expense.

2) The *Contractor* shall invite the *Employer* when pairing the nozzles with the associated shell and roof cooling rings for each tank to verify that the correct nozzles are used in the application. This shall be a hold point on the Contractors quality control plan.

3) Teflon Tape or soft thread sealant must be used on the male thread of the nozzle.

4) Fitment of the nozzles onto the cooling ring must be done using hand tightening as excessive tightening torque will damage the nozzles, impacting on its performance. A torque wrench shall be used, with a torque range setting as specified by the OEM, but generally in the range of 10 – 20 N.m.

12. DOCUMENTATION SUPPLY

Documents to be supplied upon award of the supply contract shall include:

1) Installation, operation, and maintenance manuals.

2) Spare parts list.

3) IA certificate as required by SANS 10108 (if applicable).

4) 3D model for integration into the plant model.

5) A general arrangement.

6) Nozzle data sheets for *Employers* acceptance.

7) Equipment design and construction information for each piece of equipment (sales documents).

8) Approval documents (and indication of equivalency if required in section 8 and 9).

9) Performance data to indicate the hydraulic performance of the equipment.

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FIRE SYSTEM SPECIFICATION

NON-RETURN VALVES

Document number	PL 906
Version number	2
Classification	Unclassified
Effective date	1 July 2025
Review date	1 July 2028

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SUMMARY VERSION CONTROL

VERSION NO.	NATURE OF AMENDMENT	PAGE NO.	DATE REVISED
0	New Specification	ALL	1 July 2025
1	Comments during review between TPL and GreyJones included	ALL	11 July 2025
2	Comments and review from TPL	ALL	27 August 2025

Note: Only latest amendments and/or additions are reflected in italics in the body of the document.

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DOCUMENTATION SIGN-OFF SHEET

I, the undersigned hereby approve this procedure.

ROLE	CAPACITY/ FUNCTION	SIGNATURE	DATE
Compiled by:	**Pieter Jacobs**		
Approved by:	**Papa Moratwe**		

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TECHNICAL SPECIFICATION – NON-RETURN VALVE

1. INTRODUCTION

This specification covers the design, fabrication, manufacture, procurement, supply, delivery to site and handover documentation of the non-return valves to be used as back flow prevention valves within Transnet Pipelines fire protection systems.

Where the terms 'Valve' and 'equipment' are used in this specification, they shall be interpreted to mean Plant and Materials as defined in NEC3 Clause 11.2(12).

This specification is not site specific but has been prepared as a generic project specification. Site specific valve summary sheets and valve data sheets specifying the site-specific data pertaining to the valves are to be developed by the *Contractor* and submitted to the *Employer* for acceptance.

The process fluid for the valves will be either potable water (supplied by the municipality for the respective site), foam concentrate or a foam premix (a 1% or 3% mixture of foam concentrate and potable water).

Properties of the foam concentrate can be found in the Foam Concentrate Specification, document PL915. The *Contractor* shall review the properties of the foam concentrate when determining the suitability with the equipment.

The importance of correctly tagging the valve is underscored as the *Employer* relies on the *Contractor* to provide the valves as specified on the approved P&IDs and with the correct corresponding tag number. The installation *Contractor* will receive the valves on site and will install the valves after pairing the valve tag number with the valve number indicated on the construction drawings.

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2. DEFINITIONS

The following definitions shall apply when reading this specification;

Term	Definition
^{0}C	Degrees Celsius
ASME	American Society of Mechanical Engineers
ASTM	American Society for Testing & Materials and its successor ASTM International
API	American Petroleum Institute
cP	Centipoise
cSt	Centistoke
DFT	Dry Film Thickness
IA	Intrinsic Approval
ISO	International Standards Organization
kg/m^3	Kilograms per cubic metre
OEM	Original Equipment Manufacturer
SANS	South African National Standards
SOQ	Schedule of Quantities
Contractor	The successful tenderer
Employer	Transnet Pipelines
UV	Ultra-violet

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3. ENGINEERING STANDARDS

Although not bound in nor issued with this document, the following standardized specifications shall form part of the contract document:

3.1 Applicable Standards

ASME B16.5	Pipe Flanges and Flange Fittings
BS EN 1074	Valves for water supply. Fitness for purpose requirements and appropriate verification tests
EN 558	Face to Face Valve Dimensions
EN10204	Metallic products - Types of inspection documents
SANS 10089-1	The Petroleum Industry Part 1: Storage and distribution of petroleum products in above-ground bulk installations
SANS 1700	Fasteners
SANS 1091	National colour standard
SANS 10140-2	Identification Colour Marking Part 2: Identification of Hazards and Equipment in Work.

3.2 Water and Foam Premix Application

ASME 16.1	Gray Iron Pipe Flanges and Flanged Fittings
FM1210	Check Valves for Fire Protection Service
UL312	Check Valves for Fire Protection Service

3.3 Foam Concentrate Application

API 598	Valve Inspection and Testing
API 6D	Specification for Pipeline and Piping Valves

3.4 Referenced standards

PL 915	Foam Concentrate

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4. LOCATION

The *Contractor* shall take cognizance of the following data of the valve location when preparing the offer;

City	*Contractor* to indicate on data sheet.
Depot	Transnet Pipelines – *Contractor* to indicate on data sheet.
Area	*Contractor* to indicate on data sheet.
Hazardous Area Classification (SANS10089 Part 2 and SANS 10108)	*Contractor* to indicate on data sheet.

5. PROCESS FLUID DATA

The *Contractor* shall take cognizance of the following process fluid data for the valve when preparing the offer;

Process Fluid 1	Water
Temperature @ Operating Point	5 - 50 °C
Density @ Operating Point	997 kg/m³ @ 25°C
Viscosity @ Operating Point	0.9 cP at 25°C
Process Fluid 2	Foam Concentrate
Temperature @ Operating Point	5 - 35 °C
Density @ Operating Point	1000 - 1100 kg/m³
Viscosity @ Operating Point	2625 cP at 20°C (Non-Newtonian)
Process Fluid 3	Foam Pre-mix
Temperature @ Operating Point	5 - 50 °C
Density @ Operating Point	997 kg/m³ @ 25°C
Viscosity @ Operating Point	0.9 cP at 25°C

Process fluid data shown to be confirmed by the *Contractor* during the detailed design;

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6. PROCESS DATA

The *Contractor* shall take cognizance of the following process data for the valve when preparing the offer;

Maximum Flow Rate	*Contractor* to indicate on data sheet.
Minimum Flow Rate	*Contractor* to indicate on data sheet.
Maximum pipeline fluid velocity	*Contractor* to indicate on data sheet.
Flow Direction	To be indicated on valve body
Maximum Design Temperature	60°C
Maximum Operating Temperature	50°C
Minimum Operating Temperature	0°C
Design Pressure	16 barg. *Contractor* to indicate on data sheet.
Maximum Upstream Operating Pressure	*Contractor* to indicate on data sheet.
Minimum Upstream Operating Pressure	*Contractor* to indicate on data sheet.
Maximum Downstream Operating Pressure	*Contractor* to indicate on data sheet.
Minimum Downstream Operating Pressure	*Contractor* to indicate on data sheet.
Maximum Valve Differential Pressure	To be the same as the design pressure
Minimum Valve Differential Pressure	To be the differential between the minimum upstream and the minimum downstream pressures. *Contractor* to indicate on data sheet..
Assumed Flow Stoppage Time	1 second (*Contractor* to indicate on data sheet.)

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7. VALVE DESIGN

The *Contractor* shall take cognizance of the following physical properties of each valve when preparing the offer;

7.1 Valve design for Process Fluid 1 – Water and Foam Pre-mix

Valve Design Specifications	API 598, EN 1074
End Connections (Refer to **Error! Reference source not found.**)	Valves ≤ 150NB Flanged type between ANSI Class 150 raised face to ASME B16.5 Valves > 150NB Wafer type between ANSI Class 150 raised face to ASME B16.5
Valve design	Swing check *Contractor* to indicate on data sheet.
FM Approval and/or UL Listing	Not required
Size Range	50NB – 400NB
Fire Safe	Not required
Counter-weight and spring	If required to prevent check valve slam based on assumed flow stoppage time
Special Fasteners	Bolts and nuts other than those used for the flange class shall be supplied with the valve. Metric bolts and nuts shall be used at all times.
Test Pressure	Typically, 1.5 x design pressure.
Liquid Tightness	Yes, to ISO 5208 Rate A.
Maximum permissible reverse velocity	0.15 m/s

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7.2 Valve design for Process Fluid 2 – Foam Concentrate

Valve Design Specifications	API 598, EN 1074
End Connections	50NB ≤ Valves <200NB Flanged type between ANSI Class 150 raised face to ASME B16.5.
Valve Design	Swing check. *Contractor* to indicate on data sheet.
FM Approval and/or UL Listing	Not required
Size Range	50NB- 200NB
Fire Safe	Not required
Counter-weight and spring	If required to prevent check valve slam based on assumed flow stoppage time
Special Fasteners	Bolts and nuts other than those used for the flange class shall be supplied with the valve. Metric bolts and nuts shall be used at all times.
Test Pressure	Typically, 1.5 x design pressure.
Liquid Tightness	Yes, to ISO 5208 Rate A.
Maximum permissible reverse velocity	0.15m/s

Note: During the design review stage and prior to valve design assembly, the *Contractor* shall submit to the *Employer* for acceptance of the dimensioned General Arrangement (GA) drawings of each valve.

8. MATERIALS OF CONSTRUCTION

The *Contractor* shall take cognizance of the following physical properties of each valve when preparing the offer. The *Contractor* shall take note that all wetted internal components of the equipment shall not be made of Zinc, Brass, Bronze, Carbon Steel, or Ductile Iron.

8.1 Wafer Swing Check

Body	Stainless Steel or Ductile Iron. Cast iron is not acceptable.
Plates	Manufacturers recommendations, to be compatible with process fluid – to be compatible with process fluid
Valve trim	Manufacturers recommendations, to be compatible with process fluid – to be compatible with process fluid
Disc	Stainless Steel
Nameplate	Stainless Steel

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8.2 Flanged Swing Check

Body and bonnet	Ductile iron. Cast iron is not acceptable.
Disc	Manufacturers recommendations, to be compatible with process fluid – to be compatible with process fluid
Valve trim	Manufacturers recommendations, to be compatible with process fluid – to be compatible with process fluid
Nameplate	Stainless steel

9. CORROSION PROTECTION

All valves shall be externally and internally protected. The *Contractor* shall refer to the approved P&ID's for each valve when preparing the offer for the corrosion protection system.

Corrosion protection specification for all equipment supplied shall be as per the *Contractor's* recommendation and in accordance with international standards specified for installations in normal industrial non-coastal environments.

Notwithstanding the *Contractors'* recommendation, each ductile iron/carbon steel valve shall be provided with the minimum corrosion protection system as specified in the table below;

External	Minimum 200 microns DFT epoxy or paint coating to colour Signal Red A11 ,preferred If a Bronze body is used, no external corrosion coating is required
Internal	Epoxy or Enamel coating (if in contact with aggressive fluids) – *Contractor* to indicate on data sheet

The preferred colour for all valves shall be manufactured according to standard colour specifications of the SANS 1091 and SANS 10140 – 2 (4.4). The *Contractors* standard red or similar valve colour will be considered subject to approval by the *Employer*. The external corrosion protection of all valves shall be UV resistant, and the colour of the valve shall not fade or degrade over time with exposure to the elements.

Equipment made from Brass, Bronze and stainless steel do not require corrosion protection.

10. QUALITY CONTROL

The valve shall be provided with the following minimum quality control documentation;

Material Certification	Required
EN10204 Type Certificate	Type 3.2 (3rd party validation)
Valve Certification	Indicating compliance with this specification
Valve Data Sheet Approvals	To be prepared by the *Contractor* and submitted to the *Employer* for acceptance prior to procurement of valves
Drawing Approvals	Submission of General Arrangement (GA) drawings to the *Employer* for acceptance during the design stage
Factory Pressure Test Certificate	Required
Site Hydrostatic Pressure Test	Required
Graph of deceleration and reverse velocity	Required

11. DOCUMENTATION

The certificates shall have the valve serial number on them for traceability between documents.

Each valve shall be provided with the following documentation;

At tender stage	• OEM valve data sheet with dimensioned drawing • Applicable design standards • Certificates from authoritative bodies (such as API, ISO9001, UL, FM, etc.) • Response showing the relationship between the deceleration of the liquid column and the maximum reverse velocity through the valve.
Design phase	• Valve data sheets for *Employers* acceptance. • General Arrangement (GA) drawing for *Employers* approval. The GA shall indicate the location of counter-weights, lifting lugs etc. to be reviewed and accepted by the *Employer.* • IA Certificates (if applicable)
Delivery to site	• Design standard certificate. • Certificate of manufacture. • Material certificates. • Factory pressure test certificate. • Installation and maintenance manual. • Spare parts list. • A general arrangement. • Maintenance and operation manuals.

	• Performance data to indicate the hydraulic performance of the valve including the pressure drop at all flow rates (may be graph, chart, or equations). • Reverse velocity versus liquid column deceleration

Material, design standard, Pressure Test and Manufacturing certificates shall be supplied with all valves.

12. GENERAL

The valve selection, supply and delivery shall adhere to the following specific requirements;

13.1 Equipment:

1) The swing check valves shall be of the AVK make or approved equivalent.

2) The direction of flow shall be cast or stamped on the valve body. Riveted tags are not acceptable.

3) The *Contractor* shall review the process conditions on each valve and its respective application and advise the seal type required to ensure zero leakage and that is compatible with the process fluid as identified on the approved P&IDs.

4) The *Contractor* shall submit calculations of the Predicated Check Valve slam for each individual valve and include the results on the datasheets submitted for acceptance to the *Employer*. The assumed liquid stoppage time, the maximum pipeline fluid velocity and the specified maximum permissible reverse velocity to ensure that the check valves do not slam shut shall also be included. The *Contractor* is responsible for demonstrating that for the given conditions that the valves will not slam shut.

5) All valves shall be new and manufactured from all new materials unless otherwise specified in the enquiry.

6) Valves shall:

   - Valves shall be suitable for outdoor use and shall not be adversely affected by rainfall or exposure to sunlight.

   - Valves shall reliably open and close even after extended periods in open or closed position.

7) All valves must be of high quality and suitable for a long service life of occasional use. Valves should provide at least 20 years of service, subject to the *Contractor*s specified maintenance regime.

8) Each valve shall be tagged and permanently attached with a minimum 16-gauge stainless steel plate of minimum dimensions 15mm high by 50 mm long. The tags shall be attached with 16-gauge stainless steel wire to the valve and shall not be attached to the valve handles or in a way that interferes with installation or operation of the valves. Tags shall not be attached through bolt holes. The valve's tag number as specified on the approved P&IDs shall be permanently hammer stamped on the tag. The height of the text on the tag shall be a minimum of 10 mm high.

13.2 Supply:

1) The *Contractor* shall provide installation instructions detailing the labor, equipment and any special procedures, tools, equipment or personnel required for the installation.

2) The *Contractor* shall include the provision of all specialist tools, equipment and services necessary for the installation and / or maintenance of the valves.

3) The material of construction for all valve parts shall be specified on the equipment drawings or on the approved P&IDs. Submission of this information does not in any way negate the *Contractor's* responsibility to ensure that the specified materials are suitable for the service required by this or any other documents pertaining to the enquiry.

4) The *Contractor* is to provide full operating and maintenance and overhaul manuals including detailed section and exploded diagrams of the valves, parts lists, typical spares lists and pricing.

5) The *Contractor* is to provide drawings indicating all relevant dimensions affecting the installation including space required to perform maintenance; this information is to be clearly indicated for all required valve sizes.

6) The *Contractor* shall provide a copy of all manufacturers coating specifications relevant to the products specified.

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13.3 Storage:

Storage of the valves shall be:

- Undercover
- On dunnage, made of inert material, at least 150mm above ground level
- All openings shall be sealed

The valves shall be stored in an area away from regular vehicle movements and contamination by incompatible materials (e.g. carbon steel and stainless steel).

13.4 Delivery:

1) Prior to delivery, the *Contractor* shall invite the *Employer* to the OEMs premises for an inspection of the valves to ensure conformance to this specification. The *Contractor* shall only deliver the equipment to site once a release certificate for each item of equipment shown on the datasheet issued.

2) The valves shall be loaded and transported on suitable transport arranged by the *Contractor*. All items shall be secured on the transport vehicle to avoid damage to the valves and their coatings. Valves shall not be allowed to rest directly against each other.

3) All stainless-steel valves are to be kept free of contamination by incompatible materials such as carbon steel grindings, etc. Should valves become contaminated, the *Contractor* shall clean the valves at his own expense. If this is unsuccessful, the *Contractor* shall replace the valves at his own expense.

4) Valves shall be supplied with plastic end caps on both ends.

5) Valves shall be supplied in sealed wooden containers with plastic linings. A plastic lining shall be wrapped around each individual item. Flange faces and mating surfaces shall be protected during transport and handling.

6) Valves shall be separated so as not to bear against each other and shall be firmly secured by suitable padded lashings to prevent movement and damage in transit. The valves shall not be dropped, bumped or subjected to shock or rough handling and any valve damaged during transport or handling may be rejected by the *Employer*.

7) The *Contractor* shall make allowance for and comply with all the *Employers* Health Safety Security and Environmental (HSSE) requirements at the delivery point.

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8) The *Contractor* shall allow for off-loading to a location on site as directed by the *Employers* representative. An off-loading method statement in compliance with the *Employers* HSE policy shall be supplied for approval prior to delivery.

13. INSTALLATION AND COMMISSIONING REQUIREMENTS

The *Contractor* shall allow for the following as a minimum for the supply, installation and commissioning of the valves:

1) All valves shall be supplied complete and ready for installation including any special fittings or fixtures required i.e. extended studs for wafer installation of long valve.

2) All valves shall undergo an on-site in-situ hydro-static test at 1.5 x the design pressure during hydro-static testing of the piping system. The valves will not be removed during testing of the piping system.

3) The *Employer* shall be advised of all Factory testing and allowed the opportunity to observe Factory Acceptance Tests if required by the *Employer*.

14. DOCUMENTATION SUPPLY

Documents to be supplied upon award of the supply contract shall include:

1) Installation, operation, and maintenance manual
2) Spare parts list
3) IA certificate as required by SANS 10108 (if applicable)
4) Reverse velocity versus liquid column deceleration
5) Valve data sheets for *Employers* acceptance
6) 3D model for integration into the plant model
7) A general arrangement.
8) Equipment design and construction information for each piece of equipment (sales documents)
9) Approval documents (and indication of equivalency if required in section 1)
10) Performance data to indicate the hydraulic performance of the valve including the pressure drop at all flow rates (maybe graph, chart or equations)

FIRE SYSTEM SPECIFICATION

BACK FLOW PREVENTER

Document number	PL 907
Version number	4
Classification	Unclassified
Effective date	1 December 2025
Review date	1 July 2028

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SUMMARY VERSION CONTROL

VERSION NO.	NATURE OF AMENDMENT	PAGE NO.	DATE REVISED
0	New Specification	ALL	1 July 2025
1	Comments during review between TPL and GreyJones included	ALL	11 July 2025
2	Comments and review from TPL	ALL	27 August 2025
3	Removal of reference for *Contractor* to submit information for valve integration for inclusion into *Employers* design.	ALL	23 September 2025
4	Insultation specification added	ALL	18 December 2025

Note: Only latest amendments and/or additions are reflected in italics in the body of the document.

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DOCUMENTATION SIGN-OFF SHEET

I, the undersigned hereby approve this procedure.

ROLE	CAPACITY/ FUNCTION	SIGNATURE	DATE
Compiled by:	**Pieter Jacobs**		
Approved by:	**Papa Moratwe**		

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14 Documentation Supply 15

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TECHNICAL SPECIFICATION – BACK FLOW PREVENTER

1 INTRODUCTION

This specification covers the design, fabrication, manufacture, procurement, supply, delivery to site and handover documentation of the back flow preventer valves to be used as a positive isolation mechanism between the new Transnet Pipelines fire protection systems and the municipal potable water supply system. However, the application of this valve in the designed system is only applicable to depots with a municipal supply line size of 100NB and below.

Where the terms 'valve' and 'equipment' are used in this specification, they shall be interpreted to mean Plant and Materials as defined in NEC3 Clause 11.2(12).

This specification is not site specific but has been prepared as a generic project specification. Site specific valve summary sheets and valve data sheets specifying the site-specific data pertaining to the valves are to be developed by the *Contractor* and submitted to the *Employer* for acceptance.

The process fluid for the valves will be potable water (supplied by the municipality for the respective site).

The importance of correctly tagging the valve is underscored as the *Employer* relies on the *Contractor* to provide the valves as specified on the data sheet and with the correct corresponding tag number. The installation *Contractor* will receive the valves on site and will install the valves after pairing the valve tag number with the valve number indicated on the construction drawings.

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2 DEFINITIONS

The following definitions shall apply when reading this specification;

Term	Definition
^{0}C	Degrees Celsius
ASME	American Society of Mechanical Engineers
ASTM	American Society for Testing & Materials and its successor ASTM International
API	American Petroleum Institute
cP	Centipoise
DFT	Dry Film Thickness
EN	European Norm
IA	Intrinsic Approval
ISO	International Standards Organisation
kg/m^3	Kilograms per cubic metre
OEM	Original Equipment Manufacturer
SANS	South African National Standards
SOQ	Schedule of Quantities
Contractor	The successful tenderer
Employer	Transnet Pipelines
UV	Ultra-violet

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3 ENGINEERING STANDARDS

Although not bound in nor issued with this document, the following standardised specifications shall form part of the contract document:

ASME B16.5	Pipe Flanges and Flange Fittings
EN 1092	Flanges and their Joints – Circular Flanges for Pipes, Valves, Fittings and Accessories, PN Designated
EN 1717	Protection against pollution of potable water in water installations and general requirements of devices to prevent pollution by backflow
EN 12729	Devices to prevent pollution by backflow of potable water – Controllable backflow preventer with reduced pressure zone – Family B – Type A
FM 1041	Backflow Preventers for Fire Protection Systems
SANS 10089-1	The Petroleum Industry Part 1: Storage and distribution of petroleum products in above-ground bulk installations
SANS 10108	The classification of hazardous locations and the selection of apparatus for use in such locations
SANS 1700	Fasteners
SANS 1091	National colour standard
SANS 10140-2	Identification Colour Marking Part 2: Identification of Hazards and Equipment in Work.
UL1469	Standard for Strength of Body and Hydraulic Pressure-Loss Testing of Backflow Special Check Valves

4 LOCATION

The *Contractor* shall take cognizance of the following data of the valve location when preparing the offer;

City	*Contractor* to indicate on data sheet
Depot	Transnet Pipelines – *Contractor* to indicate on data sheet
Area	*Contractor* to indicate on data sheet
Hazardous Area Classification (SANS10089 Part 2 and SANS 10108)	*Contractor* to indicate on data sheet

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5 PROCESS FLUID DATA

The *Contractor* shall take cognizance of the following process fluid data for the valve when preparing the offer;

Process Fluid 1	Water
Temperature @ Operating Point	5 – 50 °C
Density @ Operating Point	997 kg/m³ @ 25°C
Viscosity @ Operating Point	0.9 cP at 25°C

Process fluid data shown to be confirmed by the *Contractor* during the detailed design;

6 PROCESS DATA

The *Contractor* shall take cognizance of the following process data for the valve when preparing the offer;

Maximum Flow Rate	*Contractor* to indicate on data sheet
Minimum Flow Rate	*Contractor* to indicate on data sheet
Maximum pipeline fluid velocity	*Contractor* to indicate on data sheet
Flow Direction	To be indicated on valve body
Maximum Design Temperature	60°C
Maximum Operating Temperature	50°C
Minimum Operating Temperature	0°C
Design Pressure	*Contractor* to indicate on data sheet
Maximum Upstream Operating Pressure	*Contractor* to indicate on data sheet
Minimum Upstream Operating Pressure	*Contractor* to indicate on data sheet
Maximum Downstream Operating Pressure	*Contractor* to indicate on data sheet
Minimum Downstream Operating Pressure	*Contractor* to indicate on data sheet
Maximum Valve Differential Pressure	To be the same as the design pressure
Minimum Valve Differential Pressure	To be the differential between the minimum upstream and the minimum downstream pressures. *Contractor* to indicate on data sheet
Assumed Flow Stoppage Time	0.5 second (*Contractor* to indicate on data sheet)

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7 VALVE DESIGN

The *Contractor* shall take cognizance of the following physical properties of each valve materials when preparing the offer;

Valve Design Specifications	EN 1717, EN 12729
Include upstream and downstream isolation Valves	No
Include Upstream Strainer	The supply of an upstream strainer shall be included with the back flow preventer as an assembly if a strainer is required by the back flow preventer OEM as part of the installation
End Connections	ANSI Class 150 raised face to ASME B16.5 PN 16 to EN 1092-1 Refer valve data sheet
Valve Body	Flanged
FM Approval and/or UL Listing	Not required
Size Range	50NB – 300NB. Refer valve data sheet.
Special Fasteners	Bolts and nuts other than those used for the flange class shall be supplied with the valve. Metric bolts and nuts shall be used at all times.
Test Pressure	Manufacturers standard.
Liquid Tightness	Yes to ISO 5208 Rate A.
Maximum permissible reverse velocity	0.15 m/s

Note: During the design stage and prior to design assembly, the *Contractor* shall submit to the *Employer* for acceptance the dimensioned General Arrangement (GA) drawings of each valve.

8 MATERIALS OF CONSTRUCTION

The *Contractor* shall take cognizance of the following physical properties of each valve when preparing the offer;

Body and Cover	Ductile iron or brass. Cast iron is not acceptable.
Membrane	EPDM
Disc	EPDM
Seals	EPDM
Valve trim	Stainless steel
Nameplate	Stainless steel

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9 CORROSION PROTECTION

All valves shall be externally and internally protected. The *Contractor* shall refer to the approved P&ID's for each valve when preparing the offer for the corrosion protection system. Corrosion protection specification for all equipment supplied shall be as per the *Contractor's* recommendation and in accordance with international standards specified for installations in normal industrial non-coastal environments.

Notwithstanding the *Contractors'* recommendation, each ductile iron/carbon steel valve shall be provided with the minimum corrosion protection system as specified in the table below;

External	Minimum 200 microns DFT epoxy or paint coating to colour Signal Red A11 ,preferred If a Bronze body is used, no external corrosion coating is required
Internal	Epoxy or Enamel coating (if in contact with aggressive fluids) – *Contractor* to indicate on data sheet

The preferred colour for all valves shall be manufactured according to standard colour specifications of the SANS 1091 and SANS 10140 – 2 (4.4). The *Contractors* standard red or similar valve colour will be considered subject to approval by the *Employer*. The external corrosion protection of all valves shall be UV resistant, and the colour of the valve shall not fade or degrade over time with exposure to the elements.

Equipment made from Brass, Bronze and stainless steel do not require corrosion protection.

10 QUALITY CONTROL

The valve shall be provided with the following minimum quality control documentation;

Material Certification	Required
EN10204 Type Certificate	Type 3.1
Valve Certification	Indicating compliance with this specification
Valve Data Sheet Approvals	To be prepared by the *Contractor* and submitted to the *Employer* for acceptance prior to procurement of valves
Drawing Approvals	Submission of General Arrangement (GA) drawings to the *Employer* for acceptance during the design stage
Factory Pressure Test Certificate	Required
Site Hydrostatic Pressure Test	Required
Graph of deceleration and reverse velocity	Required

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11 DOCUMENTATION

The certificates shall have the valve serial number on them for traceability between documents.

Each valve shall be provided with the following documentation;

At tender stage	• OEM valve data sheet with dimensioned drawing • Applicable design standards • Certificates from authoritative bodies (such as API, ISO9001, UL, FM, etc.) • Response showing the relationship between the deceleration of the liquid column and the maximum reverse velocity through the valve
Design phase	• Valve data sheets for *Employers* acceptance. • General Arrangement (GA) drawing for *Employers* approval. The GA shall be reviewed and accepted by the *Employer.* • IA Certificates (if applicable)
Delivery to site	• Design standard certificate. • Certificate of manufacture. • Material certificates. • Factory pressure test certificate. • Installation and maintenance manual. • Spare parts list. • A general arrangement. • Maintenance and operation manuals. • Performance data to indicate the hydraulic performance of the valve including the pressure drop at all flow rates (may be graph, chart or equations). • Reverse velocity versus liquid column deceleration

Material, design standard, Pressure Test and Manufacturing certificates shall be supplied with all valves.

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12 GENERAL

The valve selection, supply and delivery shall adhere to the following specific requirements;

12.1 Equipment:

1) Valves that are 100 NB and smaller shall be of the Caleffi or approved equivalent. Valves that are greater than 100NB in size shall be of the Bermad type.

2) The direction of flow shall be cast or stamped on the valve body. Riveted tags are not acceptable.

3) The *Contractor* shall submit calculations of the Predicated Check Valve slam for each individual valve and include the results on the datasheets submitted for acceptance to the *Employer.* The assumed liquid stoppage time, the maximum pipeline fluid velocity and the specified maximum permissible reverse velocity to ensure that the check valves do not slam shut shall also be included. The *Contractor* is responsible for demonstrating that for the given conditions that the valves will not slam shut.

4) The body of the back flow preventer valve is required to be insulated to protect the relief valve assembly from damage. The relief valve assembly containing process fluid subjected to ambient conditions require insulation to prevent the fluid from dropping below 4°C.

5) All valves shall be new and manufactured from all new materials unless otherwise specified in the enquiry.

6) Valves shall:

   - Valves shall be suitable for outdoor use and shall not be adversely affected by rainfall or exposure to sunlight.
   - Valves shall reliably open and close even after extended periods in open or closed position.

7) All valves must be of high quality and suitable for a long service life of occasional use. Valves should provide at least 20 years of service, subject to the *Contractors'* specified maintenance regime.

8) Each valve shall be tagged and permanently attached with a minimum 16-gauge stainless steel plate of minimum dimensions 15mm high by 50 mm long. The tags shall be attached with 16-gauge stainless steel wire to the valve and shall not be attached to the valve handles or in a way that interferes with installation or operation of the valves. Tags shall not be attached through bolt holes. The valve tag number as specified on the data sheet, shall be permanently hammer stamped on the tag. The height of the text on the tag shall be a minimum of 10 mm high.

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12.2 Supply:

1) The *Contractor* shall provide installation instructions detailing the labor, equipment and any special procedures, tools, equipment or personnel required for the installation.

2) The *Contractor* shall include the provision of all specialist tools, equipment and services necessary for the installation and / or maintenance of the valves.

3) The material of manufacture of all parts shall be specified on the equipment drawings or data sheets. Submission of this information does not in any way negate the Contractor's responsibility to ensure that the specified materials are suitable for the service required by this or any other documents pertaining to the enquiry.

4) The *Contractor* is to provide full operating and maintenance and overhaul manuals including detailed section and exploded diagrams of the valves, parts lists, typical spares lists and pricing.

5) The *Contractor* is to provide drawings indicating all relevant dimensions affecting the installation including space required to perform maintenance; this information is to be clearly indicated for all required valve sizes.

6) The *Contractor* shall provide a copy of all manufacturers coating specifications relevant to the products specified.

12.3 Storage:

Storage of the valves shall be:

- Undercover
- On dunnage, made of inert material, at least 150mm above ground level
- All openings shall be sealed

The valves shall be stored in an area away from regular vehicle movements and contamination by incompatible materials (e.g. carbon steel and stainless steel).

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12.4 Delivery:

1) Prior to delivery, the *Contractor* shall invite the *Employer* to the OEM's premises for an inspection of the valves to ensure conformance to this specification. The *Contractor* shall only deliver the equipment to site once a release certificate for each item of equipment shown on the datasheet issued.

2) The valves shall be loaded and transported on suitable transport arranged by the Contractor. All items shall be secured on the transport vehicle to avoid damage to the valves and their coatings. Valves shall not be allowed to rest directly against each other.

3) All stainless-steel valves are to be kept free of contamination by incompatible materials such as carbon steel grindings, etc. Should valves become contaminated, the *Contractor* shall clean the valves at his own expense. If this is unsuccessful, the *Contractor* shall replace the valves at his own expense.

4) Valves shall be supplied with plastic end caps on both ends.

5) Valves shall be supplied in sealed wooden containers with plastic linings. A plastic lining shall be wrapped around each individual item. Flange faces and mating surfaces shall be protected during transport and handling.

6) Valves shall be separated so as not to bear against each other and shall be firmly secured by suitable padded lashings to prevent movement and damage in transit. The valves shall not be dropped, bumped or subjected to shock or rough handling and any valve damaged during transport or handling may be rejected by the *Employer*.

7) The *Contractor* shall make allowance for and comply with all the *Employers* Health Safety Security and Environmental (HSSE) requirements at the delivery point.

8) The *Contractor* shall allow for off-loading to a location on site as directed by the *Employers* representative. An off-loading method statement in compliance with the *Employers* HSE policy shall be supplied for approval prior to delivery.

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13 INSTALLATION AND COMMISSIONING REQUIREMENTS

The *Contractor* shall allow for the following as a minimum for the supply, installation and commissioning of the valves:

1) All valves shall be supplied complete and ready for installation including any special fittings or fixtures required i.e. extended studs for wafer installation of long valve.

2) All valves shall undergo an on-site in-situ hydro-static test at 1.5 x the design pressure during hydro-static testing of the piping system. The valves will not be removed during testing of the piping system.

3) The *Employer* shall be advised of all Factory testing and allowed the opportunity to observe Factory Acceptance Tests if required by the *Employer*.

14 DOCUMENTATION SUPPLY

Documents to be supplied upon award of the supply contract shall include:

1) Installation, operation and maintenance manual

2) Spare parts list

3) IA certificate as required by SANS 10108 (if applicable)

4) Reverse velocity versus liquid column deceleration

5) 3D model for integration into the plant model

6) A general arrangement.

7) Equipment design and construction information for each piece of equipment (sales documents)

8) Approval documents (and indication of equivalency if required in section 10 and 11)

9) Performance data to indicate the hydraulic performance of the valve including the pressure drop at all flow rates (may be graph, chart or equations)

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FIRE SYSTEM SPECIFICATION

JOCKEY PUMP-SET AND ASSOCIATED EQUIPMENT SPECIFICATION

Document number	PL 908
Version number	1
Classification	Unclassified
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Review date	1 July 2028

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SUMMARY VERSION CONTROL

VERSION NO.	NATURE OF AMENDMENT	PAGE NO.	DATE REVISED
0	New Specification	ALL	1 July 2025
1	Comments during review between TPL and GreyJones included	ALL	23 July 2025

Note: Only latest amendments and/or additions are reflected in italics in the body of the document.

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DOCUMENTATION SIGN-OFF SHEET

I, the undersigned hereby approve this procedure.

ROLE	CAPACITY/ FUNCTION	SIGNATURE	DATE
Compiled by:	**Pieter Jacobs**		
Approved by:	**Papa Moratwe**		

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TECHNICAL SPECIFICATION – JOCKEY PUMP-SET AND ASSOCIATED EQUIPMENT SPECIFICATION

1 INTRODUCTION

The firefighting system at the depot will consist of two main booster fire pump-sets that each comprise of a water pump and a foam concentrate pump driven by a diesel engine. The main fire pump-sets will be used to deliver the required flow rates at the required design pressures. Details of the main fire pump-sets are in the Fire Pump Specification, document PL 901.

Where the terms 'Pump-set' and 'Equipment' are used in this specification, they shall be interpreted to mean Plant and Materials as defined in NEC3 Clause 11.2(12).

In addition to the fire pump-sets, the system will include a jockey pump-set and associated equipment that will maintain the system pressure at a pre-determined set-point.

The jockey pump-set and associated equipment will comprise of a Jockey Pump Control Panel (JPCP), an electric motor, a water pump and an instrument stand mounted with a pressure gauge and a pressure switch.

The JPCP will interface with the electric motor of the jockey pump, the pressure switch and the Fire Control Panel (FCP). Details of the FCP are in the Control System Specification, document PL 913. The JPCP will not interface with the Engine Control Panel (ECP) of the fire pump-sets.

This specification details the requirements for the supply of the jockey pump-set and associated equipment and the interface with the FCP only.

2 OVERVIEW OF SPECIFICATION

The *Contractor* is responsible for the design, procurement, supply, fabrication, assembly, pre-delivery testing, delivery to site, installation, final assembly, on-site testing, quality assurance (QA) documentation and commissioning of one jockey pump-set and associated equipment in accordance with this specification and to the satisfaction of the *Employer* or his designated representative(s).

The total number of pump-sets called for under this specification is one.

This specification is divided into several sections that provide individual specifications of each of the major equipment components i.e. the primary driver, the water pump and the Jockey Pump Control Panel. A separate section is also provided that provides the specifications and performance testing criteria for the pump-set as a complete unit.

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3 BATTERY LIMITS

The battery limits of this specification are outlined below.

- The jockey pump suction and discharge flanges
- The battery limit for the instrumentation scope called for under this specification shall be within the Jocky Pump Control Panel (JPCP) that will include the output and input signals that exist between the Fire Control Panel (FCP) and the JPCP.

4 DEFINITIONS

Where acronyms and/or the below terms are used in this specification, the following definitions shall apply;

Term	Definition
AC	Alternating Current
AFC	Approved for Construction
ANSI	American National Standards Institute
BOQ	Bill of Quantities
CAD	Computer Aided Design
CD	Compact Disc
DB	Distribution Board
DOL	Direct Online
DWG	Drawings
ECP..	Engine Control Panel
EHDP	Equipment Handover and Document Procedure
FAT	Factory Acceptance Test
FCP	Fire Control Panel
GA	General Arrangement
hr	Hour
HSSE	Health, Safety, Security and Environmental Plan
IP	Ingress Protection
ISO	International Standards Organisation
JPCP	Jockey Pump Control Panel
kPa	Kilopascal
kW	Kilowatt

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Term	Definition
L/min	Litres per minute
m^3	Cubic metres
MCC	Motor Control Centre
MSL	Mean Sea Level
MWT	Medium Wall Thickness
NFPA	National Fire Protection Association
NPSH	Net Positive Suction Head
O&M	Operating and Maintenance Manual
OEM	Original Equipment Manufacturer
PDF	Portable Document Format
QA	Quality Assurance
RF	Raised Face
RFSO	Raised Face Slip-on
RPM	Revolutions Per Minute
SABS	South Africa Bureau of Standards
SANS	South African National Standards
SLD	Single Line Diagram
STD	Standard
TPL	The *Employer*
UL	Underwriters Laboratory
Employer	The *Employer* is the *Employer* as defined in the *Contract Data*
Contractor	The *Contractor* is the *Contractor* as defined in the *Contract Data* or the *Contractors* sub-contractor

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5 APPLICABLE STANDARDS AND SPECIFICATIONS

Although not bound in nor issued with this document, the following standardised specifications as amended shall form part of this specification;

5.1 Engineering Standards:

ASME Section IX Boiler and Pressure Vessel Code	Qualification Standard for Welding and Brazing Procedures, Welders, Brazers, and Welding and Brazing Operators
BS EN 12756	Mechanical seals. Principal dimensions, designation and material codes
ISO 1940-1	Mechanical Vibration – Balance Quality Requirements for Rotors in a Constant (Rigid) State – Part 1: Specifications and Verification of Balance Tolerances
ISO 9001	Quality Management
ISO 9906	Rotodynamic Pumps – Hydraulic Performance Acceptance Tests – Grades 1, 2 and 3
SANS 455	Covered Electrodes for the Manual Arc Welding of Carbon and Carbon Manganese Steels
SANS 121	Hot Dip Galvanised Coatings on Fabricated Iron and Steel Articles – Specifications and Test Methods
SANS12944	Paints and varnishes — Corrosion protection of steel structures by protective paint systems
SANS 50025	Hot Rolled Products of Structural Steel
OSHAct 85 of 1993	Occupational Health and Safety Act.
SABS 086-1	Installation, inspection and maintenance of equipment used in explosive atmospheres
SABS 0142	The Wiring of Premises
SANS 9906 - 2016	Rotodynamic Pumps – Hydraulic Performance Tests – Grades 1,2 and 3

5.2 Client Standards

PL100 - Rev 05	Transnet Pipelines Drawing Office Standard (PL100)
PL101 - Rev 06	Drawing Office Standard (PL101)
PL102 - Rev 03	Transnet Pipelines Drawing Office Standard (PL102)
PL103 - Rev 06	Transnet Pipelines Drawing Office Standard (PL103)
PL631 – Rev 08	Transnet Pipelines Specification for Low Voltage Switchgear and Distribution Boards
PL666 – Rev 01	Transnet Pipelines Electrical Design Criteria

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PL711 – Rev 10	Transnet Pipelines Specification for Equipment Cabinets to House Electronic Equipment
PL727 – Rev 011	Transnet Pipelines Cabling, Racking, Trenching and Earthing Installation Codes of Practice
PL909	Pressure Gauge Specification
PL 913	Control System Specification
PL 917	Equipment Handover and Document Procedure
TPL-TECH-DO-WI-001- Rev 0	Transnet Pipelines Handover of As-built and Other Documents from Technical Projects to Drawing Office Work Instruction

6 LOCATION

The *Contractor* shall take cognizance of the following data of the valve location when preparing the offer;

City	*Contractor* to indicate on data sheet
Depot	Transnet Pipelines – *Contractor* to indicate on data sheet for depot
Area	*Contractor* to indicate on data sheet

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7 GENERAL

The *Contractor* shall take cognisance of the following information during the pricing and execution of the scope of *work*, and the *Contractor* shall make provision for costs associated with meeting all the requirements of this specification, whether implicitly or explicitly implied.

7.1 Equipment Numbering

The *Contractor* shall provide one pump-set and associated equipment that meets or exceed the minimum requirements of this specification.

The pumps shall be labelled in accordance with the *Employers* site location depot number in conjunction with the approved P&ID's as follows;

Jockey Pump-set: XX-P183

The JPCP shall be labelled in accordance with this specification as follows;

Jockey Pump-set: XX-P183-C-1

The instrumentation located on the instrument stand shall be labelled in accordance with this specification as follows;

Pressure Indicator: XX-PI183C

Pressure Switch: XX-PS183

Where the XX represents the *Employers* depot number.

7.2 Baseplate

The jockey pump-set comprising of the electric motor and water pump shall be mounted and secured to a baseplate using SANS 1700 A4-70 stainless steel fasteners.

The JPCP will not be mounted on the baseplate but will be mounted off an adjacent wall or structural steel column.

The baseplate shall be fabricated from mild steel to SANS 50025 with no bolt on sections.

The baseplate will be fixed to a concrete plinth using chemical anchors that are sized, supplied and installed by the *Contractor*.

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All welding shall be fully continuous fillet with a minimum weld size of 6mm. All welding shall be in accordance with the American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code Section IX, and welding electrodes shall be to SANS 455:2005.

All welding on the baseplate shall be done in accordance with an approved Weld Procedure Specification (WPS) and the procedure shall be qualified by a Procedure Qualification Record (PQR). All welders shall be qualified for the weld procedure. Copies of the WPS, PQR and welder performance qualifications (WPQ's) shall be included in the project quality assurance (QA) file.

The baseplate shall be hot-dipped galvanized to SANS 121. No fabrication or modification to the structural steel and the baseplate shall take place once galvanized.

Defects that arise due to damage to the baseplate shall be prepared in accordance with the following procedure;

- Zincfix two pack, solvent free, zinc rich amine cured epoxy coating or similar approved shall be used.
- All surfaces to be coated shall be dry, clean and free from contamination.
- The surface shall be mechanically abraded using grinding or flapper discs to achieve a 40-50 micron blast profile as an alternative to achieving this profile using abrasive blast cleaning.
- Surfaces shall be abraded by a minimum radius of 25mm around the defect using 180 grit abrasive water paper and water as a lubricant. The defect shall be exposed to bare metal, but the size should be kept as small as possible.
- Immediately after abrasion, the surface shall be wiped clean, and the premixed repair material shall be applied within the abraded area. The repair 'patch' shall not overlap the un-abraded galvanising.

The *Contractor* shall submit drawings of the baseplate to the *Employer* for review and comment prior to fabrication.

Each baseplate shall be provided with an easily accessible earth lug. The earth lug shall be welded to the baseplate, and the lug material shall be austenitic stainless steel and shall not be painted. The lug shall be minimum 6mm thick, 50mm long by 50mm wide with radiused corners and shall have a 15mm diameter threaded hole drilled in the centre of the lug.

The baseplate shall be designed to prevent the accumulation and pooling of liquids.

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7.3 Site location

City	*Contractor* to indicate on data sheet.
Depot	The *Employer* – *Contractor* to indicate on data sheet.
Area	*Contractor* to indicate on data sheet.
Hazardous Area Classification (SANS10089 Part 2 and SANS 10108)	*Contractor* to indicate on data sheet.

7.4 Corrosive Environment

In accordance with SANS 12944, the corrosivity category for the pump-sets is described using the atmospheric-corrosivity categories. Six categories used to classify the environment is given in the table below. The *Contractor* shall indicate on the data sheet the corrosivity category that will be complied with when submitting to the *Employer* for acceptance.

All sites shall be generally classified as C2 except for sites that are within 20 km of the coast that shall be classified as C5-M, and the Witbank site that shall be classified as C5-I.

Category of corrosivity	**Exterior**	**Interior**
C1 Very low		Buildings with heating and clean atmospheres.
C2 Low	Atmospheres with low levels of contamination. Rural areas.	Unheated buildings with possible condensation.
C3 Medium	Urban and industrial atmospheres, with moderate SO2 contamination. Coastal areas with low salinity.	Manufacturing plants with high humidity and some contamination.
C4 High	Industrial areas and coastal areas with moderate salinity.	Chemical industries, swimming pools.
C5-I Very high (industrial)	Industrial areas with high humidity and with an aggressive atmosphere.	Buildings or areas with almost permanent condensation and high levels of contamination.
C5-M Very high (marine)	Coastal and marine areas with high salinity.	Buildings or areas with permanent condensation and high levels of contamination.

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7.5 Access to the site

The *Contractor* shall familiarise themselves with the physical, administrative and logistical site access constraints prior to submission of the tender and all costs associated with overcoming these constraints shall be deemed to be included in the offer.

7.6 Delivery of Equipment to Site and Installation

The *Contractor* shall make provision in their offer for the delivery, offloading to a safe location on site as required and approved by the *Employer*, and installation into the final position of all equipment called for under this specification.

The *Contractor* shall take cognisance of the fact that there is no space available on site to temporarily store the equipment called for under this specification. It is the responsibility of the *Contractor* to arrange a temporary storage location in the event the equipment cannot be delivered to site after release from the OEM's premises. The temporary storage location arranged by the *Contractor* must be approved by the *Employer* and would require the *Employer* to be present at the location of both delivery and temporary storage. The costs incurred for storage and insurances shall be covered by the *Contractor*.

The *Contractor* shall make provision for safe storage and insurances for the pump-sets at the OEM or *Contractor*s facilities from the issue date of the Shop Release Certificate (SRC) that is issued by the *Employer* to the *Contractor* before it is delivered to site. During storage of the pump-set at the *Contractors* facilities, the pump-set shall be housed within a weatherproof enclosure and shall be protected against damage.

The SRC will only be issued by the *Employer* to the *Contractor* upon deemed completion of all Factory Acceptance Test (FAT) punch items. The *Employer* shall determine when punch items are deemed complete.

The delivery address of all equipment shall be the site address as contained within the Works Information.

The *Contractor* shall make provision for all Plant, Equipment, Insurances, Personnel, Materials and Costs required to load at the OEM's facilities, transport to site, offload at the destination, handle, and install into final position all equipment called for under this specification.

Upon final installation of the equipment, The *Employer* will then be invited by the *Contractor* to inspect the installation to ensure that the final installation meets with the *Employers* requirement.

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7.7 Health, Safety, Security and Environmental

The *Contractor* shall make provision for compliance with the *Employer's* Health, Safety, Security and Environmental (HSSE) requirements whilst working on the site.

7.8 Language

All documentation and correspondence communicated under this specification shall be in the English language.

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8 ELECTRIC MOTOR

The primary driver for the jockey pump is an electric induction motor. The motor will draw power from the JPCP and shall be started and stopped by the JPCP.

8.1 Type of Motor

Motors manufactured to this specification shall comply with the applicable parts of SABS IEC 60034 as amended and be in accordance with the requirements of the *Employers* specification PL666 Rev 001.

The induction motor shall be in accordance with the following;

Voltage	400V
Phase	3 Phase
Frequency	50Hz
Enclosure Type	IP 66 (pump house will be fitted with sprinklers)
Earthing	Solidly earth system
Temperature Class	T3
Gas Group	1
Zone	1
kW Rating	*Contractor* to specify
Speed	*Contractor* to specify

8.2 Intermittent Operation

The motor shall be designed for intermittent starts and shall be designed for 10 start attempts per hour with a minimum run time between starts of 67 seconds.

Start attempts and continuous running of the motor will be monitored by the FCP.

Start attempts that exceed 10 per hour and continuous running that exceeds 5 minutes will activate an alarm within the FCP. Provision for monitoring and an alarm by the JPCP is not required. The alarm and monitoring system is included here for information only.

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8.3 Nameplate

The motor supplier shall provide a nameplate made of grade 316 stainless steel, securely fixed to the motor in a prominent position with the following information embossed onto the nameplate in 5mm high Arial font text:

- Make or Manufacturer
- Model
- Type
- Serial Number
- kW Rating
- Rotational Speed (RPM)
- Max Torque (Nm) at the stated rotational speed
- Date of Manufacture

The information on the nameplate shall not be engraved.

9 WATER PUMP

9.1 Type of Driver

The details of the fire water pump driver are specified in Section 8.

9.2 Type of Pump

The jockey water pump called for under this specification is a non-self-priming vertical multistage pump coupled to an electric motor with the pump designed to the manufacturers standard in accordance with an ISO 9001 quality management system.

The suction inlet and the discharge outlet shall be in the horizontal plane, and the discharge shall be mounted directly above the suction and on the same side.

Preference will be given to pumps manufactured by SPP, Grundfos and KSB. Alternatives will be considered but are subject to approval by the *Employer*.

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9.3 Balance Tolerances

The pump shaft and impeller shall be dynamically balanced to ISO 1940-1 with balance quality grade G6.3 and shall be supplied with a balancing certificate.

The permissible residual specific unbalance based on the specified quality grade and service speed shall be in accordance with the 'white area' of Figure 2 of ISO 1940-1.

9.4 Materials of Construction

The design life of the pump shall be 20 years.

The materials of construction of the pump shall be designed and selected to operate for a minimum of 70000 continuous hours with intermittent starts throughout the design life expectancy.

Jockey Pump Materials of Construction	
Part	Material
Pump Body	Cast Iron
Impeller	Stainless Steel AISI 304
Diffuser	Stainless Steel AISI 304
Casing	Stainless Steel AISI 316
Shaft	Stainless Steel AISI 316
Seal Plate	Stainless Steel AISI 316
Mechanical Seal	Manufacturers Standard
Elastomers	Viton
Coupling Guard	Stainless Steel AISI 304
Fill/Drain Plugs	Stainless Steel AISI 316
Tie Rods	Zinc Plated Carbon Steel
Seal Gland	Stainless Steel AISI 316

9.5 Direction of Rotation

The direction of pump rotation shall be to the manufacturers standard.

The direction of pump rotation shall be indicated on a stainless steel plate that is permanently secured to the casing of the pump.

The directional arrow shall be embossed onto the plate and shall not be engraved or etched.

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9.6 End Connections

The pipeline suction size will be a 50 NB, and the pipeline discharge size will be a 50 NB.

To accommodate discrepancies in pipeline suction sizes and pump flange sizes, reducers will be installed. Pump suction and discharge flanges that are larger than the corresponding pipeline size as specified herein will not be accepted.

The preferred pump flange connections are ANSI Class 150 RF.

The inlet and outlet of the pump end connections shall be indicated on a stainless steel plate that is permanently secured to the pump casing.

The text ‘INLET’ or ‘OUTLET’ shall be embossed onto the plate with a minimum text height of 5mm in Arial font and shall not be engraved or etched.

9.7 Process Fluid Characteristics

The process fluid will be potable water at standard temperature.

The following fluid characteristics were used in the hydraulic analysis.

Temperature (°C)	Density (kg/m³)	Dynamic Viscosity (cP)
25	997	0.89
35	994	0.72
45	990	0.59

9.8 Pump Duty Points

The *Contractor* shall refer to the data sheets for the pump rated capacity and total rated head.

The maximum generated pressure capabilities of the pump shall not exceed the system design pressure of 1600 kPag.

The *Contractor* shall submit with the offer the mechanisms in place that will prevent the system design pressure from being exceeded.

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9.9 Strainer Specification

A strainer will not be installed on the suction inlet to the pump. A strainer will not be positioned on the pump suction line. The *Contractor* shall ensure that the water tank and piping systems are free from any foreign objects that could cause damage to the pump.

9.10 Suction Conditions

Where required, reducers will be provided for and installed by the *Contractor* to match the pipeline sizes to the pump suction and discharge flanges.

The small end of the reducer will be welded to the pump connection flanges and the large end of the reducer will be welded to the discharge and suction piping system. i.e. if reducers are required, they will be fitted immediately upstream of the pump suction inlet flange.

The pump will take suction from a dedicated atmospheric water reservoir.

9.11 Net Positive Suction Head (NPSH)

The *Contractor* shall specify the NPSH available and the NPSH required on the pump data sheet. The NPSH available shall be calculated on the basis that the reservoir is at the minimum operating level.

The pump required NPSH shall at all times be a minimum of 1.0 m below the available NPSH.

9.12 Pump Discharge Operating Conditions

Under normal start-up and running conditions, the pump discharge pressure shall be maintained at the set point provided by feedback from the pressure switch.

There will be no bellows fitted between the discharge pipeline and the pump discharge outlet nozzle.

9.13 Guards

All external rotating or moving components shall be suitably covered with guards in compliance with the requirements of the OSHAct.

The guards shall be fixed in position and shall be easily removable during maintenance and inspection. Each guard shall contain a suitably sized viewing port fabricated of a mesh or grid that will facilitate visual inspection of the moving component without the need to remove the guard.

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9.14 Coupling

A coupling shall be provided between the driver and the water pump.

The coupling between the driver and the pump must allow each unit to be removed without disturbing the other.

9.15 Gearbox

Under no circumstances will gearboxes between the pump and driver be considered.

9.16 Shaft Sealing System

Rotating shafts through the pump casing shall be sealed by a mechanical seal to BS EN 12756. The process fluid shall be used as the lubricating fluid between seal faces. An external fluid supply will not be provided.

9.17 Pressure Gauges

Pressure gauges mounted to the pump casing are not required. Pressure gauges will be fitted on the pump discharge piping.

9.18 Bearing Thermometers

Bearing thermometers are not required under this specification. The *Contractor* shall specify the expected normal operating bearing housing temperature as well as the maximum permissible bearing housing temperature during pump operation.

9.19 Nameplate

The supplier shall provide a nameplate made of grade 316 stainless steel, securely fixed by rivets or pins to the pump in a prominent position with the following information embossed onto the nameplate:

- Supplier Name
- Make or manufacturer.
- Model
- Serial number
- Design Process Medium
- Impeller diameter (mm)
- Rated capacity in (m^3/hr or L/min) at speed (RPM)

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- Rated discharge pressure (kPa) at speed (RPM)
- NPSH required.
- Direction of rotation
- Date of manufacture

9.20 Dismantling and Assembly

The pump shall be easily dismantled and assembled without the need to remove other components of the pump-set. Common wearing parts shall be maintainable with the pump in position.

9.21 OEM Performance Test

The specified pump duty point of the pump shall be tested at the OEM's shop in accordance with SANS 9906-2016 Accuracy Grade 2U (ISO 9906-2012) and shall be supplied with a test certificate.

The OEM performance test shall be a signed factory test as defined by SANS 9906-2016 and shall be non-witnessed.

10 JOCKEY PUMP CONTROL PANEL AND INSTRUMENTATION

The jockey pump-set shall be provided with a dedicated Jockey Pump Control Panel (JPCP). The location of the JPCP shall be suitably mounted on an adjacent pump house wall or structural steel column within the pump house. The JPCP shall be protected against vibration.

The JPCP shall comprise a fully enclosed panel with lamps, key switches, labels, components, gauges, buttons, and any other equipment as required by this section of the specification.

The pressure switch and pressure indicator shall be mounted on a separate dedicated instrument stand that is designed, submitted to the *Employer* for approval, supplied and installed by the *Contractor*.

10.1 JPCP Power Supply

The JPCP will source its power from the normal power DB located within the pump house.

The JPCP shall incorporate over-voltage protection to prevent any malfunction or damage which might occur from source power surges.

A circuit breaker shall be provided between the DB and the JPCP to allow for electrical isolation of the JPCP. The circuit shall be lockable.

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10.2 System Design

The system shall be designed and constructed as a hard wired system. All functions/aspects of control shall be performed by individual components to fulfil the control requirements, separately mounted in the JPCP.

Power to the jockey pump electric motor and pressure switch will be derived from the JPCP.

The JPCP will interface with the Fire Control Panel (FCP) via suitable terminations as per the *Employers* approved vendor list. The design and supply of the FCP is provided for elsewhere and is not included in the scope of this specification.

The *Contractor* shall gather all information required of the FCP and provide all information required by the FCP designer, to ensure successful cable integration between the FCP and JPCP.

The *Contractor* shall ensure that the cable selection considers all factors including the voltage drop, current carrying capacity, impedance and is suitable for the system.

The wiring and cabling will be completed as per SANS 10142-2 and TPL Specifications PL727.

All electrical isolators shall be lockable.

An emergency stop push button shall be provided to shut down the pump-set in all events and is to be hard wired.

10.3 Jockey Pump Control Panel

A key switch shall be provided on the JPCP for selection between the JPCP ‘Auto’ and ‘Maintenance’ modes.

10.4 Jockey Pump-set Start and Stop Commands

The jockey pump-set will be required to start and stop when placed in ‘Auto’ mode and in ‘Maintenance’ mode.

- Auto Mode

The start and stop command of the Jockey Pump in Auto mode is governed only by the pressure switch. In the event that the system pressure drops below the design set-point, the pressure switch sends a ‘low pressure’ signal to the JPCP, which then starts the jockey pump's electric motor. The motor runs continuously until the pressure returns to the set-point, at which point the JPCP stops the motor.

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- Maintenance mode

In Maintenance mode, the jockey pump can only be started using the start push button on the JPCP. The pressure switch is disabled for starting/stopping the pump in this mode. The pump can be stopped using the stop push button or emergency stop button on the JPCP. The 'Low Pressure' pilot light will still illuminate if system pressure drops below the set-point, even though the pressure switch won't control the pump.

10.4.1.1 Jockey Pump-set Run and Fail Events.

- Auto Mode

During a "Run" event, the JPCP will continuously transmit a "run event" to the FCP. The FCP does not latch the "Run" signal hence it must be transmitted continuously. A "run" pilot light will be used to indicate when the pump is running.

During a "Fail" event, the JPCP shall transmit a "Fail" event if the following situations occur:

  - Loss of power to the JPCP
  - The jockey pump fails to meet the run condition after the JPCP sends a run command.

The fail event will remain continuous until a "Reset Run Fault" button is pressed, or when the power is restored to the JPCP. A "fail" pilot light shall be used when the pump fails to start after the JPCP sends a command.

- Maintenance mode

The JPCP shall not transmit a "Run" event to the FCP. The "Fail" event shall automatically terminate when the JPCP returns to Auto Mode, without any present logic faults and the need to use the "Reset Run Fault" button.

10.5 JPCP and FCP Interface

The JPCP will only interface with the FCP.

All signals from the JPCP to FCP will be via a potential free contact in the JPCP.

There will be no signals from the FCP to the JPCP.

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10.6 Emergency Stop

The JPCP is equipped with an emergency stop button that will immediately stop the jockey pump-set in both Auto and Maintenance modes, overriding the pressure switch. Activating this emergency stop button triggers a ‘Fail’ event at both the JPCP and FCP, preventing the jockey pump-set from starting until the ‘Reset Run Fault’ button on the JPCP is pressed. This ensures that the pump cannot be restarted until the fault is cleared, regardless of the system's running condition

10.7 Labels

All labels shall be of the Traffolyte engraved type that are permanently fixed to the panel with stainless steel screws. The use of adhesive to attach the labels to the panel shall not be permitted.

All label text shall be in uppercase Arial font.

The JPCP shall have a label representing the label numbering in accordance with Section 7.1 and located at the top centre of the control panel door with a white background with black text of height 12 mm.

All components, lamps, instruments, key switches, and buttons shall have labels with a white background with black text of height 6 mm.

All cautionary labels shall have a red background with white text of height 12 mm.

A cautionary label shall be provided that bears the following text;

“IMPORTANT NOTICE: THIS MACHINE SHOULD ALWAYS BE LEFT IN AUTO MODE WITH THE KEY REMOVED.”

10.8 Instrument and Cable Tagging and Numbering

All instrument and cables shall be suitably tagged.

The instrument and cable tags must be permanently fixed, may not be fixed by adhesive and must not be susceptible to degradation in the environment in which it is installed.

Tags may not be handwritten and may not be of paper or cardboard construction.

Cables shall be tagged with Grafoplast TRASP® or similar approved identification system.

Cables must be identified in accordance with the *Employers* specifications.

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10.9 Panel Construction

Except as modified by the requirements or concessions in this document, the panel design and construction must comply with the requirements of the *Employer's* standards including PL631 and PL711.

Components, pilot lights, push buttons and any other equipment fitted to the panel shall not reduce the IP rating of the panel.

The panels shall be electric orange, powder coated carbon steel to colour B26 with a minimum IP rating of 66 and shall be lockable. The panel may be subjected to discharge from water sprinkler systems within the pump house.

The panel shall have sealed gland plates on the bottom of the panel.

Cable glands shall be used for entry of cables into all panels via gland plates. Cable glands shall be suitable for the service, cable type and size and not compromise on IP rating. Cable glands shall be located in such a way so as to allow the tightening and loosening of any gland at any time.

All equipment installed in panels, with the exception of face mounted items on the operator panels, shall be installed on a backing plate mounted to but separate from the back or sides of the panel.

The panels shall have 20% additional space for the installation of relays and terminals.

No trunking run shall have a cable loading of more than 80% for the completed design and installation.

All wiring connections outside of dedicated equipment connections shall be made in accordance with the *Employers* specification.

All components shall be DIN rail mounted, if components are panel mounted, they shall not compromise the IP rating of the panel.

Side or top access panels are not permitted.

10.10 Cabling, Racking and Instrument Tubing

The *Contractor* shall make provision for the supply and installation of the cabling and racking between the jockey pump motor, the instrument stand and the JPCP.

The instrument tubing between the process connection on the jockey pump piping discharge and the instrument stand will be done by the *Contractor*.

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10.11 Panel Face Mounted Instruments

The following components shall be face mounted on the JPCP;

- Emergency Stop Push Button of the self-latching and twist to reset type.
- Ammeter
- Voltmeter
- Key Operated ‘Auto/Maintenance’ Switch
- Jockey Pump ‘Fail’ Pilot Light
- Jockey Pump ‘Run’ Pilot Light
- ‘Low Pressure’ Pilot Light
- ‘Reset Run Fault’ Push Button
- Jockey Pump ‘Start’ Push Button
- Jockey Pump ‘Stop’ Push Button
- Lamp test push button

10.12 Gauges, Push Buttons and Pilot Lights

All indicating gauges shall be red lined to show alarm levels and shall be minimum 60 mm in diameter.

Gauges of different sizes will not be accepted. Display units of all gauges shall be amperes (Amps), volts (V) and kilopascal (kPa) for the selected application.

All pilot lights and push buttons shall be 22 mm in diameter incorporating LED indication in the required colour and the indicating colour shall be evident without the LED lit. The push buttons shall only illuminate when pressed or when the Lamp test push button is pressed.

10.13 Instrument Stand and Instrumentation Specification

The *Contractor* shall design and submit to the *Employer* for review, comment and acceptance the instrument stand that will be used to mount the pressure gauge and the pressure switch.

The *Contractor* shall fabricate, supply and install the instrument stand in accordance with the *Employers* requirements.

The instrument stand shall be fabricated according to the following specifications;

- Circular structural steel stand to be 60.3mm diameter with 2.0mm wall thickness to a height of 1300mm.

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- 230mm square 6mm thick base plate with 4 OFF 12mm diameter holes drilled.
- 4 OFF chemical anchors to suit holes drilled in the square base plate and grouted into position.
- Four 40 x 4mm gusset plates between base plate and stand
- Adaptor plates and suitable fasteners for the fitting of the pressure switch and pressure gauge
- All structural steel shall be hot dipped galvanised.

The fixing connection of the pressure gauge and pressure switch to the instrument stand shall be included on the detailed drawing prepared and submitted by the *Contractor* to the *Employer* for acceptance.

The pressure gauge shall be in accordance with the Pressure Gauge Specification, document PL 909.

11 PUMP-SETS

The *Contractor* shall read the below requirements in conjunction with the Equipment Handover and Document Procedure (EHDP), document PL 917.

11.1 Tolerances

11.1.1 Alignment Tolerances

During the installation of the pump-set, the *Contractor* shall line and level each pump-set using brass shims and steel wedges.

Once the pump-sets have been installed onto the prepared foundations, and prior to the connection of any pipework, the *Contractor* shall perform and include in the QA file, a laser alignment certificate of the fire water pump. The *Employer* must be invited to witness the laser alignment of the pump.

Installation and alignment shall be as per the OEM's recommendations.

During installation and connection of the pipework to the pump flanges, the *Contractor* shall make themselves available on site as necessary to witness the pipe-on and pipe-off exercises that shall be performed by the piping installation contractor, and at the end of the pipe-on pipe-off exercise, the *Contractor* shall be satisfied that the suction and discharge pipework for the pump has not imposed any undue stresses and forces on the pump.

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Prior to the commencement of on-site commissioning, the *Contractor* shall perform and include in the QA file a second on-site laser alignment certificate of the fire water pump to confirm that the alignment of the fire water pump has not be displaced during the installation of the pipework. The *Employer* shall be invited to witness the second laser alignment test as well.

11.2 Baseplate and Equipment

The dimensions of the pump-set baseplate and location of the HD bolt holes shall be fabricated within a tolerance of ±1 mm to the dimensions as shown on the AFC pump-set drawing.

The centreline and elevations of all pump inlet and outlet nozzles shall be located within a tolerance of ±0.5 mm to the dimensions as shown on the AFC pump-set drawing.

11.3 Static Tests

Notwithstanding the OEM's hydrostatic test of the pump, the *Contractor* shall perform for each pump called for under this specification, a 30-minute hydro-static test that is witnessed by the *Employer*.

The test pressure shall be no less than the greater of 1.5 times the pump shut-off head or the OEM's hydrostatic test pressure.

Once the test pressure has stabilised, the pump casings shall maintain the test pressure for the duration of the test and during the test there shall be no leakage from the pump.

The hydrostatic test shall be performed and witnessed during the FAT of the pump-sets and shall be performed with the pumps assembled as a part of the pump-set and not in isolation on a test bench prior to final assembly.

11.4 Equipment Handover and Document Procedure

The *Contractor* shall comply with the *Employer's* Equipment Handover and Document Procedure, document PL 917, during the testing and handover of the pump-sets.

11.4.1 Shop Performance Test

A shop performance test of the pump will not be required.

11.4.2 Factory Acceptance Tests

Each pump-set and JPCP called for under this specification shall be simultaneously subject to a FAT that is arranged and performed by the *Contractor* and witnessed by the *Employer*.

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The FAT shall be a test of the pump-set and JPCP to ensure compliance before delivery of the pump-set to site.

The following minimum information will be reviewed by the *Employer* at the FAT for each pump-set;

- Pump-set dimensional checks and equipment arrangement conformance to the AFC drawings.
- Pump alignment certificates.
- Quality Assurance Files
- Design and operation of Jockey Pump Control Panel and all associated logic and emergency stops against the JPCP FCP Control Narrative
- Instrument hook-ups and calibration ranges.
- DFT of corrosion protection systems
- Cable rack routing
- Other requirements of this specification not specifically listed above.

11.4.3 Site Acceptance Testing and Commissioning

Upon successful completion of the pump-set installation, the pump-sets shall be subject to a site acceptance test (SAT). The SAT will be arranged and performed by the *Contractor* and witnessed by the *Employer*.

The predominant focus of the SAT will be of the Jockey Pump Control Panel and to establish readiness for final commissioning.

The requirements for commissioning and handover of the pump-sets are documented in the Works Information.

12 DOCUMENTATION

All drawings shall have the title block unique for the project included on the drawing, located at the lower right hand side of the drawing.

For drawings the minimum size is A3, and the maximum size is A1. A4 may only be used for parts lists and similar documents.

Individual dimensioned General Arrangement (GA) drawings for the following items shall be included in the QA file;

- Water pump
- Primary driver

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- Baseplate
- Coupler
- Jockey Pump Control Panel
- Pressure Switch
- Pump-set arrangement.

Individual detail drawings for the following items shall be included in the QA file;

- Water pump
- Mechanical seal
- Primary driver
- Couplers

The *Contractor* shall submit to the *Employer* an Approved for Construction (AFC) General Arrangement drawing. The drawing shall be stamped or clearly marked in red, ‘Approved for Construction’.

The AFC GA drawing shall contain the following information as a minimum;

- Dimensioned plan view on assembled pump-set including suitable dimensioned sections and elevations
- Holding down bolt details
- Mass of the following equipment;
  - Primary driver
  - Water pump
  - Jockey Pump Control Panel
  - Miscellaneous
  - Total
- Dimensioned location of all suction and discharge flanges including elevations.
- Inlet and outlet pump flanges
- Centrelines of baseplate
- Location of earthing points
- Location of lifting lugs
- The technical specifications of each of the following items of equipment;
  - Primary driver showing manufacturer, model number, RPM and kW rating.
  - Water pump showing equipment number, manufacturer, model number and duty point.
  - Mechanical showing seal design, manufacturer and model number
  - Pressure switch showing manufacturer and model number.
  - Drive coupling showing manufacturer, design and model number.

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- Allowable forces and moments for the water pump

The AFC GA shall be updated to as-built status with all changes incorporated upon successful completion of commissioning.

Native final drawings shall be submitted in AutoCAD format with the final handover documentation. Electronic copies in PDF format shall also be submitted on CD.

All electronic drawings must be searchable, and hard/scanned copies must be clear and legible.

13 PROJECT QUALITY REQUIREMENTS

13.1 Quality Control Plan

The *Contractor* shall prepare a quality control plan (QCP) for the design, approval, installation and commissioning of the pump-sets.

The QCP shall be submitted to the *Employer* for approval. The *Employer* will apply hold, surveillance and witness points as deemed necessary. Hold points will require the signature of the *Employer* or the *Employers* nominated representative before proceeding to the subsequent activity on the QCP.

The *Contractor* shall make provision for a duration of 2 weeks as an approval/review period for the *Employer*.

A selection of the *Contractors* scope shall be submitted to the *Employer* for review, approval, construction and comment in accordance with the below table.

Information to be Provided by the *Contractor*	**Issue Status**
AFC GA drawing of pump-set	Initially for *Employer* review but ultimately as Approved for Construction
Jockey Pump Control Panel internal and external layout and GA drawings	For approval
Electrical schematic drawings of the Jockey Pump Control Panel	For approval
Power distribution diagrams	For approval
Cable schedules	For approval
Internal wiring diagrams of the Jockey Pump Control Panel	For approval

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13.2 Quality Assurance File

The *Contractor* shall also prepare at the beginning of the project and keep up to date through the project lifecycle a Quality Assurance (QA) file with the following minimum sections;

- Pump-set Specification.
- Quality Control Plan
- Program
- Design
  - Instrument hook-up diagrams.
- Purchase Orders
- Equipment Specifications and data sheets
  - Water pump curves
  - Primary driver data sheets
  - Pressure switch data sheets.
  - Instrument data sheets.
  - Process instrument data sheets.
- Baseplate design
  - Weld Procedure Specification
  - Procedure Qualification Records
  - Material certificates for all structural steel
  - Galvanising Certificates
- Drawings
  - Baseplate
  - Primary driver
  - Coupler
  - Water pump
  - Mechanical seal
  - Jockey Pump Control Panel
  - Pump-set
  - Cable rack routing and sizing diagrams
- Electrical, Control and Instrumentation
  - Cable test certificates (continuity and earth testing)
  - Instrument installation verification against hook-up diagrams.
- Equipment and Handover Documentation in accordance with the Equipment and Handover Document *Procedure*, document PL 917.

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- *Employer Contractor* Correspondence

The *Contractor* shall prepare and issue to the *Employer* the approved original QA file plus one hard copy. The contents of the approved QA file shall also be submitted on a CD.

14 EQUIPMENT WARRANTY

The warranty period for all equipment called for under this specification shall be twelve months from the date of the Final Commissioning Certificate signed by the *Employer*.

The responsibility of the *Contractor* concerning his equipment is in no way alleviated by the issue of the Final Commissioning Certificate.

Maintenance by the *Employer* during the warranty period shall be limited to cleaning and necessary lubrication only as included in the operating and maintenance manuals submitted by the *Contractor*. All other maintenance or adjustments shall be carried out by the *Contractor*.

Should any component part of any main or ancillary equipment fail to perform in accordance with its intended function during the warranty period, the *Employer* shall reserve the right to reject the component part and order its replacement with a more reliable part at the *Contractors* expense. The replacement part shall be guaranteed for a further 12 months.

15 OPERATING AND MAINTENANCE MANUALS

An operating and maintenance (O&M) manual shall be prepared and submitted by the *Contractor* and shall be separate from the QA documentation.

The *Contractor* shall prepare and issue to the *Employer* the approved original O&M file plus one hard copy. The contents of the approved O&M file shall also be submitted on a CD.

The O&M manual shall contain the following information as a minimum;

- Numbered spare parts list and associated diagram for the following equipment;
  - Water pump
  - Coupler
  - Primary driver
- Recommended spare parts list with OEM part number and local equivalent part number for the following equipment;
  - Water pump
  - Coupler
  - Primary driver

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- Operating and Maintenance manuals for the following equipment;
  - Water pump
  - Coupler
  - Primary driver
- Service manuals

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FIRE SYSTEM SPECIFICATION

PRESSURE GAUGE SPECIFICATION

Document number	PL 909
Version number	3
Classification	Unclassified
Effective date	1 July 2025
Review date	1 July 2028

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SUMMARY VERSION CONTROL

VERSION NO.	NATURE OF AMENDMENT	PAGE NO.	DATE REVISED
0	New Specification	ALL	1 July 2025
1	Comments during review between TPL and GreyJones included	ALL	24 July 2025
2	Comments and review from TPL	ALL	27 August 2025
3	Inclusion of measuring element	ALL	23 January 2026

Note: Only latest amendments and/or additions are reflected in italics in the body of the document.

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DOCUMENTATION SIGN-OFF SHEET

I, the undersigned hereby approve this procedure.

ROLE	CAPACITY/ FUNCTION	SIGNATURE	DATE
Compiled by:	**Pieter Jacobs**		
Approved by:	**Papa Moratwe**		

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TECHNICAL SPECIFICATION – PRESSURE GAUGE SPECIFICATION

1 INTRODUCTION

This specification covers the design, fabrication, manufacture, procurement, supply, delivery to site and handover documentation of the Pressure Gauge equipment to be used within Transnet Pipelines fire protection systems.

Where the term ‘Gauge’ or ‘equipment’ is used in this specification, they shall be interpreted to mean Plant and Materials as defined in NEC3 Clause 11.2(12).

This specification is not site specific but has been prepared as a generic project specification. Site specific Pressure Gauge summary sheets and Pressure Gauge data sheets specifying the site-specific data pertaining to the gauges are to be developed by the *Contractor* and submitted to the *Employer* for acceptance.

The process fluid for the equipment will be potable water (supplied by the municipality for the respective site), foam concentrate or foam pre-mix (a mixture of 3% foam concentrate with water).

Properties of the foam concentrate can be found in the Foam Concentrate Specification, document PL915. The *Contractor* shall review the properties of the foam concentrate when determining the suitability with the equipment.

The importance of correctly tagging the Pressure Gauge is underscored as the *Employer* relies on the *Contractor* to provide the gauges as specified on the approved P&IDs and with the correct corresponding tag number. The installation *Contractor* will receive the gauges on site and will install the gauges after pairing the Pressure Gauge tag number with the number indicated on the construction drawings.

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2 DEFINITIONS

The following definitions shall apply when reading this specification;

Term	Definition
^{0}C	Degrees Celsius
BS	British Standard
BSP	British Standard Pipe
cP	Centipoise
cSt	Centistoke
ISO	International Standards Organisation
IP	Ingress Protection
kg/m^3	Kilograms per cubic metre
kPag	Kilopascals Gauge
NPT	National Pipe Thread
NB	Nominal Bore
OEM	Original Equipment Manufacturer
SANS	South African National Standards
SOQ	Schedule of Quantities
Contractor	The successful tenderer
Employer	Transnet Pipelines
UV	Ultra-violet

3 ENGINEERING STANDARDS

Although not bound in nor issued with this document, the following standardised specifications shall form part of the contract document:

3.1 Applicable Standards

EN 837-1	Pressure Gauges. Bourdon tube Pressure Gauges. Dimensions, metrology, requirements, and testing
EN 837-2	Pressure Gauges. Selection and installation recommendations for Pressure Gauges
SANS 10089-1	The Petroleum Industry Part 1: Storage and distribution of petroleum products in above-ground bulk installations

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3.2 Referenced Standards

PL 915	Foam Concentrate

4 LOCATION

The *Contractor* shall take cognizance of the following data of the Pressure Gauge location when preparing the offer;

City	*Contractor* to indicate on data sheet.
Depot	Transnet Pipelines – *Contractor* to indicate on data sheet.
Area	*Contractor* to indicate on data sheet.

5 PROCESS FLUID DATA

The *Contractor* shall take cognizance of the following process fluid data for the equipment when preparing the offer;

Process Fluid 1	Water
Temperature @ Operating Point	5 – 50 °C
Density @ Operating Point	997 kg/m³ @ 25°C
Viscosity @ Operating Point	0.9 cP at 25°C
Process Fluid 2	Foam Concentrate
Temperature @ Operating Point	5 – 35 °C
Density @ Operating Point	1000 – 1100 kg/m³
Viscosity @ Operating Point	2625 cP at 20°C (Non-Newtonian)
Process Fluid 3	Foam Pre-mix
Temperature @ Operating Point	5 – 50 °C
Density @ Operating Point	997 kg/m³ @ 25°C
Viscosity @ Operating Point	0.9 cP at 25°C

Process fluid data shown to be confirmed by the *Contractor* during the detailed design.

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6 PROCESS DATA

The *Contractor* shall take cognizance of the process data for the Pressure Gauges and its application and placement in the approved P&ID'S when preparing the data sheets and offer.

Maximum Design Temperature	60°C
Maximum Operating Temperature	50°C
Minimum Operating Temperature	0°C
Design Pressure	25 barg. *Contractor* to indicate on data sheet.
Maximum Operating Pressure	*Contractor* to indicate on data sheet.
Minimum Operating Pressure	*Contractor* to indicate on data sheet.
Pulsating Pressure	*Contractor* to indicate on data sheet.

7 EQUIPMENT DESIGN

The *Contractor* shall take cognizance of the equipment design data as displayed on the approved P&IDs when preparing the data sheets and the offer. All gauges are standardized to fit its respective application in any of the fluid process systems.

Gauge Type	Pressure/ Compound *Contractor* to indicate on data sheet
Gauge Mounting	Pipeline
Measuring element	Bourdon tube
Dial Colouring	White with Black Lettering
Accuracy Class	Class 1.6
Unit Measurement	kPa
Minimum Gauge Value	-100 kPa – Compound 0 kPa – Pressure
Maximum Gauge Value	2500 kPa
Gauge Figure Intervals	100 kPa
Gauge Minor Graduations	50 kPa
Drag Pointer Required	Yes
Glycerine Filled	Yes
Pressure Connection Specification	15NB NPT Male
Bezel Design	Rolled Ring Type

The gauge display units shall be in kPa. All gauges supplied under this specification shall be supplied with the same gauge display units and a mix of gauge display units will not be accepted.

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All gauges shall provide readings in ‘Gauge’ pressure and not ‘Absolute’ pressure.

All gauges for outdoor use shall be minimum IP65 rated and it is the responsibility of the *Contractor* to indicate on the data sheet.

8 MATERIALS OF CONSTRUCTION

The *Contractor* shall take cognizance of the following physical properties of each valve when preparing the offer. The *Contractor* shall take note that all wetted internal components of the equipment shall not be made of Zinc, Brass, Bronze, Carbon Steel, or Ductile Iron.

Dial	Aluminium
Case	Stainless Steel 316
Case internals	Stainless Steel 316
Bezel	Stainless Steel 316
Pressure connection	Stainless Steel 316
Window	Instrument glass

9 CORROSION PROTECTION

All gauges for outdoor use shall be UV resistant and the colour of the equipment shall not fade or degrade over time with exposure to the elements.

10 QUALITY CONTROL

The equipment shall be provided with the following minimum quality control documentation;

Material Test Certificates	Required per EN 10204
Inspection Certificates – Type 3.2	Required per EN10204
Gauge Data Sheet Approvals	To be prepared by the *Contractor* and submitted to the *Employer* for acceptance prior to procurement of the Pressure Gauges
Factory Pressure Test Certificate	Required

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11 DOCUMENTATION

Each Pressure gauge shall be provided with the following documentation;

At tender stage	• OEM Pressure Gauge data sheet with dimensioned drawing • Applicable design standards
Design stage	• General Arrangement (GA) • Pressure Gauge data sheets for *Employers* acceptance. • IA certification • IP65 Certification
Delivery to site	• Design standard certificate. • Material test certificates • Inspection Certificates • General arrangement drawing

12 GENERAL

The equipment selection, supply and delivery shall adhere to the following specific requirements;

12.1 Equipment

1) All gauges shall be new and manufactured from all new materials unless otherwise specified in the enquiry.

2) The gauge display value indicating the normal operating pressure of the process, must lie between the 40 – 60% range of the pressure gauge dial.

3) All gauges must be of high quality and suitable for a long service life of occasional use. Gauges should provide at least 10 years of service, subject to the Contractors' specified maintenance regime.

4) Each gauge shall be tagged and permanently attached with a minimum 16-gauge stainless steel plate of minimum dimensions 15mm high by 50 mm long. The tags shall be attached with 16-gauge stainless steel wire to the gauge and shall not be attached in a way that interferes with installation or operation of the gauges. The gauge's tag number as specified on the approved P&IDs shall be permanently hammer stamped on the tag. The height of the text on the tag shall be a minimum of 10 mm high.

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12.2 Supply

The *Contractor* shall provide installation instructions detailing the labour, equipment and any special procedures, tools, equipment, or personnel required for the installation.

The *Contractor* shall include the provision of all specialist tools, equipment, and services necessary for the installation and / or maintenance of the equipment.

The material of manufacture of all parts shall be specified on the equipment drawings or data sheets. Submission of this information does not in any way negate the Contractor's responsibility to ensure that the specified materials are suitable for the service required by this or any other documents pertaining to the enquiry.

The *Contractor* is to provide full operating and maintenance and overhaul manuals including detailed section and exploded diagrams of the equipment, parts lists, typical spares lists and pricing.

The *Contractor* is to provide drawings indicating all relevant dimensions affecting the installation including space required to perform maintenance.

The *Contractor* shall provide a copy of all manufacturers coating specifications relevant to the products specified.

12.3 Storage:

Storage of the equipment shall be:

- Undercover
- On dunnage, made of inert material, at least 150mm above ground level.
- All openings shall be sealed.

The equipment shall be stored in an area away from regular vehicle movements and contamination by incompatible materials (e.g. carbon steel and stainless steel).

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12.4 Delivery:

1) Prior to delivery, the *Contractor* shall invite the *Employer* to the OEM's premises for an inspection of the gauges to ensure conformance to this specification. The *Contractor* shall only deliver the equipment to site once a release certificate for each item of equipment shown on the datasheet issued.

2) The equipment shall be loaded and transported on suitable transport arranged by the Contractor. All items shall be secured on the transport vehicle to avoid damage to the equipment and coatings. Equipment shall not be allowed to rest directly against each other.

3) All stainless-steel equipment items are to be kept free of contamination by incompatible materials such as carbon steel grindings, etc. Should equipment become contaminated, the *Contractor* shall clean the equipment at his own expense. If this is unsuccessful, the *Contractor* shall replace the equipment at his own expense.

4) Equipment shall be supplied in sealed wooden containers with plastic linings. A plastic lining shall be wrapped around each individual item. Flange faces and mating surfaces shall be protected during transport and handling.

5) Equipment shall be separated so as not to bear against each other and shall be firmly secured by suitable padded lashings to prevent movement and damage in transit. The equipment shall not be dropped, bumped into or subjected to shock or rough handling and any Pressure Gauge damaged during transport or handling may be rejected by the Project Manager.

6) The *Contractor* shall make allowance for and comply with all the *Employers* Health Safety Security and Environmental (HSSE) requirements at the delivery point.

7) The *Contractor* shall allow for off-loading to a location on site as directed by the *Employers* representative. An off-loading method statement in compliance with the *Employers* HSE policy shall be supplied for approval prior to delivery.

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13 DOCUMENTATION SUPPLY

Documents to be supplied upon award of the supply contract shall include:

1) Installation, operation and maintenance manual

2) Spare parts list

3) IA certificate as required by SANS 10108 (if applicable)

4) A general arrangement.

5) Pressure Gauge sheets for *Employers'* acceptance

6) Equipment design and construction information for each piece of equipment (sales documents)

7) Approval documents (and indication of equivalency if required in section 10 and 11)

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FIRE SYSTEM SPECIFICATION

FIRE DEPARTMENT INTERFACE EQUIPMENT SPECIFICATION

Document number	PL 910
Version number	3
Classification	Unclassified
Effective date	1 July 2025
Review date	1 July 2028

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SUMMARY VERSION CONTROL

VERSION NO.	NATURE OF AMENDMENT	PAGE NO.	DATE REVISED
0	New Specification	ALL	1 July 2025
1	Comments during review between TPL and GreyJones included	ALL	10 July 2025
2	Comments and review from TPL	ALL	27 August 2025
3	Specification on hose boxes, hoses, hydrants and branch pipes added	ALL	09 January 2026

Note: Only latest amendments and/or additions are reflected in italics in the body of the document.

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DOCUMENTATION SIGN-OFF SHEET

I, the undersigned hereby approve this procedure.

ROLE	CAPACITY/ FUNCTION	SIGNATURE	DATE
Compiled by:	**Pieter Jacobs**		
Approved by:	**Papa Moratwe**		

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TECHNICAL SPECIFICATION – FIRE DEPARTMENT INTERFACE

1 INTRODUCTION

This specification covers the design, fabrication, manufacture, procurement, supply, delivery to site and handover documentation of the fire department interface valves, connections and equipment to be used within Transnet Pipelines fire protection systems.

Where the term ‘equipment’ is used in this specification, it shall be interpreted to mean Plant and Materials as defined in NEC3 Clause 11.2(12).

This specification is not site specific but has been prepared as a generic project specification. Site specific equipment summary sheets and equipment data sheets specifying the site-specific data pertaining to the equipment are to be developed by the *Contractor* and submitted to the *Employer* for acceptance.

The process fluid for the equipment will be potable water (supplied by the municipality for the respective site) or foam pre-mix (a mixture of 3% foam concentrate with water).

Properties of the foam concentrate can be found in the Foam Concentrate Specification, document PL 915. The *Contractor* shall review the properties of the foam concentrate when determining the suitability with the equipment.

The importance of correctly tagging the equipment is underscored as the *Employer* relies on the *Contractor* to provide the equipment as specified on the approved P&IDs and with the correct corresponding tag number. The installation *Contractor* will receive the equipment on site and will install the equipment after pairing the equipment tag number with the equipment number indicated on the construction drawings.

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2 DEFINITIONS

The following definitions shall apply when reading this specification;

Term	Definition
^{0}C	Degrees Celsius
BS	British Standard
BSP	British Standard Pipe
cP	Centipoise
ISO	International Standards Organisation
kg/m^3	Kilograms per cubic metre
NPT	National Pipe Thread
SANS	South African National Standards
SOQ	Schedule of Quantities
Contractor	The successful tenderer
Employer	Transnet Pipelines
UV	Ultra-violet

3 ENGINEERING STANDARDS

Although not bound in nor issued with this document, the following standardised specifications shall form part of the contract document:

3.1 Applicable Standards

SANS 543	Fire Hose Reels
SANS 1128-1	Firefighting Equipment: Components of underground and above-ground hydrant systems
SANS 1128-2	Firefighting Equipment: Hose couplings, connectors, and branch pipe and nozzle connections
SANS 10089-1	The Petroleum Industry Part 1: Storage and distribution of petroleum products in above-ground bulk installations
SANS 1700	Fasteners
SANS 1091	National colour standard
SANS 10140-2	Identification Colour Marking Part 2: Identification of Hazards and Equipment in Work.

3.2 Referenced Standards

PL 915	Foam Concentrate

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4 LOCATION

The *Contractor* shall take cognizance of the following data of the equipment location when preparing the offer;

City	*Contractor* to indicate on data sheet
Depot	Transnet Pipelines –*Contractor* to indicate on data sheet
Area	*Contractor* to indicate on data sheet

5 PROCESS FLUID DATA

The *Contractor* shall take cognizance of the following process fluid data for the equipment when preparing the offer;

Process Fluid 1	Water
Temperature @ Operating Point	5 - 50 °C
Density @ Operating Point	997 kg/m³ @ 25°C
Viscosity @ Operating Point	0.9 cP at 25°C
Process Fluid 3	Foam Pre-mix
Temperature @ Operating Point	5 – 50 °C
Density @ Operating Point	997 kg/m³ @ 25°C
Viscosity @ Operating Point	0.9 cP at 25°C

Process fluid data shown to be confirmed by the *Contractor* during the detailed design.

6 PROCESS DATA

The *Contractor* shall take cognizance of the process data of the equipment when preparing the offer.

Maximum Flow Rate	*Contractor* to indicate on data sheet
Minimum Flow Rate	*Contractor* to indicate on data sheet
Flow Direction	To be indicated on valve body if applicable
Maximum Design Temperature	60°C
Maximum Operating Temperature	50°C
Minimum Operating Temperature	0°C
Design Pressure	16 barg. *Contractor* to indicate on data sheet
Maximum Upstream Operating Pressure	*Contractor* to indicate on data sheet

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Minimum Upstream Operating Pressure	*Contractor* to indicate on data sheet
Maximum Downstream Operating Pressure	*Contractor* to indicate on data sheet
Minimum Downstream Operating Pressure	*Contractor* to indicate on data sheet
Maximum Valve Differential Pressure	To be the same as the design pressure
Minimum Valve Differential Pressure	To be the differential between the minimum upstream and the minimum downstream pressures. *Contractor* to indicate on data sheet

7 EQUIPMENT DESIGN

The *Contractor* shall take cognizance of the equipment design data when preparing the offer to ensure it is reliable and applied correctly in its respective application.

7.1 Hydrants

The equipment design of the hydrants in the table below includes the hydrant that has the process fluids water and foam premix.

Design Specifications	Double lugged right angled valve (to SANS 1128)
Manifold Inlet	150 mm, Male BSP Thread.
Fire Hydrant Outlet	65 mm Female Instantaneous Outlet with double opposing ‘lug’.
Spindle square size	16 mm
Design flow rate per head	450 L/min
Actuator	Handwheel
Actuation	Manual
Bore	Full Bore
Outlet Cap and Chain	Yes
Pressure rating	16 barg
Available pressure per head	7 barg
Test Pressure	Typically, 1.5 x design pressure.

7.2 Fire Boxes

The fire boxes shall be equipped with various equipment as described below:

- Non percolating hose with instantaneous couplings
- Spray type branch pipe or equivalent.
- Hydrant valve rubber, lip washer

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7.2.1 Hose Box

Design	Free standing
Box shape	Rectangular
Doors	Single
Latch	Non-corrosive and non-lockable
Signage	Applicable statutory signage

7.2.2 Instantaneous Coupling

Coupling connection size	65 NB
Coupling connection type	Female instantaneous connection (double lugged) Male instantaneous connection
Pipeline connection size	80NB
Pipeline connection type	Male BSP tapered thread
End Cap	Snap-on rubber cap secured with chain

7.2.3 Firewater Hose

Design	Non- percolating
Hose Diameter	64 mm
Hose Length	30 m
Hose Couplings	Male instantaneous couplings on inlet Female instantaneous couplings on outlet
Average short length burst pressure	48 bar
Maximum advised working pressure	22.5 bar
Maximum coil diameter	500 mm
Temperature range	-20°C to 50 °C

7.2.4 Branch Pipe

Design	Straight through 19mm nozzle
Coupling connection size	65 NB
Coupling connection type	Male instantaneous Connection
Design pressure	16 bar

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8 MATERIAL OF CONSTRUCTION

Fire Hydrant valve	
Body material	Bronze
Spindle material	Stainless steel 316
Bush and thrust collar	DZR Brass
Seat	Nickel Plated Ductile Iron
Outlet cap	UV Resistant Rubber
Outlet Cap Chain	Stainless Steel 316
Hydrant valve lip washer	Rubber
Fire water hose	
Body	High grade synthetic rubber with a polyamide woven jacket (non-percolating)
Instantaneous Coupling	
Body	Light Alloy
End Cap	UV Resistant Rubber
End Cap Chain	Stainless steel 316
Hose Box	
Body	Mild steel
Stand	Mild steel
Branch pipe	
Body	Aluminium

9 CORROSION PROTECTION

All equipment shall be externally and internally protected. The *Contractor* shall refer to the approved P&IDs for each equipment when preparing the offer for the corrosion protection system.

Corrosion protection specification for all equipment supplied shall be as per the *Contractor's* recommendation and in accordance with international standards specified for installations in normal industrial non-coastal environments.

Notwithstanding the *Contractors'* recommendation, each ductile iron/carbon steel equipment shall be provided with the minimum corrosion protection system as specified in the table below;

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External	Minimum 200 microns DFT epoxy or paint coating to colour Signal Red A11 ,preferred. If a Bronze body is used, no external corrosion coating is required
Internal	Epoxy or Enamel coating (if in contact with aggressive fluids) – *Contractor* to indicate on data sheet

As per SANS 10140-2, subsection 4.4, all equipment intended and used for firefighting purposes, are required to be paint coated in Signal Red A11 as described in SANS 1091.

The *Contractors* standard red or similar equipment colour will be considered subject to approval by the *Employer*. The external corrosion protection of all equipment shall be UV resistant, and the colour of the equipment shall not fade or degrade over time with exposure to the elements.

Equipment made from Brass, Bronze and stainless steel do not require corrosion protection.

10 QUALITY CONTROL

The equipment shall be provided with the following minimum quality control documentation;

Material Certification	Required
EN10204 Type Certificate	Type 3.1 To be applied where necessary
Equipment Data Sheet Approvals	To be prepared by the *Contractor* and submitted to the *Employer* for acceptance prior to procurement of equipment.
Drawing Approvals	Submission of General Arrangement (GA) drawings to the *Employer* for acceptance during the design stage
Factory Pressure Test Certificate	Required

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11 DOCUMENTATION

Each equipment shall be provided with the following documentation;

At tender stage	• OEM equipment data sheet with dimensioned drawing. • Applicable design standards.
Design stage	• Equipment data sheets for *Employers* acceptance. • General Arrangement (GA) drawing for *Employers* approval. The GA shall indicate the location handwheels etc. to be reviewed and accepted by the *Employer*. • IA Certificates (if applicable).
Delivery to site	• Design standard certificate. • Certificate of manufacture. • Material certificates. • Factory pressure test certificate. • Installation and maintenance manual. • Spare parts list. • A general arrangement. • Maintenance and operation manuals. • Performance data to indicate the hydraulic performance of the equipment including the pressure drop at all flow rates (may be graph, chart, or equations).

12 GENERAL

The equipment selection, supply and delivery shall adhere to the following specific requirements;

12.1 Equipment:

1) All shall be new and manufactured from all new materials unless otherwise specified in the enquiry.

2) All equipment is required to be SANS compliant.

3) Equipment and ancillary equipment shall:

- Be lockable in the open and closed position.
- Be provided with polypropylene valve lock seals for each valve.
- All valves shall be right-handed / open through clockwise motion of input.

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- Shall be suitable for outdoor use and shall not be adversely affected by rainfall or exposure to sunlight.
- Valves shall reliably open and close even after extended periods in open or closed position.

4) All equipment must be of high quality and suitable for a long service life of occasional use. Equipment should provide at least 20 years of service, subject to the *Contractors* specified maintenance regime.

5) Each piece of equipment shall be tagged and permanently attached with a minimum 16-gauge stainless steel plate of minimum dimensions 15mm high by 50 mm long. The tags shall be attached with 16-gauge stainless steel wire to the equipment and shall not be attached to the equipment handles or in a way that interferes with installation or operation of the equipment. Tags shall not be attached through bolt holes. The equipment tag number as specified on the approved P&IDs shall be permanently hammer stamped on the tag. The height of the text on the tag shall be a minimum of 10 mm high.

6) All hydrant hose boxes shall be signal red in colour and shall be marked externally “FIRE HOSE” and be provided with a statutory signage indicating location on site.

12.2 Supply

1) The *Contractor* shall provide installation instructions detailing the labour, equipment and any special procedures, tools, equipment, or personnel required for the installation.

2) The *Contractor* shall include the provision of all specialist tools, equipment, and services necessary for the installation and / or maintenance of the equipment.

3) The material of manufacture of all parts shall be specified on the equipment drawings or data sheets. Submission of this information does not in any way negate the *Contractor’s* responsibility to ensure that the specified materials are suitable for the service required by this or any other documents pertaining to the enquiry.

4) The *Contractor* is to provide full operating and maintenance and overhaul manuals including detailed section and exploded diagrams of the equipment, parts lists, typical spares lists and pricing.

5) The *Contractor* is to provide drawings indicating all relevant dimensions affecting the installation including space required to perform maintenance.

6) The *Contractor* shall provide a copy of all manufacturers coating specifications relevant to the products specified.

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12.3 Storage:

Storage of the equipment shall be:

- Undercover
- On dunnage, made of inert material, at least 150mm above ground level.
- All openings shall be sealed.

The equipment shall be stored in an area away from regular vehicle movements and contamination by incompatible materials (e.g. carbon steel and stainless steel).

12.4 Delivery:

1) Prior to delivery, the *Contractor* shall invite the *Employer* to the OEM's premises for an inspection of the equipment to ensure conformance to this specification. The *Contractor* shall only deliver the equipment to site once a release certificate for each item of equipment shown on the datasheet issued.

2) They shall be loaded and transported on suitable transport arranged by the *Contractor*. All items shall be secured on the transport vehicle to avoid damage to the equipment and coatings. equipment shall not be allowed to rest directly against each other.

3) All stainless-steel equipment items are to be kept free of contamination by incompatible materials such as carbon steel grindings, etc. Should equipment become contaminated, the *Contractor* shall clean the equipment at his own expense. If this is unsuccessful, the *Contractor* shall replace the equipment at his own expense.

4) Equipment shall be supplied with plastic end caps on all end connections.

5) Equipment shall be supplied in sealed wooden containers with plastic linings. A plastic lining shall be wrapped around each individual item. Flange faces and mating surfaces shall be protected during transport and handling.

6) Equipment shall be separated so as not to bear against each other and shall be firmly secured by suitable padded lashings to prevent movement and damage in transit. The equipment shall not be dropped, bumped, or subjected to shock or rough handling and any equipment damaged during transport or handling may be rejected by the *Employer*.

7) The *Contractor* shall make allowance for and comply with all the *Employers* Health Safety Security and Environmental (HSSE) requirements at the delivery point.

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8) The *Contractor* shall allow for off-loading to a location on site as directed by the *Employers* representative. An off-loading method statement in compliance with the *Employers* HSE policy shall be supplied for approval prior to delivery.

13 DOCUMENTATION SUPPLY

Documents to be supplied upon award of the supply contract shall include:

1) Installation, operation and maintenance manual

2) Spare parts list

3) A general arrangement.

4) Equipment data sheets for *Employers* acceptance

5) Equipment design and construction information for each piece of equipment (sales documents)

6) Approval documents (and indication of equivalency if required in Section 9 and 10).

7) Performance data to indicate the hydraulic performance of the equipment including the pressure drop at all flow rates (maybe graph, chart or equation).

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FIRE SYSTEM SPECIFICATION

FOAM CONCENTRATE TANK SPECIFICATION

Document number	PL 911
Version number	3
Classification	Unclassified
Effective date	1 July 2025
Review date	1 July 2028

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SUMMARY VERSION CONTROL

VERSION NO.	NATURE OF AMENDMENT	PAGE NO.	DATE REVISED
0	New Specification	ALL	1 July 2025
1	Comments during review between TPL and GreyJones included	ALL	23 July 2025
2	Comments and review from TPL	ALL	27 August 2025
3	Updated drawing reference	ALL	5 February 2026

Note: Only latest amendments and/or additions are reflected in italics in the body of the document.

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DOCUMENTATION SIGN-OFF SHEET

I, the undersigned hereby approve this procedure.

ROLE	CAPACITY/ FUNCTION	SIGNATURE	DATE
Compiled by:	**Pieter Jacobs**		
Approved by:	**Papa Moratwe**		

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TECHNICAL SPECIFICATION – FOAM CONCENTRATE TANK

1 INTRODUCTION

This specification covers the design, fabrication, manufacture, procurement, supply, delivery to site, installation and handover documentation of the glass reinforced plastic (GRP) foam concentrate storage Tank and associated equipment to be used within Transnet Pipelines fire protection systems.

Where the terms 'Tank' and 'equipment' are used in this specification, they shall be interpreted to mean Plant and Materials as defined in NEC3 Clause 11.2(12).

This specification is not site specific but has been prepared as a generic project specification. Site specific equipment data sheets specifying the site-specific data pertaining to each item of equipment are to be developed by the *Contractor* and submitted to the *Employer* for acceptance.

The process fluids for the equipment will be foam concentrate.

Properties of the foam concentrate can be found in the Foam Concentrate Specification, document PL 915. The *Contractor* shall review the properties of the foam concentrate when determining the suitability with the equipment.

The *Contractor* shall review the equipment specific data sheet for each item of equipment to become familiar with the operating conditions of the equipment prior to submission of the offer.

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2 DEFINITIONS

The following definitions shall apply when reading this specification;

Term	Definition
^{0}C	Degrees Celsius
ASME	American Society of Mechanical Engineers
ASTM	American Society for Testing & Materials and its successor ASTM International
API	American Petroleum Institute
AR-SFFF	Alcohol Resistant Synthetic Fluorine Free Foam
barg	Gauge pressure with units bar
cP	Centipoise
cST	Centistoke
DFT	Dry Film Thickness
GRP	Glass Reinforced Plastic
IA	Intrinsic Approval
ISO	International Standards Organisation
kg/m^3	Kilograms per cubic metre
m^3	Cubic Metre
OEM	Original Equipment Manufacturer
RFSO	Raised Face Slip-on
SANS	South African National Standards
SOQ	Schedule of Quantities
Contractor	The successful tenderer
Employer	Transnet Pipelines
UV	Ultra-violet

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3 ENGINEERING STANDARDS

Although not bound in nor issued with this document, the following standardized specifications shall form part of the contract document:

3.1 Applicable Standards

ASME B16.5	Pipe Flanges and Flange Fittings
BS 6464	Specification for reinforced plastic pipes, fittings and joints for process plants
ISO 9001	Quality Management
NFPA 20	Standard for the Installation of Stationary Pumps for Fire Protection
SANS 10089-1	The Petroleum Industry Part 1: Storage and distribution of petroleum products in above-ground bulk installations
SANS 10228	The identification and classification of dangerous goods for transport
SANS 53121 (EN 13121).	GRP Tanks and vessels for use above ground
SANS 1700	Fasteners
SANS 1091	National colour standard
SANS 10140-2	Identification Colour Marking Part 2: Identification of Hazards and Equipment in Work.

3.2 Referenced Standards

PL 915	Foam Concentrate
PL 917	Equipment Handover and Document Procedure

4 LOCATION

The *Contractor* shall take cognizance of the following data of the Tank location when preparing the offer;

City	*Contractor* to indicate on data sheet.
Depot	Transnet Pipelines – *Contractor* to indicate on data sheet.
Area	*Contractor* to indicate on data sheet.

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5 PROCESS FLUID DATA

The *Contractor* shall take cognizance of the following process fluid data for the Tank when preparing the offer;

Process Fluid 1	Foam Concentrate
Temperature @ Operating Point	5 - 35 °C
Density @ Operating Point	1000 - 1100 kg/m³
Viscosity @ Operating Point	2625 cP at 20°C (Non- Newtonian)

Process fluid data shown to be confirmed by the *Contractor* during the detailed design.

6 PROCESS DATA

The *Contractor* shall take cognizance of the following process data for the Tank when preparing the offer;

Maximum Flow Rate Into Tank	*Contractor* to indicate on data sheet.
Maximum Flow Rate Out of Tank	*Contractor* to indicate on data sheet.
Maximum Design Temperature	60^0 C
Minimum Design Temperature	0^0 C
Operating Temperature	Ambient for site
Design Pressure	Max. pressure drop across desiccant breather at 2 x max inlet flow rate to tank
Operating Pressure	Atmospheric
Design Vacuum	Max. pressure drop across desiccant breather at 2 x max outlet flow rate from tank
Mode of Operation	Cyclic
SANS 10228 Classification	Class 8 : Corrosives
Maximum Operating Level	*Contractor* to indicate on data sheet.
Minimum Operating Level	*Contractor* to indicate on data sheet.

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7 TANK DESIGN DATA

The *Contractor* shall take cognizance of the following physical properties of the Tank when preparing the offer;

Design Code	SANS 53121 (EN 13121)
Tank Design Form Factor	Circular
Tank Design Volume Required at 3%	*Contractor* to indicate on data sheet. (the Tank shall be designed for this volume)
Tank Design Internal Diameter	*Contractor* to indicate on data sheet.
Tank Bottom	Flat
Tank Top	Semi Torispherical
Support Type	Fully Supported by Concrete Foundation
Lifting Lugs	Yes – Manufacturers Design and Recommendation
Cat Ladder	None
Insulation	None
SANS 347 Categorisation	Not Regulated
Wind Loading	*The Contractor* to provide
Tank Level Indication	By clear sight tube mounted on side of tank.
Final Tank Colour	Midnight Blue (Plascon G116)

8 TANK NOZZLES

All nozzles shall be ANSI Class 150 raised face slip-on (RFSO) in accordance with ASME B16.5.

The *Contractor* shall submit to the *Employer* a drawing of the foam concentrate tank showing the nozzle and equipment positions, sizes and elevations to be fitted on the tank.

The *Contractor* shall not proceed with the fabrication and installation of the nozzles until the *Employer* has accepted the drawing indicating the locations of the nozzles and other relevant equipment.

A selection of the nozzles will be double sided.

9 TANK ANCILLARIES

The *Contractor* shall manufacture and install the following equipment on the Tank;

1) Inlet drop tube on the Tank filling and recirculation line (nozzles A1, A2, A3 and A4)

The inlet drop tubes shall be fabricated from GRP in accordance with BS 6464 or stainless steel 316 as indicated on the general arrangement drawing.

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The inlet drop tubes will each be flanged on one end and will be bolted to the Tank internal side of the respective double-sided flange.

The inlet drop tubes will be supported from the internal Tank shell on the inside of the Tank. The *Contractor* will be required to design the connection between the inlet drop tube supports and the Tank wall.

2) Anti-vortex device on the foam pump suction line outlet (nozzle B1)

The anti-vortex device shall be fabricated from stainless steel 316 and will comply largely with the NFPA 20 design for anti-vortex devices.

The anti-vortex device will be flanged on one end and will be bolted to the Tank internal side of the respective double-sided flange.

The anti-vortex device will be supported from the floor on the inside of the Tank. The *Contractor* will be required to design the removable connection between the underside of the anti-vortex device and the Tank floor.

3) Tank vent (nozzle V1)

The Tank will vent through a stainless-steel pipeline. The specification of the pipeline shall be in accordance with the project specification. The outlet of the pipeline shall be fitted with a desiccant breather to prevent moisture ingress and contamination of the product. The pipeline shall be supported from the outside shell of the Tank as indicated on the general arrangement drawing. The desiccant breather shall be sized for twice the maximum inflow and outflow of the storage tank, and shall take into account tank breathing that may occur due to ambient temperature differentials.

4) Visual Tank level indicator with float (nozzles G1 and G2)

The Tank will be fitted with a visual Tank level indicator with float.

The Tank level indicator shall be designed, submitted to the *Employer* for acceptance, supplied in accordance with the *Employer's* requirements, fabricated, constructed and installed on the Tank nozzles G1 and G2 as indicated on the general arrangement drawing.

The Tank level indicator shall be constructed of clear PVC schedule 80 50NB pipe and fittings and shall be provided with a drain flange and flanged fittings to connect to the flanges of the stainless steel piping system. The Tank level indicator shall be fitted with a red 40mm ball float (similar to a table tennis ball) prior to final installation. The Tank level indicator with float shall be installed and tested during the hydraulic fill test.

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5) Foam concentrate sampling point (Nozzle S1)

The tank will be provided with a sampling point to sample test foam concentrate.

6) Tank Manhole (Nozzle M1 and M2)

The tank manholes will be used as an access point for inspection, maintenance, and cleaning. The manhole shall be sealed with gaskets to prevent any leakages from occurring. It is the responsibility of the *Contractor* to ensure the manhole is tested for leakages and the results of it must be approved by the *Employer*.

7) Low-level Nozzle (Nozzle D1)

The use of the low-level nozzles it to assist in the flushing the tank floor for tank cleaning in the event of contaminated foam.

10 MATERIALS OF CONSTRUCTION

The *Contractor* shall take cognizance of the following materials of construction when preparing the offer;

Tank Materials	Glass Reinforced Plastic (GRP) - Manufacturers standard in accordance with the design code
Piping	ASTM A312 316L in accordance with the project specification or GRP in accordance with BS 6464
Fittings	ASTM A403 WP316L in accordance with project specification or GRP
Flanges	ASTM A182 F316L RFSO 150LB or GRP to ASME B16.5 Class 150 pattern
Bolting	Stainless steel A4-70 to SANS 1700-5-8
Flange Gaskets	KlingerSIL C-4400 or similar approved
Miscellaneous Steel Components	Stainless steel 316
Tank Nameplate	Stainless Steel 316

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11 TANK IDENTIFICATION AND MARKING

All text and numerals shall be painted on the Tank in accordance with the following specifications;

1) Numerals and letters shall be in Arial Font colour black
2) Characters shall be of such size as to be clearly visible and identifiable
3) Characters shall be of minimum height 290 mm and of minimum width 25 mm.

The *Contractor* shall paint the following text on the Tank at a location as determined by the *Employer* on site;

1) *Contractor* The Tank number as indicated on the approved tank data sheet that will be prepared by the and submitted to the *Employer* for acceptance.
2) The text “FOAM CONCENTRATE TANK”
3) The design volume required as depicted on the approved tank data sheet

The *Contractor* shall paint as separate indications the tank levels of the Tank in accordance with the levels indicated on the approved Tank data sheet.

The usable volume of the Tank during 3% storage of foam concentrate shall be indicated as follows;

Tank Mark	**Setting**
100%	*Contractor* to indicate on data sheet.
0%	*Contractor* to indicate on data sheet.

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The Tank shall be permanently fitted with a nameplate in a location and size approved by the *Employer* that indicates as a minimum the following information;

Contract Number	*Contractor* to provide
Client	Transnet Pipelines (TPL)
Order Number	*Contractor* to provide
Manufacturers Reference	*Contractor* to provide
Date of Manufacture	*Contractor* to provide
Design Code	*Contractor* to provide
Design Pressure	16 barg
Design Vacuum	*Contractor* to provide
Safe Fill Level	*Contractor* to provide
Test Pressure	1.5 x Design Pressure
Product Stored	*Contractor* to provide
Inspection Category	*Contractor* to provide
Inspection Authority	*Contractor* to provide
Empty Mass	*Contractor* to provide
Capacity	*Contractor* to provide
Equipment Number	As shown on the approved P&ID
Design Temperature	60^0 C
Maximum Operating Temperature	35^0 C
Design SG	*Contractor* to provide

The Tank nameplates shall be submitted to the *Employer* for review and acceptance prior to fabrication.

12 TANK FOUNDATION

The Tank foundation will be designed by the *Contractor* in conjunction with design data input from the OEM and the applicable standards.

The *Contractor* shall provide the following information on the datasheet;

1) The gross mass of the Tank
2) Any construction tolerances that apply to the top of the Tank foundation or finishing requirements
3) Tank floor and Tank foundation interface specification (if required)

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13 TESTING

The *Contractor* shall complete all testing required for approval and certification of the Tanks that must be approved by the *Employer*.

The *Contractor* shall perform an onsite hydraulic fill test of the Tank for a minimum duration of 1 hour that is witnessed by the *Employer* using water to a fill height that accounts for the variance in density between the test fluid and the process fluid. The water for the hydraulic fill test will be provided by the *Employer*. The Tank shall be fitted with all Tank ancillaries during performance of the hydraulic fill test. The *Contractor* shall empty, clean and dry the inside of the tank prior to the introduction of foam concentrate.

14 QUALITY CONTROL

The Tank design, fabrication and quality control shall be performed by an ISO 9001 accredited company.

14.1 Quality Control Plan

Prior to the commencement of any work by the *Contractor*, the *Contractor* shall submit to the *Employer* for acceptance a detailed quality control plan.

14.2 Documentation

The Tanks shall be provided with the following minimum quality control documentation;

Material Certificates	Required
Approved for Construction/Fabrication Drawings	Required
Design Calculations	Required
Punch Lists and Handover Certificates	Required
As-built Drawings	Required
Shop Fill Test Certificate	Required
Site Fill Test	Required – witnessed by the *Employer* or the *Employers* AIA
Quality Assurance Data book	2 OFF hard copies and scanned soft copy

14.3 Foundation

Prior to the installation of the Tank, the Tank manufacturer shall inspect the foundation to ensure that the foundation is acceptable and ready for installation of the Tank. The results of this inspection must be acknowledged by the *Employer*, as well as any discrepancies.

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14.4 Tank Piping Ancillaries and Tank Accessories

Prior to the installation of the Tank piping ancillaries, the *Contractor* shall present to the *Employer* the Tank piping ancillaries to enable the *Employer* to verify that the construction of the Tank piping ancillaries meet with the design requirements of the *Employer*.

15 INSTALLATION, HANDOVER AND COMMISSIONING REQUIREMENTS

Prior to delivery, the *Contractor* shall invite the *Employer* to the OEM's premises for an inspection of the Tank to ensure conformance to this specification. The *Contractor* shall only deliver the equipment to site once a release certificate for each item of equipment shown on the datasheet issued.

The *Contractor* shall comply with the *Employer's* Equipment Handover and Document Procedure, document PL 917.

Prior to filling the Tank with the process fluid, the *Contractor* shall invite the *Employer* to perform a punch of the Tank. The *Contractor* shall complete all punch items prior to being issued with a 'Ready for Fill' certificate signed by the *Employer*. The *Contractor* shall not fill the Tank with the process fluid until the 'Ready for Fill' certificate has been signed by the *Employer.*

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16 DOCUMENTATION

Data packs shall be provided in an indexed lever arch file, with a scanned electronic copy for the Tank, detailing the following but not limited to items;

1) Third party inspection reports.
2) Approved Tank design.
3) Design Calculations.
4) Approved for Construction/Fabrication Drawings.
5) As-built Drawings.
6) Tank Data sheets for *Employers* acceptance.
7) Punch Lists and Handover Documentation.
8) Material certificates.
9) NDT (Non-Destructive Testing) Reports.
10) Certificate of compliance.

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FIRE SYSTEM SPECIFICATION

PIPING SUPPLY AND INSTALLATION SPECIFICATION

Document number	PL 912
Version number	1
Classification	Unclassified
Effective date	1 July 2025
Review date	1 July 2028

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SUMMARY VERSION CONTROL

VERSION NO.	NATURE OF AMENDMENT	PAGE NO.	DATE REVISED
0	New Specification	ALL	1 July 2025
1	Comments during review between TPL and GreyJones included	ALL	30 July 2025

Note: Only latest amendments and/or additions are reflected in italics in the body of the document.

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DOCUMENTATION SIGN-OFF SHEET

I, the undersigned hereby approve this procedure.

ROLE	CAPACITY/ FUNCTION	SIGNATURE	DATE
Compiled by:	**Pieter Jacobs**		
Approved by:	**Papa Moratwe**		

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TECHNICAL SPECIFICATION - PIPING SUPLLYING AND INSTALATION SPECIFICATION

1. INTRODUCTION

This specification covers the design, fabrication, manufacture, procurement, supply, delivery to site and handover documentation of the piping systems within Transnet Pipelines fire protection systems.

Where the terms ‘piping supply’, ‘fittings’, ‘equipment’, ‘pipes’ etc. are used in this specification, they shall be interpreted to mean Plant and Materials as defined in NEC3 Clause 11.2(12).

This specification is not site specific but has been prepared as a generic project specification.

The piping system for the firefighting protection system must be designed in accordance with the following codes and standards;

- Occupational Health and Safety Act
- SANS 10089-1
- Pressure Equipment Regulations
- SANS 347
- ASME B31.3

The fire protection system design also utilizes applicable NFPA codes where appropriate.

For steel piping classified in accordance with SANS 347 as ‘Not Regulated (NR)’ or ‘Sound Engineering Practice (SEP)’, Category D of ASME B31.3 has been chosen as the design, fabrication, assembly, erection, inspection, examination and testing code for the piping system and is amplified and at times attenuated by the requirements of this specification.

For steel piping classified in accordance with SANS 347 as ‘Category 1’ or higher, Normal Fluid Service of ASME B31.3 has been chosen as the design, fabrication, assembly, erection, inspection, examination and testing code for the piping system and is at times amplified by the requirements of this specification.

Where a conflict exists between ASME B31.3 and this specification for steel piping classified as NR or SEP, this specification shall take precedence.

Where a conflict exists between ASME B31.3 and this specification for steel piping classified as Category 1 or higher, the *Contractor* shall notify the *Employer* in writing of the conflict and the *Employer* shall solely determine the means for corrective action.

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For non-metallic piping classified in accordance with SANS 347 as ‘Not Regulated (NR)’ or ‘Sound Engineering Practice (SEP)’, SANS 10268, SANS 10269, SANS 10270, SANS 4427, SANS 6269 and ASME F2164 has been chosen as the design, fabrication, assembly, erection, inspection, examination and testing codes for the piping system and is amplified by the requirements of this specification.

This specification forms an integral component of the Works Information and details the design, material specification, procurement, supply, delivery to site, fabrication, assembly, erection, inspection, examination, testing and handover requirements for the piping system that is to be executed by the *Contractor* during the provision of the *works*.

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2. ACRONYMS AND DEFINITIONS

Term	Definition
^{0}C	Degrees Celsius
≥	Greater than and equal to
≤	Less than and equal to
>	Greater than
<	Less than
AIA	Approved Inspection Authority
AFC	Approved For Construction
ANSI	American National Standards Institute
API	American Petroleum Institute
ASME	American Society of Mechanical Engineers
ASTM	American Society for Testing and Materials
Contractor	As defined in the Contract Data
CS	Carbon Steel
DFT	Dry Film Thickness
Employer	As defined in the Contract Data
ERW	Electric Resistance Welding
Fire Areas	Defined as the area encompassed by a horizontal line 300mm below the top of a bund wall and a vertical line 3000mm externally offset from a bund wall
GA	General Arrangement
Gr.	Grade (referring to material specification as listed in the relevant standard)
HDPE	High Density Polyethylene
IPE	Inspector of Pressurised Equipment
LB	Pound
m	Metres
mm	Millimetres
NB	Nominal Bore
NDE	Non-destructive Examination
NDT	Non-destructive Testing
NFPA	National Fire Protection Association
NR	Not Regulated
OEM	Original Equipment Manufacturer
PDF	Portable Document Format
Employer	As defined in the Contract Data
OD	Outer Diameter

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OEM	Original Equipment Manufacturer
PN	Pressure Nominal
PSL	Produce Standard Level
PVC	Poly-vinyl Chloride
QA	Quality Assurance
QCP	Quality Control Plan
RF	Raised Face
SANS	South African National Standard
SABS	South African Bureau of Standards
Sch.	Schedule (referring to pipe wall thickness)
SDR	Standard Dimension Ratio
SEP	Sound Engineering Practice
SS	Stainless Steel
Std.	Standard (Referring to pipe wall thickness – typically Sch. 40)
TPL	Transnet Pipelines

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3. ENGINEERING STANDARDS

Although not bound in nor issued with this document, the following standardized specifications shall form part of the contract document and shall be read in conjunction with this specification:

3.1 Applicable Standards

ASME IX	Boiler and Pressure Vessel Code Section IX
ASME B16.5	Pipe Flanges and Flange Fittings
ASME B16.9	Factory Made Wrought Buttwelding Fittings
ASME B16.11	Forged Fittings, Socket-Welding and Threaded
ASME B31.3	Process Piping
ASME B36.10M	Welded and Seamless Wrought Steel Pipe
ASME B16.47	Large Diameter Steel Flanges
ASME B16.48	Steel Line Blanks
ASME B46.1	Surface Texture, Surface Roughness, Waviness and Lay
ASME F2164	Standard Practice for Field Leak Testing of Polyethylene Pressure Pipe Systems Using Hydrostatic Pressure
ASTM A53	Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
ASTM A105	Steel Forging
ASTM A106	Steel Pipes
ASTM A182	Stainless Steel Forgings
ASTM A234	Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service
ASTM A240	Stainless Steel Plate
ASTM A312	Stainless Steel Fittings
ASTM A516	Standard Specification for Pressure Vessel Plates, Carbon Steel, for Moderate- and Lower-Temperature Service
API 5L	Specification for Line Pipe
API 650	Welded Tanks for Oil Storage
API 653	Tank Inspection, Repair, Alteration, and Reconstruction
API 1104	Welding of Pipelines and Related Facilities
EN 10204	Metallic products - Types of inspection documents
MSS SP-97	Integrally Reinforced Branch Outlet Fittings
OSHAct	Occupational Health and Safety Act and Regulations 85 of 1993
SANS 32	Internal and/or external protective coatings for steel tubes — Specification for hot dip galvanized coatings applied in automatic plants
SANS 121	Hot dip galvanized coatings on fabricated iron and steel articles - Specifications and test methods

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SANS 347	Categorisation and Conformity Assessment Criteria for All Pressure Equipment
SANS 1091	National Colour Standard
SANS 1200	Standardised Specification for Civil Engineering Construction
SANS 1445	Thermal insulation materials for Industrial Application
SANS 1700	Fasteners
SANS 4427	Plastic Piping Systems – Polyethylene Pipes and Fittings for Water Supply
SANS 6269	Welding of thermoplastics – Test Methods for Welded Joints
SANS 9288	Thermal Insulation – Heat Transfer by Radiation – Physical Quantities and definitions
SANS 10089-1	Part 1: Storage and Distribution of Petroleum Products in above-ground Bulk Installations
SANS 10129	Plastic Tape Wrapping of Steel Pipelines
SANS 10140	Identification Colour Marking
SANS 10268	Welding of thermoplastics – Welding Processes
SANS 10269	Welding of thermoplastics – Testing and Approval of Welders
SANS 10270	Welding of thermoplastics – Approval of Welding Procedures and Welds
SANS 10684	Fasteners - Hot dip galvanized coatings
SANS 12944	Paints and Varnishes – Corrosion Protection of Steel Structures by Protective Paint Systems
SANS 61241	Code of Practice for Thermal Insulation of pipework and equipment in the temperature range of -100^{0}C to + 870^{0}C

3.2 Referenced Standards

PL 407	Specification for Painting of Manifold Piping and Ancillary Equipment
PL 415/G	Specifications Requirements for Steel Flange Insulating Gasket Kit
PL 838/1	Application of a Corrosion Protection Lining to the Interior Surfaces of Steel Tanks, or Part thereof, Used for Storage of Petroleum Product
PL 838/2	Application of a Corrosion Protection Coating to the Exterior Surfaces of Steel Tanks used for Storage of Petroleum Product
PL 877	Transnet Pipelines Colour Coding of Pipelines and Ancillary Equipment.
PL 915	Foam Concentrate

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4. SYSTEM DESIGN

The nominal system design pressures will be as follows;

Material Specification	Nominal Design Pressure (kPag)
Carbon Steel	1600
Stainless Steel	1600
HDPE	1600

The *Contractor* shall use the values in the above table as a guideline when reviewing this specification as the indicated pressures are nominal only. The actual piping system design pressures shall be determined by the *Contractor* but at no times shall be less than the values in the above table.

5. PROCESS FLUID DATA

The *Contractor* shall use the following process fluid data for the system during the detailed design;

Process Fluid 1	Water
Temperature @ Operating Point	5 - 50 °C
Density @ Operating Point	997 kg/m³ @ 25°C
Viscosity @ Operating Point	0.9 cP at 25°C
Process Fluid 2	Foam Concentrate
Temperature @ Operating Point	5 - 35 °C
Density @ Operating Point	1000 - 1100 kg/m³
Viscosity @ Operating Point	2625 cP at 20°C (Non-Newtonian)
Process Fluid 3	Foam Pre-mix
Temperature @ Operating Point	5 - 50 °C
Density @ Operating Point	997 kg/m³ @ 25°C
Viscosity @ Operating Point	0.9 cP at 25°C

Process fluid data shown to be confirmed by the *Contractor* during the detailed design.

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6. PIPING MATERIAL SPECIFICATIONS

The design, procurement and supply of piping material shall adhere to the specific requirements indicated in this document.

6.1 Fasteners

All fasteners shall be of the hexagon bolt and hexagon nut type and conform as a minimum to SANS 1700 including the following:

- All fasteners used shall be metric fasteners.
- All fasteners to be supplied and fitted in flanges in accordance with the specified ASME flange bolt tables.
- Each bolt head is fitted with a flat washer to match the specification of the bolt.
- Each nut is fitted with a flat washer to match the specification of the bolt.
- Each bolt length is sized so that a minimum of two, and a maximum of five full threads are visible.
- No bolts are cut to the 'right' size.
- All fasteners are new.
- Carbon steel bolts, nuts and washers shall be ordered as hot-dipped galvanized to SANS 121 (ISO 1461) as specified in SANS 1700-7-7 with the necessary thread under-cuts as required by SANS 1700
- *Contractor* to verify the length of the bolts prior to procurement for each flange set and special equipment items. The *Contractor* is recommended to submit to the *Employer,* for approval, the projected thread length for each of the flange pair sizes. Bolt lengths for specials (wafer type equipment, orifice plate flanges etc.) will be reviewed in accordance with this specification during the site construction QA procedure.
- No painting of stainless steel and/or galvanized carbon steel nuts, bolts and washers will be permitted. Flanges are to be painted prior to insertion of bolts/studs and bolt-up.
- The stainless-steel bolting specification shall be applied to all carbon steel to stainless steel flange joints. Carbon steel bolting shall not be permitted on any stainless-steel flange joints.

  Material specifications shall be indicated on the approved for construction drawings and isometrics prepared by the *Contractor*. Should the Works Information indicate a specification not addressed in this document, this discrepancy shall be addressed with the *Employer* prior to the *Contractor* producing AFC drawings.

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6.2 Carbon Steel Piping (Black and Galvanized)

This piping spec shall be used through the project for the carbon steel piping and shall remain with the size range as provided below:

- Spec I : Ø ≤ 40NB.
- Spec II : 50NB ≤ Ø ≤ 150NB
- Spec III: 200NB ≤ Ø ≤ 600NB

The schedule of the pipe and fittings shall be as per the below table unless otherwise stated.

Table 1					
Spec I – Carbon steel piping (≤40NB)					
Item no.	**Component**	**Ends**	**Type**	**Material Spec**	**Dimension Spec**
1	Pipe	Plain End	CS Pipe Seamless	ASTM A106 Gr B	Sch.80
2	Fittings (Elbow, cap, Red, Tee)	Butt Weld	CS Seamless	ASTM A234 WPB	Sch. 80
3	Olet	Butt Weld	CS Weldolet	ASTM A105	Sch. Same as pipe
4	Flanges	Raised Face	CS Slip on RF or CS Screwed RF	ASTM A105	ANSI B16.5 150LB
5	Gaskets	Raised Face	Ring Gasket CNAF - Aramid fibre gaskets bound with Nitrile Butadine rubber	KlingerSIL C-4400 or approved equivalent	3 mm thick
6	Bolting		CS Forged, Hot-dipped Galvanized	Gr 8.8S U	Length to suit flange connection

Table 2					
Spec II – Carbon Steel Piping (50NB ≤ Ø ≤ 150NB)					
Item no.	**Component**	**Ends**	**Type**	**Material Spec**	**Dimension Spec**
1	Pipe	Plain End	CS Pipe Seamless	ASTM A106 Gr B	Sch. Std.
2	Fittings (Elbow, cap, Red, Tee)	Butt Weld	CS Seamless	ASTM A234 WPB	Sch. Std.
3	Olet	Butt Weld	CS Weldolet	ASTM A105	Sch. Same as pipe
4	Flanges	Raised Face	CS Slip on RF or CS Screwed RF	ASTM A105	ANSI B16.5 150LB

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Table 2					
Spec II – Carbon Steel Piping (50NB ≤ Ø ≤ 150NB)					
Item no.	**Component**	**Ends**	**Type**	**Material Spec**	**Dimension Spec**
5	Gaskets	Raised Face	Ring Gasket CNAF - Aramid fibre gaskets bound with Nitrile Butadine rubber	KlingerSIL C-4400 or approved equivalent	3 mm thick
6	Bolting		CS Forged, Hot-dipped Galvanized	Gr 8.8S U	Length to suit flange connection

Table 3					
Spec III – Carbon Steel Piping (200NB ≤ Ø ≤ 600NB)					
Item no.	**Component**	**Ends**	**Type**	**Material Spec**	**Dimension Spec**
1	Pipe	Plain End	CS Pipe Seamed (ERW)	API 5L Gr. B PSL1	Sch. Std.
2	Fittings (Elbow, Red, Tee)	Butt Weld	CS Seamed (ERW)	ASTM A234 WPBW	Sch. Std.
3	Cap	Butt Weld	CS Seamless	ASTM A234 WPB	Sch. Std.
4	Olet	Butt Weld	CS Weldolet	ASTM A105	Sch. Same as pipe
5	Flanges	Raised Face	CS Slip on RF or CS Screwed RF	ASTM A105	ANSI B16.5 150LB
6	Gaskets	Raised Face	Ring Gasket CNAF - Aramid fibre gaskets bound with Nitrile Butadine rubber	KlingerSIL C-4400 or approved equivalent	3 mm thick
7	Bolting		CS Forged, Hot-dipped Galvanized	Gr 8.8S U	Length to suit flange connection

Where piping is specified as seamed, under no circumstances will helical seamed pipe be accepted. All seamed piping shall be of the longitudinal seam type.

Only where bolts are required to be inserted into threaded sockets (i.e. lugged butterfly valves) electrogalvanized bolts may be utilized.

All piping 100NB and larger shall be procured and supplied as 12 metre lengths.

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All piping smaller than 100NB shall be procured and supplied as 6 metre lengths.

All loose flanges that are hot dipped galvanised shall be centrifuged as part of the hot-dipped galvanizing process.

All elbows shall be supplied as long radius with the bend radius equal to 1.5 times the outside diameter.

Dimensions shall be as per ASTM B36.10M, MSS SP-97 and ASTM B16.9.

All elbows, caps, reducers, tees and olets shall be supplied with beveled ends suitable for butt welding. Where raised face weld neck flanges are specified, they shall be supplied with beveled ends suitable for butt welding.

Flange facing surface finish shall be as per ASME B46.1 (3.2μm to 6.4 μm). In all cases, flange and mating surfaces shall be protected during the coating or galvanizing application process to ensure that the gramophone or machined finish complies with this specification.

Flanges that are hot-dipped galvanized may be supplied flat prior to galvanizing and shall then be machined to achieve a serrated concentric or serrated spiral finish in accordance with ASME B46.1.

6.2.1 Hot-dipped Galvanising

Galvanized components shall be hot-dipped galvanizing in accordance with SANS 32 and SANS 121.

The piping system shall not be modified post galvanizing with the exception of the field fit welds that are to be prepared and completed in accordance with this specification.

6.2.2 Steel Coatings

Unless agreed to in writing between the *Employer* and the *Contractor*, all un-galvanised carbon steel pipe and fittings shall be supplied to site as blasted and primed in accordance with this specification.

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6.3 Stainless Steel Piping

This piping spec shall be used through the project for the Stainless- steel piping and shall remain with the size range as provided below:

- Spec IV: ≤40NB.
- Spec V :50NB ≤ Ø ≤80NB
- Spec VI :100NB ≤ Ø ≤600NB

Table 4					
Spec IV - Standard Stainless-Steel Piping					
Item no.	**Component**	**Ends**	**Type**	**Material Spec**	**Dimension Spec**
1	Pipe	Plain End	SS Seamless Pipe	ASTM A312 316L	Sch. 40s.
2	Fittings (Elbow, cap, Red, Tee)	Butt Weld	SS Seamless	ASTM A403 WP316L-S	Sch. 40s
3	Olet	Butt Weld	SS Weld-olet	ASTM A182 F316L	Sch. Same as pipe
4	Flanges	Raised Face	SS Slip on RF or SS Screwed RF	ASTM A182 F316L	ASME B16.5 150LB
5	Gaskets	Raised Face	Ring Gasket - Aramid fibre gaskets bound with Nitrile Butadine rubber	KlingerSIL C-4400 or Similar approved	3 mm think
6	Bolting		SS (SABS 1700-5-8)	A4-70	Length to suit flange connection

Table 5					
Spec V - Standard Stainless-Steel Piping					
Item no.	**Component**	**Ends**	**Type**	**Material Spec**	**Dimension Spec**
1	Pipe	Plain End	SS Seamless Pipe	ASTM A312 316L	Sch. 10s. (Note)
2	Fittings (Elbow, cap, Red, Tee)	Butt Weld	SS Seamless	ASTM A403 WP316L-S	Sch. 10s. (Note)
3	Olet	Butt Weld	SS Weldolet	ASTM A182 F316L	Sch. Same as pipe
4	Flanges	Raised Face	316 SS Slip on RF or SS Screwed RF	ASTM A182 F316L	ASME B16.5 150LB

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Table 5					
Spec V - Standard Stainless-Steel Piping					
Item no.	**Component**	**Ends**	**Type**	**Material Spec**	**Dimension Spec**
5	Gaskets	Raised Face	Ring Gasket - Aramid fibre gaskets bound with Nitrile Butadine rubber	KlingerSIL C-4400 or Similar approved	3 mm think
6	Bolting		SS (SABS 1700-5-8)	A4-70	Length to suit flange connection

Note: All stainless steel piping and fittings located in fire areas (refer to Section 9.2) to be Schedule 40S

Table 6					
Spec VI - Standard Stainless-Steel Piping					
Item no.	**Component**	**Ends**	**Type**	**Material Spec**	**Dimension Spec**
1	Pipe	Plain End	SS Seamed Pipe	ASTM A312 316L	Sch. 10s. (Note)
2	Fittings (Elbow, Red, Tee)	Butt Weld	SS Seamed	ASTM A403 WP316L-WX	Sch. 10s (Note)
3	Cap	Butt Weld	SS Seamless	ASTM A403 WP316L-S	Sch. Same as pipe
4	Olet	Butt Weld	SS Weldolet	ASTM A182 F316L	Sch. Same as pipe
5	Flanges	Raised Face	SS Slip-on RF or SS Screwed RF	ASTM A182 F316L	ASME B16.5 150LB
6	Gaskets	Raised Face	Ring Gasket - Aramid fibre gaskets bound with Nitrile Butadine rubber	KlingerSIL C-4400 or Similar approved	3 mm think
7	Bolting		SS (SABS 1700-5-8)	A4-70	Length to suit flange connection

Note: All stainless-steel piping and fittings located in fire areas (refer to Section 9.2) to be Schedule 40S

Where piping is specified as seamed, under no circumstances will helical seamed pipe be accepted. All seamed piping shall be of the longitudinal seam type.

All piping 100NB and larger shall be procured and supplied as 12 metre lengths.

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All piping smaller than 100NB shall be procured and supplied as 6 metre lengths.

The schedule of the pipe and fittings shall be as per the above table unless otherwise stated.

All elbows shall be supplied as long radius with the bend radius equal to 1.5 times the outside diameter.

Dimensions shall be as per ASTM B36.10M, MSS SP-97 and ASTM B16.9.

All elbows, caps, reducers, tees and olets shall be supplied with beveled ends suitable for butt welding. Where raised face weld neck flanges are specified they shall be supplied with beveled ends suitable for butt welding.

Flange facing surface finish shall be as per ASME B46.1 (3.2μm to 6.4 μm). In all cases, flange and mating surfaces shall be protected during the coating application process to ensure that the gramophone or machined finish complies with this specification.

6.4 HDPE Piping

This piping spec shall be used through the project for HDPE piping and shall remain with the size range as provided below:

- Class HFE: ≥ 15 NB.

As per SANS 4427 -3 all fittings involving HDPE piping shall not adversely affect the pipe performance or initiate stress cracking.

Table 7

Class HFE - HDPE Piping

Item no.	Component	Type	Material Spec	Dimension Spec
1	Pipe	Black High Density Polyethylene Pipe	SANS 4427-4	PE100, PN 16, SDR 11
2	Fittings	Moulded PE 100, Black High Density Polyethylene	SANS 4427-3	PE100, PN 16, SDR 11
3	Flanges	Hot-Dip Galvanized CS Blind Flange Machined to Suit OD of HDPE Pipe	ASTM A105	ANSI B16.5 150LB
4	Gaskets	Full face - Aramid fibre gaskets bound with Nitrile Butadiene rubber	KlingerSIL C-4400 or Similar approved	3 mm think
5	Bolting	CS Forged, Hot-dipped Galvanized	Gr 8.8S U	Length to suit flange connection

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All connections between PE and steel pipe shall be flange - to - flange and only molded stubs shall be used.

ATM A105 blind flanges to be machined with chamfered edges to the required HDPE OD and to be installed as a backing ring onto the pipe before joining of the stub end to the pipe. All flanges shall be hot dipped galvanized post machining of the blind flange.

HDPE pipe must be traceable and have material class and pipe class identification.

The piping shall be delivered with material certificates indicating the batch, manufacturer, material of manufacture etc.

All fittings must have molded-in or stamped-in identification and appropriate product information.

All fittings shall be molded from recognized top quality virgin PE100 resin.

The *Contractor* shall provide all product approvals for all HDPE piping, molded/extruded fittings and electro-fusion fittings to be supplied. The *Contractor* shall advise what products/manufacturer is proposed and the final product supplier shall be subject to approval by the *Employer*.

The preferred layout of the heating coils contained in each individual fittings up to and including mains dimension 160 mm should be designed so that only one complete process cycle is necessary to fully fuse the fitting to the adjoining pipes or pipeline components as applicable. To enable an easy assembly on site and a possible preassembly of one end of the fitting, electro-fusion fittings of 200 mm and above may be of a bifilar construction (2 separate fusion zones)

Fabricated fittings shall be manufactured by a piping supplier and shall be manufactured from HDPE PE100 at least one pressure class higher than the specified main pipe material.

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6.5 Markings

All steel pipes and steel fittings shall be hard stamped with the mill's heat number.

All pipes and fittings shall be permanently marked as per the relevant standard. The method for marking the pipes and fittings shall be agreed with the *Employers* AIA prior to marking.

As a minimum, the pipes shall be marked with:

- Manufacturer's Name
- Specification
- Specification Grade
- Heat Number
- Hydro/NDE Marking
- "S" for supplementary requirements as specified (stress-relieved annealed tubes, air underwater pressure test, and stabilizing heat treatment)
- Length
- Schedule Number

As a minimum, the fittings shall be marked with:

- Manufacturer
- Size
- Wall Thickness
- Material Specification
- Material Specification Grade
- Heat Code

All flanges shall be permanently marked as per the relevant standard. As a minimum, the flanges shall be marked with:

- Manufacturer's Name
- Size
- Class
- Bore
- Dimension Specification
- Material and Product Identification (ASTM or ASME grade symbol)
- "WP" in grade symbol
- Heat code
- Production code

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7. MATERIAL AND DIMENSIONAL CERTIFICATES

The *Contractor* shall supply all steel pipe and fittings with material certificates as prepared by the mill.

Material certificates for API 5L carbon steel piping shall be supplied in accordance with SR15. This means that certificates of compliance are mandatory (per SR15.1), and full traceability from mill through testing to delivery is required (per SR15.2).

All material batches supplied shall be tested by the mill at an accredited laboratory. The certificates shall all be signed by the responsible mill quality control manager and be stamped by the mill. The certificates shall be provided in hard copy and scanned into PDF format.

Each item of material supplied by the *Contractor* shall be supplied with a certificate verifying that the component has been manufactured in accordance with the applicable dimensional code. The dimensional certification need not be on a separate certificate and can be included on the material certificate. If supplied separately to the material certificate, the dimensional certificates shall be provided in hard copy and scanned into PDF format.

All material certificates shall be in accordance with EN10204 type 3.1. Material supplied from Asian countries shall have material certificates in accordance with EN10204 type 3.2.

Forgings that do not conform to a standard referenced within this specification shall have material certificates prepared and supplied in accordance with EN10204 type 3.2.

In all cases the *Contractor* shall assume the responsibilities defined as the “Manufacturer” and “Intermediary” when supplying material.

If heat treatment is specified, the mechanical properties reflected on the material certificate shall indicate the post heat treatment state and shall include the relevant verified furnace charts.

Pipes and fittings provided without traceable heat numbers and material certificates and that cannot be linked to supplied material, shall be rejected and replaced by the *Contractor* at the *Contractor*s expense.

Third party inspection by an independent company to witness the material tests is not required.

The *Employer* shall at the *Employer*s discretion conduct further material and dimensional testing of the pipe and fittings supplied. Should the pipe or fittings fail the *Employer*s material and/or dimensional tests then the *Contractor* shall remove and replace all material of the subject heat batch at the *Contractor*s expense.

It is the *Contractor*s responsibility to ensure that the material and dimensional certificates are located within the project QA file and are legible.

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8. CORROSION PROTECTION AND PAINTING

8.1 Painting and Identification of Piping

All steel piping systems shall be painted in accordance with SANS 12944 and the *Employer*s specification PL407 with colors compliant to SANS 10140, SANS 1091 and the *Employer*s color standard PL 877.

All sites shall be generally classified as C2 except for sites that are within 20 km of the coast that shall be classified as C5-M, and the Witbank site that shall be classified as C5-I.

Category of corrosivity	**Exterior**	**Interior**
C1 Very low		Buildings with heating and clean atmospheres.
C2 Low	Atmospheres with low levels of contamination. Rural areas.	Unheated buildings with possible condensation.
C3 Medium	Urban and industrial atmospheres, with moderate SO2 contamination. Coastal areas with low salinity.	Manufacturing plants with high humidity and some contamination.
C4 High	Industrial areas and coastal areas with moderate salinity.	Chemical industries, swimming pools.
C5-I Very high (industrial)	Industrial areas with high humidity and with an aggressive atmosphere.	Buildings or areas with almost permanent condensation and high levels of contamination.
C5-M Very high (marine)	Coastal and marine areas with high salinity.	Buildings or areas with permanent condensation and high levels of contamination.

The piping colour coding shall be in accordance with the following;

- Fire Water shall be Signal Red (A11).
- Foam Concentrate shall be Royal Blue (this colour shall be confirmed in writing by the *Employer* at the request of the *Contractor* prior to procurement of the paint).
- Foam Premix shall be Signal Red with White Bands.
- Insulation Flanges shall be painted Signal Red (SANS 1091: A11).

After painting of the insulating flanges, the insulating flanges shall be coated with an insulating varnish such as Insuldyn – Glyptol Red colour. Insulating flanges that are galvanized, or stainless steel shall be prepared in accordance with this specification prior to painting.

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8.1.1 Un-galvanised Carbon Steel Pipe

Prior to the commencement of any blasting or painting of pipe, the *Contractor* shall submit to the *Employer* for acceptance of the proposed corrosion protection system, the method statement as well as a QCP for review and comment. The *Contractor* shall update the proposed corrosion protection system, method statement and the QCP with the *Employer* s comments.

The *Contractor* shall blast and prime all un-galvanized carbon steel piping and fittings prior to delivery to site all in accordance with the *Employer*s specification PL407 as well as the method statement and QCP accepted by the *Employer*. The shop primer coat shall be touched up on site by the *Contractor* prior to application of the intermediate or final coat in accordance with the accepted method statement and QCP.

Notwithstanding the requirements of PL407, the corrosion protection system shall be guaranteed for a minimum life of 15 years. The *Contractor* shall include with the method statement submitted to the *Employer* for acceptance, a letter on the paint manufacturer's letterhead that the proposed corrosion protection system is guaranteed for the required life. The paint manufacturer shall inspect the application of the corrosion protection system as necessary to ensure that the requirements of the guarantee are satisfied.

The *Contractor* shall apply the final coat to all piping and fittings in accordance with PL407 or an alternate corrosion protection system that may include an intermediate and a final coat proposed by the *Contractor* and accepted by the *Employer*.

The *Employer* may at the *Employer*s discretion, appoint an inspection authority to monitor and evaluate hold points of the blasting, primer coat, intermediate coat (if applicable) and top-coat application in accordance with the approved QCP. The *Contractor* shall maintain a file with a separate set of isometric drawings of the latest revision and shall perform dry film thickness (DFT) tests on all four quadrants of the coated piping system at 3 meter centers. Separate DFT tests shall be done on the primer coat and the final coat and shall be recorded in the specified manner. DFT tests of the intermediate coat are not required.

The corrosion system shall be completed and signed off for all piping quadrants that rest on supports prior to installation of the pipe onto the support. Painting of areas of pipe that are inaccessible as they are resting on supports shall not be permitted. Where pipes have been installed on supports before completion of the corrosion protection system, the *Contractor* shall provide temporary supports to the approval of the *Employer* and remove the support to enable completion of the corrosion protection system at the pipe and support interface.

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Over and above final coat application, all steel piping conveying foam premix shall have identification bands applied as per the PL877 and PL407 specifications. The identification bands shall completely obliterate the undercoat and shall be applied to a minimum DFT as specified for the final coat.

Clause 3.3.6 of PL407 shall be interpreted to mean the following;

Post welding, the welding joint shall be stripe coated using a paint brush with the primer coat to the specified DFT over the entire girth of the weld, as well as 30mm on both sides of the weld. The approved corrosion protection system shall then be applied as if it were being applied to blasted pipe. The *Contractor* shall perform DFT tests of all welds of the stripe primer coat, the primer and final coat and record same on the corresponding isometrics.

The *Employer*s appointed inspector will perform random DFT tests to verify the DFT thickness test performed by the *Contractor*. Should 5% of the *Employer*s DFT thickness test sample be found to be of a lesser thickness than the *Contractor*s DFT thickness tests for the same sample, the *Employer*s appointed inspector shall verify all DFT tests performed by the *Contractor* at the *Contractor*s expense. The *Contractor* will then submit a corrosion protection system remedial method statement to the *Employer* for acceptance.

Pipes that run parallel to one another and that are painted with bands, shall have bands that are on the same perpendicular centerline to the axis of the pipes.

The painting of all flanges shall be completed prior to the installation of any bolts/studs and/or nuts. The *Contractor* shall ensure that the corrosion protection system is applied to the internal diameter all bolt holes. Painting of flanges with bolts/studs, washers and/or nuts in-situ is prohibited. The *Contractor* shall remove from the flange set all fasteners from flanges that have been painted and carefully remove paint applied to fasteners without causing damage to the fastener.

8.1.2 Galvanised and Stainless-Steel Pipe

Prior to the commencement of preparation and painting of pipe, the *Contractor* shall submit to the *Employer* for acceptance of the proposed pipe identification system, the method statement as well as a QCP for review and comment. The *Contractor* shall update the proposed pipe identification system, method statement and the QCP with the *Employer'*s comments.

A separate pipe identification system, method statement and QCP shall be submitted for galvanized and stainless-steel pipe.

Stainless steel piping shall be pickled and passivated prior to any preparation and/or painting.

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Notwithstanding the requirements of PL407, the piping identification system shall be guaranteed for a minimum life of 15 years. The *Contractor* shall include with the method statement submitted to the *Employer* for acceptance, a letter on the paint manufacturer's letterhead that the proposed piping identification system is guaranteed for the required life. The paint manufacture shall inspect the application of the piping identification system as necessary to ensure that the requirements of the guarantee are satisfied.

All stainless steel and galvanized carbon steel pipes shall remain unpainted but shall be painted with bands every 6000 mm, at every direction change and 100mm before and 100mm after any wall penetrations, in accordance with the PL407 colour specification for identification:

- For foam concentrate and fire water, a single 300mm band is required
- For foam premix, where the colour code requires red base with white bands, there shall be a 100mm red band, a 100mm white band and a 100mm second red band to indicate the base colour and identifier.
- The pipe shall be fully prepared in accordance with the paint manufacturer's recommendation and the PL407 paint specification.
- Pipes that run parallel to one another and that are painted with bands shall have bands that are on the same perpendicular centreline to the axis of the pipe

The *Employer*s appointed inspector will perform random DFT tests to verify the DFT thickness test performed by the *Contractor*. Should 5% of the *Employer*s DFT thickness test sample be found to be of a lesser thickness than the *Contractor*s DFT thickness tests for the same sample, the *Employer*s appointed inspector will verify all DFT tests performed by the *Contractor* at the *Contractor*s expense. The *Contractor* will then submit a corrosion protection system remedial method statement to the *Employer* for acceptance.

8.2 Additional Corrosion Protection of Underground Piping

All steel below ground shall be protected against corrosion by "Denso" type protective wrapping in accordance with SANS 10129. The product specified by the *Contractor* shall be suitable for the application and approved by the *Employer* prior to procurement.

Piping that penetrates from below ground level to above ground shall be suitably wrapped to a minimum distance of 150mm above the top of the local natural ground level.

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8.3 Corrosion Protection of Structural Steel

All pipe racks and support structures will be hot dipped galvanized to SANS 121 post fabrication and fixed by bolting (to bases or existing structure) on site.

Modification to galvanized structural steel shall not be permitted unless written approval is obtained from the *Employer*.

All modifications to structural steel shall be repaired in accordance with a galvansing repair procedure accepted by the *Employer* that shall be a two-part cold galvanizing product approved for use by galvanizers for repairs to damaged galvanize coatings as appropriate to the repairs being carried out.

Where pipe shoes or structural steel is welded to pipe as required by the design, the corrosion protection system specification for un-galvanised carbon steel pipe shall apply. Pipe shoes or structural steel welded to steel pipe or fittings that is to be galvanized, shall be galvanized during the galvanizing of the pipe or fitting. Welding of galvanized structural steel to galvanized pipe and implementation of the galvanizing repair procedure shall not be accepted as a normal means for fabrication unless written approval is obtained from the *Employer*.

Where dissimilar metals are being used (between the pipe, pipe brackets, u-bolts and pipe supports) suitable isolation means, either teflon strips, isolation kits or top hat washers shall be used to prevent galvanic corrosion.

8.4 Equipment Touch-up of Corrosion Protection System

The *Contractor* shall ensure that no damage is caused to the corrosion protection system, valve internal and external fittings and threads of equipment.

After final installation of all equipment, the *Contractor* shall apply touch-up paint to all installed equipment in accordance with the equipment corrosion protection colour code and specification.

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9. PIPE PROTECTION AGAINST EXTERNAL FACTORS

9.1 Winterisation of piping

All piping less than 50 NB which are not normally empty and that are installed outdoors shall be insulated to prevent freezing which would render them inoperable. No winterizing shall be provided within the bunds.

The temperature of piping or instrument tubing containing process fluid is to be subjected to ambient conditions and suitably insulated and cladded to prevent the process fluid from dropping below 4 °C.

The *Contractor* shall provide all calculations to the *Employer* demonstrating that the proposed lagging and cladding design satisfies these conditions for the site ambient conditions.

Insulation is to be designed and installed in accordance with SANS 1445, lagging and aluminum cladding shall be non-flammable but need not provide protection against heat or flame exposure.

9.2 Fireproofing

A suitable grade steel must be used on all exposed fire system piping subjected to heat from a fire, for the following two cases where piping is:

1) Within a 3m range of any fire zone

2) Within 300mm of the top of the bund wall.

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10. PIPE SUPPORTS

The *Contractor* shall design the pipe supports to meet the support spacing requirements as specified within the applicable design, however the maximum permissible spans for permanent and temporary pipe supports shall not be greater than the dimensions shown in the following table.

Pipe Size (NB)	CARBON STEEL		STAINLESS STEEL	
	Pipe Schedule	Max. Permissible Span (mm)	Pipe Schedule	Max. Permissible Span (mm)
15	80	2810	40S	2800
20	80	3160	40S	3130
25	80	3540	40S	3500
40	80	4260	40S	4160
50	40	4680	10S	4360
80	40	5670	10S	5000
100	40	6360	10S	5340
150	40	7580	10S	6000
200	STD (40)	8780	10S	6500
250	STD (40)	8700	10S	7000
300	STD (30 - 40)	9150	10S	7410
350	STD (30)	10850	10S	7630
400	STD (30)	11200	10S	7780
450	STD (20 - 30)	11500	10S	7890
500	STD (20)	11750	10S	8450
600	STD (20)	12250	10S	9110

Piping shall not be temporarily supported or suspended from other piping.

All piping shall be supported using U-bolts.

Temporary piping supports shall be located such that piping shall not have a sag exceeding 2 mm between any two points, when carrying pressure test or working fluid.

Piping supports, anchors and guides shall, where required by design, be set such that the finished installation will provide a uniform slope for drainage as required by the design.

Where pipe supports are welded to tanks, the external paint on the tank shall be repaired in accordance with PL 838/2. The pipe support, compensation pad and a minimum of a 500mm offset in all directions from the compensation pad shall be fully painted in accordance with this specification.

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The *Contractor* shall under no circumstances weld supports to the first bottom most strake of the tank, unless a written instruction signed by the *Employer* is received.

Where welding to the first strake of the tanks damages the internal paint lining, this shall be repaired in accordance with PL 838/1 at the *Contractor*s expense.

Pipes shall be positioned to maintain clearance to all other fixed structures, except the members to which such pipes are clamped.

The installation and welding of pipe supports to the fuel storage tanks shall conform to all requirements of API 650 and API 653.

The entire top surface of all supports shall be permanently fitted with a 15mm ultra high molecular weight polyethylene strip that shall be placed and secured to the top of the pipe support using four M12 stainless steel countersunk bolts and shall be located between the bottom of all pipe and the top of all supports. The countersunk bolts shall not be closer than 50mm from the edge of the strip. The 10mm polyethylene strip shall cover the top of the entire support.

11. INSTALLATION

11.1 Installation of Steel piping

11.1.1 General

The carbon steel and stainless steel piping system shall be fabricated, assembled, erected, installed, examined and tested in accordance with ASME B31.3 and the requirements of this specification.

Piping categorized as NR or SEP in accordance with SANS 347 shall be classified as ASME B31.3 Category D piping with the following modifications to ASME B31.3 that shall apply to this specification;

Clause	**Modification**
306.3.2	Delete. Miter bends shall not be permitted
307.2.1	Delete. Not permitted.
316	Delete. Not permitted.
317	Delete. Not applicable.
328.5.2	All Slip-on flanges shall be double welded
333	Delete. Not applicable
341.4.2	Refer to Non-destructive Testing section of this specification for the extent of required examination.
345.1. a	Delete. The piping system will be subjected to a hydrostatic leak test.
345.2.3	Special provision for Testing shall apply to this specification.

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Piping categorized as Category 1 or higher in accordance with SANS 347 shall be classified as ASME B31.3 Normal Fluid Service piping.

The re-use of the existing steel pipe shall not be permissible.

Piping system components that have not been supplied with the correct certification shall not be permissible.

Uninstalled pipe ends are to be kept closed by pipe end caps designed for this purpose.

Hand cutting and modification of gaskets is prohibited. All gaskets shall be delivered from the supplier and be purpose-made.

11.1.2 Piping

All piping shall maintain the same bottom of pipe.

Changes of direction in piping systems shall not be made using mitres.

Dis-similar materials shall be suitably isolated using Teflon pads, isolation kits or top hat washers to prevent galvanic corrosion.

At all times, piping shall be installed plumb and level unless a piping gradient is required.

The internal diameter of all fittings installed shall match the schedule of the pipe. Where piping components are of a different schedule and approved by the *Employer*, the internal diameter is to be filed to ensure a smooth ID across the weld.

The bevelling of pipe ends shall be the *Contractor*s responsibility and shall be in accordance with ANSI B16.25.

Pipework shall not be under tension when installed.

Weep holes shall be drilled on all pipe cooling ring and top foam pourer risers for all bulk storage tanks. The weep holes are to be 6 mm diameter.

Hemp and stag shall be used on all threaded joints for water and pre-mix fluid service unless indicated as otherwise.

Heavy duty Polytetrafluoroethylene (PTFE) thread seal tape shall be used on all threaded joints for foam concentrate service unless indicated as otherwise. PTFE tape shall only be wrapped twice around the thread and shall not be stretched into a string and lose form.

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All horizontal piping arrangements that share the same nominal wall penetration centerline, shall all maintain a common bottom of pipe wall penetration unless indicated otherwise. Piping penetrating walls in the same region that do not have a common bottom of pipe will not be accepted.

11.1.3 Welding

All carbon and stainless steel pipe joints shall be done by welding in accordance with ASME IX. Threaded joints shall be permitted only where indicated on standard drawings or required by equipment.

The root, filler and cap shall be entirely done with GTAW (TIG).

Pure argon gas will be preferred however gas mixtures of argon and helium or argon and hydrogen will be accepted for TIG welding.

Weld procedures shall be specified and qualified and all welders shall be qualified for the welds they perform.

Tack welds shall be performed by a qualified welder and the fillet material used for the tack weld shall be the same type as the filler material. Stainless steel weld filler material shall be 316L or 904L.

The minimum distance between all welds is to be 50mm as measured along the quadrant.

All weld slag is to be removed before the pressure test.

11.1.4 Bolting

A bolt set is deemed to consist of all the bolts/studs, washers and nuts required for the corresponding flange size to fit all bolt holes.

A suitable approved anti seize compound shall be applied to all nuts and bolts.

The *Contractor* shall implement a suitable ‘box-up’ procedure by tagging all flange sets that have had the bolts correctly torqued. The tag shall include all the necessary details of the *Contractor*s employee responsible for the box-up verification and shall include the date of the box-up.

Pressure testing of the pipeline shall not commence until all flanges have been suitably boxed up in accordance with the above procedure. Any flanges that are unbolted post hydro test shall be boxed up in accordance with the above procedure prior to commencement of commissioning. The *Contractor* shall only remove all tags upon successful completion of commissioning.

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11.1.5 Field-fit Welds

The use of field fit welds must be minimized. The provision of field welds by the *Contractor* shall comply with the general design principle of field/site weld connections for similar piping systems.

Where field fit welds are required on site for galvanized pipe and fittings, a galvanized flange shall be supplied loose and the galvanized plain ended pipe end shall be supplied 150mm longer than shown on the respective isometric or as required by the site measurement.

The *Contractor* shall trim and prepare the plain ended 'green' length to suit the required dimension and weld the loose galvanized flange onto the required pipeline length. The *Contractor* shall then apply using the two pack cold galvanizing system to all internal and external galvanised zones of the pipe and flange that are affected during the welding process.

11.1.6 Flange Alignment

Any connection to equipment shall not exert or transfer pipe stress to the equipment flanges. This shall be verified by feeler gauges with loose bolts, and recorded in the QCP before piping is securely fastened.

The *Contractor* shall ensure that flanges are centered and parallel and allow for the correct space for gasket with loose bolts, adjustment shall only be conducted to piping and not to equipment nozzles.

The *Contractor* shall conduct a pipe-on pipe-off exercise when connecting flanged piping to major equipment (tank nozzles, pumps etc.). Piping shall be permanently corrected to ensure that bolts/studs can be inserted and removed from flange bolt hole pairs without the need of any tools or forceful repositioning of the piping system. The pipe-on pipe-off exercise shall be witnessed by the *Employers* representative and shall be a hold point on the *Contractor's* QCP.

The *Contractor* shall ensure that all installed flange pairs are suitably aligned that bolts/studs can be easily inserted or removed without the need of tools or forceful repositioning of the piping system. The *Employer* or the *Employers* representative shall instruct the *Contractor* to remove a selection of the bolts/studs at the *Employers* discretion to verify compliance with this requirement. Flange pairs that do not comply with this requirement will be re-worked at the *Contractors* expense.

All flanges shall be installed with bolt holes drilled off centre and symmetrically offset from the vertical centre line of the flange. All flange bolt holes shall straddle vertical and horizontal centrelines. Flanges shall be installed square to the axis of the pipeline.

Reaming or increasing the diameter of flange bolt holes shall not be permitted.

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11.1.7 Specials Precautions when Working with Stainless Steel

The *Contractor* shall allow for pickle and passivation of all stainless steel piping, whether welded in workshops or on site, in accordance with ASTM A967/A967M-13.

Special precautions shall be taken by the *Contractor* to ensure that stainless steel pipes are kept free of contamination by carbon steel by using pipe end caps.

Mild steel contamination on stainless steel piping shall not be accepted and chemical cleaning must be conducted to eradicate contamination; buffing, grinding etc. may not be used.

11.2 Installation of HDPE piping

Where below ground piping of lengths exceeding 15 metres cannot be avoided, HDPE piping shall be used and installed underground and shall not protrude above ground at any point.

All pipes and fittings shall be inspected for defects immediately before installation and faulty pipe or fittings which have suffered damage which would affect their serviceability as determined by the *Employer* shall not be used. The cost of replacing such pipe and fittings shall be for the Contractors account.

HDPE pipes shall be transported, laid, joined and backfilled in accordance with the manufacturers written instructions.

HDPE to HDPE connections shall only be made by machine butt welding in accordance with SANS 10268-1 or electro-fusion welding in accordance with SANS 10268-2.

All HDPE welding shall be performed by qualified welders that have been tested and approved in accordance with SANS 10269.

All HDPE welding shall be done using qualified weld procedures in accordance with SANS 10270.

Weld joints shall be identified on the AFC isometric drawing in accordance with SANS 10268-10. SANS 10268-10 shall be used during the assessment and identification of defects. The Assessment Class used for quality control shall be Assessment Class I.

A selection of 5% of site welded joints per welder shall be tested in accordance with SANS 6269. The site welded joint shall be cut out either end of the joint and sent for destructive testing. The *Contractor* shall trim back the installed HDPE pipe and prepare an insertion spool of minimum 1.0 metres long for re-insertion into the HDPE pipeline.

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Welders that have prepared weld joints that do not have a 100% pass rate of the destructive testing shall no longer be allowed to perform HDPE weld joints for this project.

It must be noted that weld procedures and welding shall be monitored by an IPE in accordance with SANS 10270 that has been assigned by the *Employer*.

Machine butt welding must be maximized in the installation of the HDPE piping and electrofusion couplers or fittings may only be used with the prior approval of the *Employer*. Approval must be sought for individual connections before a methodology for the installation is implemented, where such methodology will result in it being necessary to utilize electrofusion couplers.

Importantly no metallic parts of the heating element should be exposed at any place and all coils are to be fully imbedded into the body of the fittings for protection purposes. The surface on the internal diameter of the fitting shall be smooth, protrusions from electro-fusion coils or terminals on the internal diameter will not be acceptable.

Prior to laying the pipe in a trench, the bed of the trench must be prepared to provide support throughout the entire length of the pipe. The pipe shall not be laid directly on cohesive, rocky or stony soil. .

Pipes supplied in coils of up to 63 mm diameter may be unrolled with the coil in the vertical position. For larger diameters an unwinding device shall be used. A turn-style can be used with the coil laid on it in a horizontal position or with the coil mounted vertically on a slow moving vehicle. The pipe shall never be removed from a coil in a spiral manner as this may cause kinking. Should kinking nevertheless occur the *Contractor* shall cut the pipe on either side of the kink, prepare the ends and then use an approved joint after laying. All costs of dealing with kinking shall be to the *Contractor*s' expense. A minimum bending radius of 35 x the outside diameter of the pipe shall be observed.

When flanged connections of HDPE pipe are required, the edges on both sides of the backing flange that are in contact with the HDPE shall be rounded or chamfered.

Flange connections to HDPE pipe may only be completed when the HDPE pipe is cool to minimize stresses. HDPE pipelines shall only be backfilled after completion of the hydrostatic pressure testing of the pipeline. The trench may be backfilled once the hydrostatic pressure testing is completed excluding the steel to HDPE pipe joints. HDPE to steel pipe joints shall be left uncovered until completion of hydro-testing of the steel pipe, wrapping and final box-up of the HDPE to steel flange connection.

Only upon successful completion of commissioning shall underground flange connections be treated with an approved priming solution, packed with an approved petrolatum mastic formed to an even profile and wrapped with an approved petrolatum tape and PVC outer wrap all to the product manufacturers' specification.

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Changes in direction shall only be made by using molded 45 degrees or 90-degree bends. The use of bending pipes to achieve changes in direction shall not be permitted.

No compression or screwed fittings may be used.

Victaulic fittings may be used for blanking off pipe for testing purposes only.

HDPE fabricated fittings may only be used where approved by the *Employer* and shall be suitably uprated in order to meet the pressure rating requirements.

HDPE piping shall not be pressure tested in combination with steel piping and shall be hydro tested separately. The HDPE piping shall be tested and shall be witnessed by the *Employer*s appointed AIA.

The HDPE pipes shall be tested using the Pressure Rebound Method in accordance with ASME F2164.

The hydrostatic test pressure at any point in a nonmetallic piping system shall be not less than 1.5 times the design pressure, but shall not exceed 1.5 times the maximum rated pressure of the lowest-rated component in the system. The *Contractor* shall advise the supplier of the HDPE pipe and fittings of the test pressure and communicate to the *Employer* any concerns the supplier of the HDPE pipe and fittings may have with the proposed test pressure.

The duration of the pressure test shall be as required by the Pressure Rebound Method.

The *Contractor* shall prepare and submit to the *Employer* for Acceptance a Method statement on how the HDPE pipelines will be hydro-tested. The Method Statement shall comply with the requirements of the Pressure Rebound Method for hydro static testing of HDPE pipes.

Prior to the commencement of installation, the *Contractor* shall have the following approved documentation;

- A quality plan which must be submitted to and approved by the *Employer* as well as the AIA
- Installation plans showing the location, configuration and positioning of the installation
- A data book shall be generated by the *Contractor* and verified by the *Contractor*s' site manager who shall sign the data book approval sheets. The data books are submitted by the *Contractor* to the *Employer.*

1) The data book shall contain but not be limited to the following;

- Weld control sheets showing the data of weld, welding and cooling time, ambient temperature, pressure and GPS coordinated of the weld position (accuracy to be 0.5 m (or better) in X, Y and 5 m (or better) in Z for every pipe connection, indicating whether it is a butt weld or electro-fusion coupling

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- Pressure test certificates
- Test pressure gauge calibration certificates
- Details of the welder identified for each weld in accordance with SANS 10268-10
- Material certificates
- Welder qualification procedure records
- Welder qualification certificates
- Red-lined As-built drawings
- Other documentation required by the Pressure Rebound Method

11.3 Installation of Equipment

The *Contractor* is to ensure that all necessary internal components and consumables (lubrication, etc.) are installed prior to installation.

The *Employer* will assume that all equipment installed has been checked by the *Contractor* and has been supplied in accordance with the specification prepared by the *Employer*.

The *Contractor* shall install all equipment in accordance with the original equipment manufacturers (OEM's) requirements and recommendations.

12. QUALITY CONTROL PLAN (QCP)

The *Contractor* shall prepare and submit for acceptance to the *Employer*s appointed AIA, as well as to the *Employer*, a QCP as and when required by the *Employer* but as a minimum shall make provision for the following;

- Each individual piping isometric
- Piping corrosion protection systems
- Tank Modifications
- Repair and remedial works
- Equipment corrosion protection systems

All QCP's shall be accompanied by a detailed method statement that lists the activities of the task as required by the *Employer*. The *Employer* and the *Employer*s AIA will review and submit comments to the *Contractor* on the QCP's submitted by the *Contractor*. The *Contractor* shall update the QCP with the received comments and re-submit for final approval.

Hold points will require the signature of the indicated authority before the *Contractor* may proceed to the subsequent activity on the QCP.

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The *Contractor* shall make provision to prepare and maintain throughout the project a quality data book which shall contain the following minimum sections;

- Final Acceptance and Hand-over forms
- Drawings
- General Arrangement Drawings
- Quality Control Plans
- Weld Maps indicated on Isometric Drawings
- Welding register
- Radiographic and Surveillance Reports
- Material and Dimensional Certificates
- Pressure Test Certificates
- Corrosion Protection Inspection Certificates
- Welding Procedures and Welders Coding Certificates

The order and content of the QA data book shall be approved by the *Employer*.

The *Employer* or his representative will from time to time conduct a quality audit of the *Contractor* or any of the sub-*Contractor*s to ensure that the resources and quality control facilities are in place to ensure compliance with this specification.

13. NON-DESTRUCTIVE TESTING OF STEEL PIPE

The *Employer*s appointed AIA shall determine in consultation with the *Employer* the examination method that will be used.

Non-destructive testing (NDT) of the welds and piping system shall be performed prior to painting or coating. Application of shop primer coats to pipe only is acceptable prior to commencement of non-destructive testing. The *Contractor* shall carefully remove the shop primer as required by the *Employers* appointed AIA where NDT of the area is required.

13.1 Visual Examination

Visual examination of the stainless steel and carbon steel piping system shall be done in accordance with ASME B31.3.

Piping classified as NR or SEP shall be visually examined as ASME B31.3 Category D piping. Special attention is drawn to the requirements of Clause 341.4.2 and the Acceptance Criteria of Table 341.3.2 for Category D Fluid Service.

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Piping classified as Category 1 or higher shall be visually examined as ASME B31.3 Normal Fluid Service piping. Special attention is drawn to the requirements of Clause 341.4.1 and the Acceptance Criteria of Table 341.3.2 for Normal Fluid Service.

13.2 Random Examination

Weld quality shall be verified by non-destructive testing using either radiographic examination or liquid penetrant testing as appropriate.

Random radiographic and liquid penetrant examination welds will be done on all piping systems classified in accordance with SANS 347 as NR, SEP, Category 1 and higher in accordance with ASME B31.3 Clause 341.4.1.b.

Not less than 10% of circumferential butt and miter groove welds shall be examined by radiographic examination.

Not less than 100% of all fillet welds shall be examined by liquid penetrant testing.

The examination of all welds shall be evenly distributed throughout the project scope of work and evenly distributed among all welders.

The radiographic examination and the liquid penetrant testing shall only be carried out by an approved examiner in accordance with this specification that is appointed by the *Contractor* at the *Contractor*s expense.

Notwithstanding the requirements of ASME B31.3 Clause 342.1, the *Employer* shall not certify records of the examiners employed by the *Contractor*, however the *Employer*s approved AIA will review the examiners qualifications submitted by the *Contractor* to the *Employer* for acceptance. The *Contractor* shall include in the QA file a copy of the examiners qualifications. The *Employer* reserves the right to reject the examiners qualifications. Examiners who have had their qualifications rejected by the *Employer* shall no longer conduct examinations within this framework.

Each butt or miter groove weld selected for examination shall be examined over the girth of the weld.

Weld defects on piping classified as NR or SEP shall be identified in accordance with ASME B31.3 Table 341.3.2 Category D Fluid Service.

Weld defects on piping classified as Category 1 or higher shall be identified in accordance with ASME B31.3 Table 341.3.2 Normal Fluid Service.

Welds that are identified as defective shall be removed or repaired at the *Contractor*s expense in accordance with ASME IX but repeat repairs of the same weld shall not be permitted.

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Progressive sampling for examination upon identification of defects for all piping systems shall be done in accordance with ASME B31.3 Clause 341.3.4. Any progressive sampling shall be done at the *Contractor*s expense.

The *Contractor* shall include in the QA file all radiographic certificates and results. The certificates and results shall be made available to the *Employer* or the *Employer*s AIA when requested.

All welds are to be suitably identified and referenced as a 'weld map' on the isometric drawing to the welder responsible for the weld. The 'weld maps' with welder identification are to be included in the data pack.

A welder will be prohibited from further welding on the project if more than two of the welds performed by the subject welder have failed the weld examination.

13.3 Pressure Testing

All steel piping shall be subjected to a hydrostatic leak test in accordance with ASME B31.3 as a Normal Fluid Service.

Test water shall be supplied by the *Employer*. The *Contractor* shall confirm on site with the *Employer* suitable water draw off points.

The hydraulic testing of piping systems may be required in sections throughout construction, particularly as buried pipe shall be tested before being buried and as such, before piping above it is installed.

The *Contractor* shall maintain records of all of the tests as stated above. These records shall be kept on site and shall be listed in the QCP.

The *Contractor* shall provide high point vents on steel piping requiring in-situ pressure testing.

Hydro-test water for piping systems designated for water and foam pre-mix will not be drained. Hydro-test water for piping systems designated for foam concentrate will be drained. Low point drains will not be provided. The *Contractor* shall remove all water within the foam concentrate piping system by disconnecting flange assemblies where required and using compressed air provided by the *Contractor* to blow the piping system clear and dry.

Where weep holes are to be drilled into piping, the piping system shall be hydro-tested prior to the drilling of the weep hole.

The *Contractor* shall make provision for and include in the *Contractor*s cost the required pumps, spades and blank flanges and fittings with suitable air, water and pressure gauge connections required to

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facilitate the pressure test. Pressure testing of pipelines shall not commence until the QCP documentation is up to date and signed off by the AIA and the *Employers* representative.

Flange joints and weld joints shall be left exposed for examination during and after the pressure test.

The *Contractor* shall advise the *Employer* if the hydrostatic test pressure exceeds the design operating pressure of any in-line equipment that will be tested. If required, the *Contractor* shall provide all materials and equipment necessary to blank off the equipment to prevent damage from occurring to the equipment.

The *Contractor* shall submit to the AIA and the *Employer* for acceptance a method statement on how the pipelines will be hydro-tested.

Only certified and calibrated gauges shall be used during the test. The full test pressure shall be maintained for a minimum duration of 60 minutes or longer as required by the AIA or *Employer*.

The test pressure shall be 1.5 times the design pressure.

Piping systems that fail the pressure test shall be retested at the *Contractor*s' expense.

14. FLUSHING

14.1 Pre-commissioning Flushing

The purpose of the pre-commissioning flushing exercise is to remove any foreign objects within the piping system prior to the installation of in-line equipment. Other foreign objects that may reside between the in-line equipment and end-of line equipment will be flushed out during the commissioning flushing exercise.

All pipelines installed by the *Contractor* shall be flushed with water until clean and empty, the *Contractor* shall allow for flushing prior to installation and fixing of all equipment.

The flushing procedure of each line shall be witnessed by the *Employers* representative.

With prior approval and at a time convenient to the *Employer*, the *Contractor* may use the site water system for flushing.

It is not necessary to drain the flushing water from the pipelines that are designated for water and foam pre-mix solution, however all stainless steel lines shall be drained and thoroughly dried once flushing and hydro-testing is complete.

The *Contractor* shall supply all material and equipment required to flush the pipe lines.

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All in-line control valves, orifice plates, temperature probes, safety valves, globe and butterfly valves as well as any other bore obstructed valve or item of equipment shall only be installed after the flushing is completed. The *Contractor* shall allow for the necessary cotton reel spool pieces to temporarily replace the above during flushing.

Flushing shall not be conducted through items of equipment (for example pumps, vessels and exchangers) but flush may be dumped in tanks, tanks shall then be drained and cleaned after flushing

14.2 Flushing during Commissioning

Post pre-commissioning flushing and during commissioning, the pipelines will be flushed again using the pump-sets installed under this project.

The flushing shall take place at the full flow rate of the pump and shall take place with all end of line equipment such as bund pourers, monitors, hydrant valves, top foam pourers and cooling rings disconnected and removed.

The *Contractor* shall provide and secure in place of the end of line equipment, a suitable filter bag such as a hessian bag that will prevent any foreign objects left within the pipeline to act as projectiles during the flushing process. Once the *Employer* is satisfied that the pipelines are suitably flushed, the *Contractor* shall remove the filter bags and install all permanent equipment.

15. HANDOVER

The *Contractor* is responsible for completing the *works* in accordance with this specification and to the satisfaction of the *Employer* prior to proceeding with commissioning.

The *Contractor* will only be issued with a signed ‘Ready for Commissioning’ certificate from the *Employer* when the *Contractor* has satisfied all the requirements of the commissioning and handover documentation as detailed elsewhere in the Works Information.

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16. FINAL DOCUMENTATION

Data packs shall be provided in indexed lever arch files. The *Contractor* shall submit to the *Employer* the original data packs for review and comment. The *Contractor* shall update the data packs with the *Employers* comments and provide to the *Employer* the revised original data packs, two copies of the original data packs as well as a scanned electronic copy. The required documentation includes but is not limited to:

- Third party inspection reports
- Approved piping design
- Welding procedures
- Weld Map
- Material certificates
- Equipment certificates
- NDT (Non Destructive Testing) Reports
- Certificate of manufacture
- Isometric and GA drawings updated to As-built status
- Final Acceptance and Hand-over forms
- Quality Control Plans
- Method statements
- Welding register
- Radiographic and surveillance Reports
- Material and Dimensional Certificates
- Pressure Test Certificates
- Corrosion Protection Inspection Certificates
- Equipment specifications as issued by the *Employer*
- Equipment data sheets prepared by the *Contractor* and accepted by the *Employer*
- Operating and Maintenance Manuals
- Welder Qualification Certificates
- Other documentation required by this specification
- Other documentation required by the *Employer*

During the fabrication and installation process, the *Contractor* shall prepare a set of marked-up and dimensioned red-lined as-built isometric drawings. The as-built information shall be captured on the latest revision of the AFC isometric drawings. All dimensions and directions shall be checked by the *Contractor* and marked as correct or a new dimension or pipe route shall be marked on the drawing. All marked-up information shall be clear and legible.

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The *Contractor* shall update the native CAD isometric and other construction drawings to as-built status that are to be included with the handover documentation.

17. OTHER OBLIGATIONS OF THE *CONTRACTOR*

The *Contractor* shall also comply with all other documentation issued by the *Employer*.

17.1 General

1) Pipes shall not be dragged along the ground.

2) Pipes shall not be stacked to a height exceeding 1 m

3) The pipes must be secured at the sides to prevent them from rolling.

4) Contact with harmful materials shall be avoided at all times

5) Pipes which cannot be off-loaded by hand shall only be lifted by means of suitably approved broad band slings. The use of wire, chains, hooks, crowbars and similar items shall not be permitted and the pipes, fittings and specials shall not be handled in such a manner as could cause damage to occur. No concessions will be made in the above regard and failure on the Contractors part to comply shall be considered just cause for the *Employer* to investigate and require remedial measures including replacing material at the Contractors cost.

17.2 Erection Works

1) The *Contractor* shall supply a rigging study for all lifting and rigging activities, these shall be accessed by the *Employer* and safety personnel and approved before any lifting is carried out.

2) The *Contractor* shall advise who will be responsible for the completion of all rigging studies anticipated to be required during construction.

3) The *Contractor* is further required to provide a typical rigging study for the erection of the piping to ensure that it falls within the standards that the *Employer* requires for the site installation *works*. Where such a study isn't required a suitable reason shall be given as to why this requirement hasn't been complied with.

4) Notwithstanding the above, the *Contractor* shall at all times make provision for and comply with the requirements of the Occupational Health and Safety Act and Regulations as amended.

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17.3 Transport of Material on Site

1) The *Employer* may thoroughly inspect all pipes, fittings and specials delivered to the site but his acceptance of same as being in good condition shall not relieve the *Contractor* of any of his obligations or responsibilities under this contract

2) Materials inspected and rejected by the *Employer* shall be removed from the site and shall be replaced by the *Contractor* with other approved materials at the Contractors own expense.

3) The bottom layer of all pipes must be as far as possible be in contact with the loading surface throughout their entire length and not project beyond it.

4) The pipes must be secured from slipping and shall not be pulled over sharp edges when loading and offloading.

5) The equipment shall be loaded and transported on suitable transport arranged by the Contractor. All items shall be secured on the transport vehicle to avoid damage to the equipment and their coatings.

6) All stainless-steel equipment are to be kept free of contamination by incompatible materials such as carbon steel grindings, etc. Should equipment become contaminated, the *Contractor* shall clean the equipment at his own expense. If this is unsuccessful, the *Contractor* shall replace the equipment at his own expense.

7) Fittings shall be supplied in sealed wooden containers with plastic linings. A plastic lining shall be wrapped around each individual item. Flange faces and mating surfaces shall be protected during transport and handling.

8) Rubber lined vertical posts shall be spaced on the sides of transporting vehicles to provide adequate support to the loaded pipes.

9) Before transporting HDPE pressure pipes the loading surface of the vehicle must be cleaned and free from projecting nails, screws or other sharp objects.

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17.4 Storage of HDPE Piping

1) Pipes, fittings and coils shall be stored in such a way that they are completely protected from direct sunlight. When covered they must be well ventilated to avoid accumulation of direct heat and resultant deformation. Transparent coverings shall not be used.

2) The storage location shall be flat and shall, for pipes, support the pipes throughout their length. Stones and sharp objects shall not be present.

3) Coils shall be stored in a horizontal position. The area shall be free of stones and sharp objects. If stored upright they must be secured to avoid tilting.

4) When the pipes are to be stored on site it is essential that the storage be as level as possible and any objects which may cause damage to the pipes shall be cleared from the laydown.

17.5 Tools for Erection Works

All tools and equipment (incl. cranes, fixed and moveable) required for the completion of the *works* shall be supplied by the *Contractor* and included in the cost.

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FIRE SYSTEM SPECIFICATION

FOAM CONCENTRATE

Document number	PL 915
Version number	2
Classification	Unclassified
Effective date	1 July 2025
Review date	1 July 2028

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SUMMARY VERSION CONTROL

VERSION NO.	NATURE OF AMENDMENT	PAGE NO.	DATE REVISED
0	New Specification	ALL	15 July 2025
1	Comments during review between TPL and GreyJones included	ALL	31 July 2025
2	Comments and review from TPL	ALL	27 August 2025

Note: Only latest amendments and/or additions are reflected in italics in the body of the document.

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DOCUMENTATION SIGN-OFF SHEET

I, the undersigned hereby approve this procedure.

ROLE	CAPACITY/ FUNCTION	SIGNATURE	DATE
Compiled by:	**Pieter Jacobs**		
Approved by:	**Papa Moratwe**		

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TECHNICAL SPECIFICATION – FOAM CONCENTRATE

1 INTRODUCTION

This specification covers the design, manufacture, packaging, supply, delivery to site, offloading at site, testing and handover documentation of the foam concentrate to be used with the fire protection equipment within Transnet Pipelines fire protection systems.

Where the terms ‘foam concentrate’ and ‘material’ are used in this specification, they shall be interpreted to mean Plant and Materials as defined in NEC3 Clause 11.2(12).

This specification is not site specific but has been prepared as a generic project specification.

The importance of correctly labelling the foam concentrate is underscored as the *Employer* relies on the *Contractor* to provide the foam concentrate in accordance with this specification, in the correct quantity and prescribed standards. The labelling of the received foam concentrate includes the delivery date, batch test date and the allocation of that specific IBC as “for application” or “storage.”

The application of the foam concentration that is to be used in the foam premix system must be designed for hydrocarbons/polar solvents that is used, stored, processed, or transported at the depot. A 3/3 foam concentrate (3% foam concentrate for both hydrocarbons and polar solvents respectively) must be utilized.

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2 DEFINITIONS

The following definitions shall apply when reading this specification;

Term	Definition
^{0}C	Degrees Celsius
AR-SFFF	Alcohol-Resistant Synthetic Fluorine-Free Foam
BS	British Standard
cP	Centipoise
cSt	Centistoke
EN	European Norm
GRP	Glass Reinforced Plastic tank
ISO	International Standards Organisation
IBC	Intermediate Bulk Container
kg/m^3	Kilograms per cubic metre
OHSA	Occupational Health and Safety Act
SANS	South African National Standards
Contractor	The successful tenderer
Employer	Transnet Pipelines

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3 ENGINEERING STANDARDS

Although not bound in nor issued with this document, the following standardised specifications shall form part of the contract document:

EN 1568 – Part 3	Fire extinguishing media - Foam concentrates - Part 3: Specification for low expansion foam concentrates for surface application to water-immiscible liquids
EN 1568 – Part 4	Fire extinguishing media - Foam concentrates - Part 4: Specification for low expansion foam concentrates for surface application to water-miscible liquids
IMO MSC - 1312	Revised Guidelines for the Performance and Testing Criteria, and Surveys of Foam Concentrates for Fixed Fire-Extinguishing Systems
ISO 14001	International standard for Environmental Management Systems (EMS)
LAST Fire	Foam Test
SANS 7203	Fire extinguishing media — Foam concentrate
SANS 10089-1	The Petroleum Industry Part 1: Storage and distribution of petroleum products in above-ground bulk installations
SANS 10140-2	Identification of Colour Marking Part 2: Identification of Hazards and Equipment in Work.
UL 162	Foam Equipment and Liquid Concentrates

4 LOCATION

The *Contractor* shall take cognizance of the following data of the foam delivery location when preparing the offer;

City	The foam concentrate will be used in fire systems at multiple Transnet Pipeline facilities throughout KwaZulu-Natal, Gauteng, Mpumalanga, and Free State, North-West and Limpopo.
Depot	Nationwide
Area	The foam concentrate will be stored under a shelter either within a closed pump house, or under a canopy structure.

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5 PROCESS FLUID DATA

The *Contractor* shall take note of the following process fluid data for which the foam concentrate is used in the foam premix to extinguish fires, when preparing the offer;

Process Fluid	Diesel
Temperature @ Operating Point	5 - 25 °C
Density @ Operating Point	845 kg/m³ @ 25°C
Viscosity @ Operating Point	2.96 cP at 25°C
Flashpoint	55°C
Process Fluid	Petrol
Temperature @ Operating Point	5 - 25 °C
Density @ Operating Point	783 kg/m³ @ 25°C
Viscosity @ Operating Point	5.48 cP at 25°C
Flashpoint	-40°C
Process Fluid	Jet Fuel
Temperature @ Operating Point	5 - 25 °C
Density @ Operating Point	840 kg/m³ @ 25°C
Viscosity @ Operating Point	6.72 cP at 25°C
Flashpoint	38°C
Process Fluid	Crude Oil
Temperature @ Operating Point	5 - 25 °C
Density @ Operating Point	TBC kg/m³ @ 25°C
Viscosity @ Operating Point	TBC cP at 25°C
Flashpoint	TBC °C
Process Fluid	Additives
Temperature @ Operating Point	5 - 25 °C
Density @ Operating Point	TBC kg/m³ @ 25°C
Viscosity @ Operating Point	TBC cP at 25°C
Flashpoint	TBC °C

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Process Fluid	Alcohol
Temperature @ Operating Point	5 - 25 °C
Density @ Operating Point	TBC kg/m³ @ 25°C
Viscosity @ Operating Point	TBC cP at 25°C
Flashpoint	TBC °C

Process fluid data shown to be confirmed by the *Contractor* during the detailed design.

6 FOAM CONCENTRATE DATA

Foam type	AR-SFFF
Foam Concentrate design	Class A and B fires
Maximum storage temperature	45°C
Minimum storage temperature	0°C .
Temperature @ Operating Point	Ambient
Maximum permissible density @ 20 °C	1130 kg/m³
pH at 20 °C	7-8
Biodegradable	Yes
Incompatible materials	Alkali earth metals, oxidising agents, and water reactive substances.
Hazardous decomposition products (stability and reactivity) when in contact with incompatible materials	Carbon Oxides Sulphur Oxides Nitrogen Oxides Sodium Oxides
Proportioning equipment material	Bronze Stainless steel Aluminium
Solvent suitability	Fresh and sea water
25% drainage time	60 mins

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7 FOAM PROPORTIONING METHOD

Foam Proportioning can occur in one of three ways as discussed below.

7.1 Balance Pressure Foam Proportioner with Balance Valve

The foam concentrate pump delivers pressurized concentrate to the balance valve. The balance valve matches foam pressure to the water line and recirculates excess to the tank. A check valve ensures unidirectional flow and system protection.

The proportioner injects foam concentrate into the water stream at a fixed ratio. The resulting foam solution flows to discharge devices for fire suppression.

7.2 Portable and Fixed In-Line Induction Units

7.2.1 Portable Inline Induction Unit

The portable inline inducer uses water velocity and the venturi effect to suction foam concentrate into the stream. The foam concentrate is proportioned via a calibrated orifice without the need for external power.

The operation relies entirely on hydraulic energy and flow conditions. Induction accuracy depends on maintaining specified flow and pressure. The foam solution is discharged through hoses or nozzles for firefighting.

7.2.2 Fixed Inline Induction Unit

A fixed inline proportioner uses venturi suction to draw foam concentrate into the water stream. It is permanently installed and connected to a foam storage tank via dedicated suction piping.

Accurate proportioning is maintained within specified flow and pressure ranges. The system operates without external power and requires minimal maintenance. The foam solution flows to fixed discharge devices for fire suppression.

7.3 Water Driven Foam Proportioning System

The foam concentrate system pressurizes and delivers concentrate via pump to the proportioner.

Balance valves regulate concentrate pressure to match water supply pressure, ensuring accurate dosing. Check valves prevent backflow, maintaining system integrity. Recirculation lines return excess concentrate to the tank, stabilizing pressure.

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8 FOAM DISCHARGE EQUIPMENT

The foam concentrate is used to create the foam premix which is distributed to the air aspirating and non-aspirating discharge equipment as listed below. The foam concentrated should be a low expansion foam that is less than and equal to 20 (ratio of 1:20). The following equipment includes but is not restricted to:

- Bund Pourers
- Top Foam Pourers
- Oscillating and fixed monitors
    - Non-aspirating nozzles with teeth
    - Cannons with blabber-mouth
- Hoses – foam branch pipes
- Portable foam units

9 VISCOSITY SPECIFICATION

The table below represents the pseudoplastic behaviour, which is viscosity vs shear rate, at 0°C, 10°C and 20°C. The viscosity of the foam concentrate is non-Newtonian. The purpose of this information is to provide a comparison of the *Contractors* proposed foam concentrates to identify its similarity with the predominant foam concentrate that *The Employer* currently utilizes. This is determined for its suitability with *The Employers* other fire protection systems that utilized the predominant foam concentrate.

shear rate (sec^-1)	**0˚C**	**10˚C**	**20˚C**
1	6200	5700	5200
2	3800	3500	3200
10	1200	1050	950
50	370	330	290
100	230	200	180
200	170	130	110
400	110	91	77
600	75	62	52

The table above displays the decreasing viscosity (cP) with an increasing shear rate. At a standardized operating temperature of 20˚C, the viscosity vs shear rate for the existing foam concentrate is displayed in the graph below using the values provided in the table above.

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An additional graph is shown as a dashed line that indicates the threshold for the viscosity shear rate of the superseded foam concentrate. The proposed foam concentrate shall not exceed more than a 10% deviation from the upper limit of the viscosity shear rate at 20˚C.

It is required for the *Contractor* to provide the viscosity vs shear rate at 0˚C, 10 ˚C, 20 ˚C and 35 ˚C.

The foam concentrate shall be deemed as a suitable replacement if its respective viscosity for each shear rate interval lies in the area below the upper limit graph.

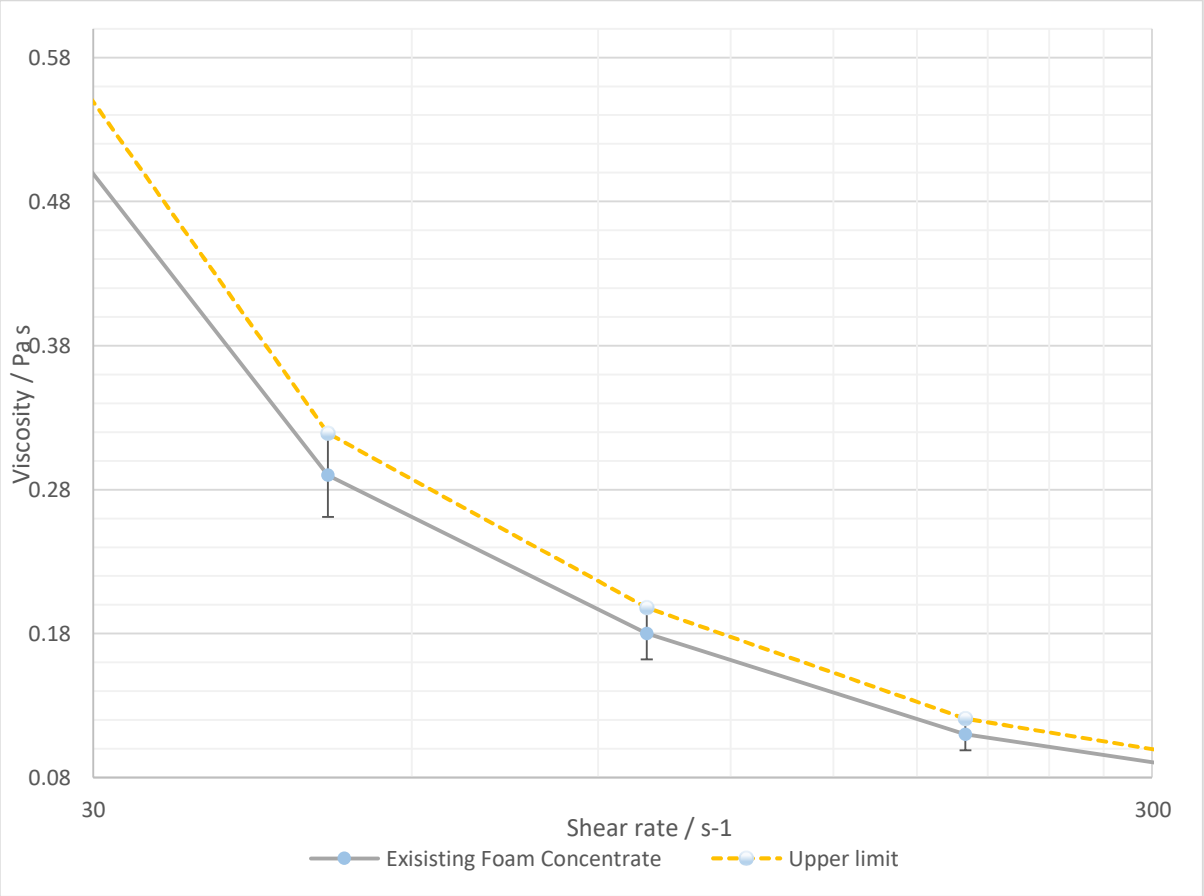


Figure 1: The viscosity versus shear rate of The *Employers* Existing Foam Concentrate

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10 TESTING AND QUALITY CONTROL

It is imperative that the foam concentrate demonstrates excellent storage characteristics as well as performance.

The Contractor shall perform three tests on the quality of the foam concentrate are various stages leading up to the delivery of the material to site. That includes one during the manufacturing process, another at storage before being delivered to site, and a final upon delivery before loading the foam concentrate into the tank.

The foam concentrate that will be delivered must be sent with samples that are from the same batch as the delivered material. These samples will be used for internal and external testing.

In the event the foam concentrate sample fails the undergone testing, it is the responsibility of the *Contractor* to remove and collect the failed material and replace it, where the replaced material will undergo the same testing requirements as previously. All shortfalls and costs are to be at the expense of the *Contractor*.

On a yearly basis, the *Employer* will conduct internal testing on its foam concentrate to ensure it is still viable to use in the event of a fire. The tests included in this evaluation are specific gravity, pH, expansion and drainage time. The testing done for the listed certifications below will be proposed if it may be conducted along with the mentioned tests above.

The material shall be provided with the following minimum quality control documentation;

Material Certification	Required
Green screen 2.2(1e)	Certified silver (firefighting foam)
IMO MSC - 1312	• Revised Guidelines for the Performance and Testing Criteria, and Surveys of Foam Concentrates for Fixed Fire-Extinguishing Systems • Freezing and thawing • Heat stability • Sedimentation • Kinematic viscosity • pH • Expansion ratio • Fire tests • Drainage time • Corrosiveness
LAST Fire	• Foam Test • Foam quality (semi-aspirated, aspirated) • Test conditions

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	• Fuel type • Fire performance data

11 DOCUMENTATION

The certificates shall have the foam concentrate batch number on them for traceability between documents. If applicable certificates from authoritative bodies (such as ISO9001, UL, FM, etc.) shall be included with the documentation supplied.

Each item of the material shall be provided with the following documentation;

At tender stage	• Viscosity shear graph • Certificates of compliance to the following specifications: • UL 162 • Green screen 2.2(1e) – certified silver.
Delivery to site	• Certificate of manufacture. • Material certificates. • Maintenance manuals.

All testing of the batch that is delivered is further required to have a sample test completed. Upon delivery, samples of the delivered material must be provided with laboratory certificates confirming conformance to this specification. A sample must be taken back to the supplier for quality control and validation testing, which corresponds to the documentation listed in the table above in subsection 1.7. The results of that sample along with appropriate certification must be delivered to the *Employer*.

The minimum information that must be provided on foam concentrate IBC should include the following:

- Name and address of manufacturer.
- Product designation
- Foam type
- Intended use
- Date of manufacture and expiration
- Quantity of foam
- Reference to standard approvals
- Range of storage temperature
- Film forming capability.

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- A graph of the viscosity vs shear rate for the proposed foam concentrate superimposed onto the existing concentrate.

12 GENERAL

The material selection, supply, delivery and testing shall adhere to the following specific requirements;

12.1 Material

1) The *Contractor* is required to describe the containment of the foam concentrate. It is to be stipulated if the product will be delivered in IBC's or as stipulated in the request for quotation.
2) The *Contractor* shall advise if the foam concentrate is to be circulated in the system as part of the foam concentrate maintenance regime.
3) The foam concentrate must be suitable in its application with regards to proportioning and the related equipment.
4) All pumps upstream of the foam concentration line will not have strainers installed.
5) A progressive cavity screw pump or water driven foam proportioning system will be used in the fixed foam system.

12.2 Supply

1) All foam concentrate IBC's delivered to site must be thoroughly sealed to prevent contamination or any tampering of the material. The seals will be broken on site by the *Employer*.
2) The containers that are used to deliver the foam concentrate shall be supplied with a minimum 50NB isolation valve, as well as a 50NB male Kamlock adaptor.
3) It is the responsibility of the *Contractor* to supply all relevant equipment used in the off-loading/storage process of the material which includes but is not limited to equipment such as forklifts. The *Employers* foam concentrate offloading pump will be used to decant the foam concentrate into the *Employers* GRP foam storage tank.
4) The chemical composition of the foam concentrate shall be specified on the data sheets. Submission of this information does not in any way negate the *Contractor's* responsibility to ensure that the specified materials are suitable for the service required by this or any other documents pertaining to the enquiry.
5) The *Contractor* is to provide full maintenance manuals for the material (circulation times, etc.).
6) The *Contractor* shall provide a copy of all manufacturers specifications relevant to the products specified.

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12.3 Storage

1) The storage area of the material shall not exceed 45°C to ensure that the material has a shelf life of at least 10 years. Refer to data sheet for further information.
2) Packaging specifications are to be provided with the delivery of the material.
3) Upon the testing approvals from the samples, the foam concentrate is to be stored in a GRP tank
4) Within the GRP tank there must be a sump tank level of about 300mm or more.

12.4 Delivery

1) The material shall be loaded and transported on suitable transport arranged and paid for by the *Contractor*. All items shall be secured on the transport vehicle to avoid damage to the material.
2) Material shall be supplied in compliance to manufacturers' recommendation.
3) The *Contractor* shall make allowance for and comply with all the *Employers* Health Safety Security and Environmental (HSSE) requirements at the delivery point.
4) The *Contractor* shall allow for off-loading to a location on site as directed by the *Employers* representative. An off-loading method statement in compliance with the *Employers* HSE policy shall be supplied for approval prior to delivery.

13 DOCUMENTATION SUPPLY

Documents to be supplied upon award of the supply contract shall include:

1) Material maintenance regime
2) Test certifications
3) Material design and construction information for each item of material (sales documents)

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FIRE SYSTEM SPECIFICATION

Equipment Handover and Document Procedure

Document number	PL 917
Version number	1
Classification	Unclassified
Effective date	1 September 2025
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SUMMARY VERSION CONTROL

VERSION NO.	NATURE OF AMENDMENT	PAGE NO.	DATE REVISED
0	New Specification	ALL	1 July 2025
1	Comments during review between TPL and GreyJones included	ALL	11 July 2025

Note: Only latest amendments and/or additions are reflected in italics in the body of the document.

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DOCUMENTATION SIGN-OFF SHEET

I, the undersigned hereby approve this procedure.

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EQUIPMENT HANDOVER AND DOCUMENT PROCEDURE

1 INTRODUCTION

The purpose of the Equipment Handover and Document Procedure (EHDP) is to describe the pre-commissioning procedures and documentation of the equipment items that is to be implemented by the *Contractor*.

The EHDP details the responsibility for the issuing of the documentation required on completion of activities through various stages by the *Contractor* and prior to the commissioning of the facilities by the *Contractor*.

It is the responsibility of the *Contractor* to expedite completion and compliance with this document, and to complete the *works* in accordance with the Works Information.

The requirements for commissioning and handover of the Plant that includes the equipment are documented in the Works Information.

2 DEFINITIONS

2.1 The *Employer*

The *Employer* is defined in the Contract Data who is the Plant owner and has appointed the *Project Manager,* the *Supervisor* and the *Contractor* to execute the *works* in their respective roles as defined below.

2.2 The *Project Manager*

The *Project Manager* is as defined in the Contract Data and is an individual or organization appointed by the *Employer* to administer the contract.

2.3 The *Supervisor*

The *Supervisor* is as defined in the Contract Data and is the *Employers* appointed expert or the *Employers* technical representative which carries out all or part of the testing and/or inspections of a project.

2.4 The *Contractor*

The *Contractor* as defined in the Contract Data and is the party which carries out all or part of the design, construction, installation and commissioning for a project.

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3 REFERENCED STANDARDS

Although not bound in nor issued with this document, the following specifications as amended shall form part of this specification.

PL100	Transnet Pipelines Drawing Office Standard (PL100)
PL101	Transnet Pipelines Drawing Office Standard (PL101)
PL102	Transnet Pipelines Drawing Office Standard (PL102)
PL103	Transnet Pipelines Drawing Office Standard (PL103)
TPL-TECH-DO-WI-001	Transnet Pipelines Handover of As-built and Other Documents from Technical Projects to Drawing Office Work Instruction
PL 901	Fire Pump Specification
PL 902	Water Tank Specification
PL 908	Jockey Pump-Set and Associated Equipment Specification
PL 911	Foam Concentrate Tank Specification
PL 913	Control System Specification
PL 916	ECP FCP Control Narrative

4 QUALITY AND PERFORMANCE ASSURANCE STAGES

The various quality and performance assurance stages can be broken down into three main categories;

- Factory Acceptance Test (FAT)
- Shop Performance Test
- Site Acceptance Test (SAT)

Each of the above quality and performance verification stages will generate their own list of punch list items. The EHDP will enable the *Project Manager* to identity certain punch list items which must be completed by the *Contractor* prior to moving to the next quality and performance assurance stage.

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5 SCOPE

The EHDP covers nine different documents/steps as a QA implementation measure during the equipment handover procedure as listed below:

- Factory Acceptance Test (FAT) Procedure
- FAT Checklist
- FAT Punch List Items
- Shop Performance Test
- Shop Release Certificate (SRC)
- Site Acceptance Test (SAT) Procedure
- SAT Checklist
- SAT Punch List
- Ready for start-up Certificate

6 DESCRIPTION OF ACTIVITIES

6.1 Factory Acceptance Test (FAT) Procedure

The *Contractor* shall prepare and submit a FAT procedure to the *Project Manager* for review and approval. The *Contractor* updates the FAT procedure to include the comments submitted by the *Project Manager*.

The *Contractor* shall make provision for all equipment (new and temporary), instruments, consumables, personnel and all other things necessary that will enable the *Project Manager* to complete the FAT at the *Contractors* or OEMS premises prior to being dispatched to site, by testing that the supply and performance of the equipment meet with all the requirements of the applicable specification.

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6.2 FAT Checklist

The *Contractor* shall prepare and submit a FAT checklist to the *Project Manager* for review and approval. The FAT procedure and checklist shall be submitted to the *Project Manager* for review and comment four weeks prior to the FAT date, and the *Project Manager* shall have two weeks to submit comments to the *Contractor* for the changes that are to be made by the *Contractor* to the FAT procedure and checklist sheet.

The *Project Manager* shall be notified four weeks prior of the *Contractors* proposed FAT date.

The *Contractor* updates the FAT checklist to include the comments submitted by the *Project Manager*.

6.3 FAT Punch List Items

The *Project Manager* submits to the *Contractor* within five working days of the FAT, a list of punch items (i.e. a defects list) identified during the FAT that are to be corrected by the *Contractor*.

Dependent on the nature of the FAT punch items, the *Employer* may elect for a FAT close-out meeting where the *Contractor* shall demonstrate to the *Project Manager* that all the FAT punch items have been rectified. Alternatively, and at the *Project Managers* discretion, the *Project Manager* may request from the *Contractor* other forms of evidence that the FAT punch items have been completed.

The *Employer* will only issue to the *Contractor* a Shop Release Certificate (SRC) when the *Project Manager* is satisfied that all FAT punch items are complete.

6.4 Shop Performance Test

Upon completion of the FAT and if required by the relevant specification, the *Contractor* shall arrange a shop performance test in accordance with the applicable specification, the results of which will be witnessed by the *Project Manager*.

6.5 Shop Release Certificate (SRC)

Upon completion of the FAT punch list items and the successful completion of the Shop Performance Test if applicable, the *Contractor* shall request from the *Project Manager* the SRC. The *Project Manager* shall sign and issue the SRC to the *Contractor* when the *Project Manager* is satisfied that all the necessary FAT punch list items have been completed and, if applicable, the equipment has passed the requirements of the Shop Performance Test.

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6.6 Site Acceptance Test (SAT) Procedure

The *Contractor* shall prepare and submit a SAT procedure to the *Project Manager* for review and approval. The SAT is typically a truncated activity schedule of the FAT and equipment items to be tested on site prior to the commencement of commissioning. The *Contractor* updates the SAT procedure to include the comments submitted by the *Project Manager*.

6.7 SAT Checklist

The *Contractor* shall prepare and submit a SAT checklist to the *Project Manager* for review and approval. The *Contractor* updates the SAT checklist to include the comments submitted by the *Project Manager*.

The same procedure and checklist submission and approval timelines apply to the SAT process that have been specified for the FAT process.

6.8 SAT Punch List Items

The *Project Manager* submits to the *Contractor* a list of punch items (i.e. Defects list) identified during the SAT that are to be corrected by the *Contractor* prior to the issue of the Ready for Start-up Certificate.

The same procedure submission timelines apply to the SAT Punch list that have been specified for the FAT Punch list.

6.9 Ready for Start-up Certificate

After final installation on site, prior to the introduction of the process medium to the equipment and prior to the start-up of the equipment, the *Contractor* shall invite the OEM to inspect the equipment to ensure that it has been installed in accordance with their requirements.

When the *Employer* is satisfied that the equipment Quality Control documentation is suitably complete and the listed Defects are complete, the *Project Manager* shall issue a Ready for Start-up Certificate to the *Contractor*.

The Ready for Start-up Certificate is a mechanism to ensure the safe commencement of start-up and pre-commissioning and is at the discretion of the *Project Manager.*

The Ready for Start-up Certificate is not in any way, shape or form an indication by the *Employer* or the *Project Manager* of Completion or acceptance of the *works*, but is indication that the applicable stages of notified Defects have been corrected and that the *Contractor* may proceed in a safe manner to begin with the start-up of the equipment, with minimal risk to the *Employers* facility operations and staff.

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7 TYPICAL DEFECT ITEMS

7.1 Category 1

A non-exhaustive list of Category 1 punch list or Defect Items are presented below.

- Welding not complete
- Hydrostatic test not complete
- Equipment not installed
- Engine controller specification deviations
- Control system inconsistencies
- Items not correctly installed
- Baseplate issues
- Shop performance test incomplete or failure to meet specification
- NDT not complete
- Fittings not installed
- Incorrect gaskets installed
- Incorrect bolts installed
- Supports outstanding
- U bolts outstanding
- Spades not removed
- Loop checks outstanding
- QA documentation incomplete
- Operating and maintenance manuals not available
- Undue stress on pipework
- Second laser alignment certificate not acceptable/incomplete
- Wet equipment (lubricating oils, cooling water etc.)
- Fuel required for tanks
- Prime engines with fuel

All Category 1 items on the pre-start-up Defects Certificate shall be completed and signed off by the *Contractor* and the *Supervisor* prior to issuing of the Shop Release Certificate, or Ready for Start-up Certificate.

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7.2 Category 2

A non-exhaustive list of Category 2 punch list or Defect Items are presented below.

- Painting Outstanding
- Insulation Outstanding
- Equipment identification and tagging (excluding cable numbering)

Category 2 items are items that in the *Supervisor* or *Project Managers* opinion can be completed by the *Contractor* after delivery to site or during or after start-up, but are to be completed prior to commissioning.

8 DOCUMENTATION

The *Contractor* shall always have available throughout the various stages, the QA documentation required by the specification and shall include the original copy of the EHDP and associated certificates.

The following documentation must always be available to the *Employer,* the *Project Manager* and the *Supervisor* in hard copy format.

8.1 Design and Drawings

The latest accepted revision of all designs, specifications, datasheets and drawings that have been issued by the *Contractor* to the *Employer* for acceptance*,* that shall include but are not limited to process and instrumentation diagrams (P&ID's), specifications, wiring schematics, datasheets, control narratives, general arrangement drawings, as-built drawings etc.

8.2 Quality Assurance Plans

Up to date Quality Assurance Plans and Quality Control Plans for all equipment applicable to the various QA stage.

8.3 Operating and Maintenance Manuals

The Operating and Maintenance Manuals for all equipment applicable to the various QA stage.

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FIRE SYSTEM SPECIFICATION

COMMISSIONING AND HANDOVER PROCEDURE

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1 INTRODUCTION

This document provides a comprehensive framework for the commissioning and handover of fire system installations, ensuring a structured transition from construction to operational readiness. The process is divided into distinct stages, each with specific documentation, responsibilities, and quality controls to guarantee that the system meets all contractual and safety requirements before being handed over for beneficial use.

Section 2 outlines the sequential stages of commissioning and handover, including the management of defects at each phase and the issuance of critical certificates such as the Ready for Commissioning and Ready for Operation Certificates.

Section 4 details the essential documentation required for commissioning, including design drawings, operating manuals, work packs, and the Defects Register. This documentation ensures traceability, compliance, and readiness at every milestone. Section 5 describes the activities undertaken during each stage, from initial inspections and defect identification to the final commissioning tests and handover procedures.

Finally, Section 6 assigns clear responsibilities to each party involved, emphasizing the collaborative effort required to achieve a safe, complaint, and efficient handover. The *Contractor*, *Project Manager*, and *Employer* each play pivotal roles in progressing the *works*, resolving defects, and validating system performance, culminating in the formal completion and transfer of the fire system installation.

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2 COMMISSIONING AND HANDOVER STAGES

The commissioning and final construction activities are sequenced to ensure that a fire system for the Site is always operational.

The Project Team identifies and documents the state of completion of the *works* in total or part (by system) such that commissioning activities can be undertaken safely.

The *Contractor* conducts pre- and cold commissioning of Plant and Materials as specified elsewhere in the Works Information. The *Contractor* develops the final commissioning plan for approval by the *Project Manager*.

The stages of commissioning and handover are listed below.

1) Pre-commissioning Defects Register
2) Ready for Commissioning Certificate
3) Commissioning
4) Pre-operation Defects Register
5) Ready for Operation Certificate
6) Pre-Completion Defects Register
7) Completion

The various commissioning and handover certificates issued by the *Project Manager* through the commissioning and handover phases, are not an indication by the *Employer* or the *Project Manager* that the *Contractor* has achieved Completion. Completion is only achieved as defined in the Contract Data and the Works Information.

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3 DEFINITIONS

3.1. The Project Team

The Project Team consists of the *Project Manager*, the *Supervisor,* the *Employers* personnel, and the *Employers* Owners Team personnel, typically as identified on the Ready for Commissioning and Ready for Operations Certificates, and the *Contractor*.

3.2. Pre-Commissioning Defects Register

The Pre-commissioning Defects Register lists all defects or outstanding activities identified by the Project Team before Commissioning. The Defects included on the Pre-Commissioning Defects Register are Defects that prevent the *Contractor* from commencing Commissioning.

3.3. Discipline Readiness Certificate

The Discipline Readiness Certificate is a progress milestone immediately prior to completion of the Ready for Commissioning Certificate. It is a discipline specific mechanism to demonstrate the responsible engineering professionals are satisfied that the applicable area of the Plant is Ready for Commissioning to commence safely.

3.4. Ready for Commissioning Certificate

The Ready for Commissioning Certificate is a progress milestone immediately prior to Commissioning. Ready for Commissioning is therefore concerned with the verification of the state of Plant and Materials, to determine readiness for Commissioning by the *Contractor*.

3.5. Commissioning

Commissioning is the act of verifying the Plant and Materials that meet the approved design and performance criteria, and that the *works* are fit for purpose.

The Commissioning tests are a complete functionality test of the system using the normal process fluid and will include start-up and operation of the system from the various local and remote starter panels.

3.6. Pre-Operation Defects Register

The Pre-operation Defects Register lists all Defects or outstanding activities identified by the Project Team before or during Commissioning and before handover to the *Employers* operations team.

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The Defects included on the Pre-operation Defects Register are Defects that prevent the *Employer* from taking beneficial operation of the new fire system and prevent the *Contractor* from commencing with decommissioning and demolition of the existing fire system.

3.7. Ready for Operation Certificate

The Ready for Operation Certificate is a progress milestone immediately prior to handover of the new fire system to the *Employers* operations for beneficial use. It is concerned with verification that the *Employer* has been adequately trained in the safe and controlled use of the system, that the *works* is sufficiently advanced and that the necessary documentation is available.

The Ready for Operation (RFO) certificate is typically issued after key Plant, Material and documentation is handed over to the *Employer,* as well as the training of the *Employers* staff on the new Plant and Material is complete.

3.8. Pre-Completion Defects Register

The Pre-Completion Defects Register lists all Defects or outstanding activities identified by the Project Team in accordance with the Works Information and lists items that require completion prior to the issue of the Completion certificate.

The Pre-Completion Defects Register is a combined list of all Defects identified during the execution, pre-commissioning, and commissioning of the *works.*

3.9. Completion

Completion means Completion as defined by the Contract.

3.10. Defect Classification

The *Project Manager* makes the final decision on the classification of the Defect as either Category 1, 2, 3 or 4. The *Project Manager* decides the frequency and format of risk reviews of the Defect Register, and whether they will take place or not.

- **Category 1** (Pre-commissioning Defects Register)

The *Contractor* corrects all Category 1 Defects on the Pre-commissioning Defects Register. The *Supervisor* signs the Defects as corrected before the *Project Manager* signs the Ready for Commissioning Certificate.

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Typical examples of Category 1 items are:

- Discipline specific readiness certificates outstanding
- Welding incomplete
- NDT incomplete
- Items of Plant and Materials incomplete or outstanding
- Incorrect gaskets installed
- Items not correctly installed
- Incorrect bolts installed
- Supports outstanding
- Pipe anchoring incomplete
- Loop checks outstanding
- Certificates of Compliance outstanding
- Hazardous Area Classification documentation outstanding
- Red-lined as-built drawings not available
- Grouting not complete
- QA documentation incomplete
- Spades not removed
- HAZOP action items incomplete

- **Category 2** (Pre-operation Defects Register)

The *Contractor* corrects all Category 2 Defects on the Pre-operation Defects Register. The *Supervisor* signs off the Defects as corrected before the *Project Manager* signs and issues the Ready for Operations Certificate.

Typical examples of Category 2 items are:

- Process, performance or operational issues that arise during Commissioning.
- Flow-direction arrows missing
- Valve tagging and numbering
- Valve lock-outs
- Effluent, drainage, or stormwater issues unresolved or incomplete
- Signage and labelling
- Lighting and access
- Insulation outstanding
- As-built site layout unavailable
- Maintainability and access issues with Plant and Materials

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- Emergency response plan unavailable
- Employee training and handover outstanding
- SPIR list not available
- Re-instatement of Plant and Materials (e.g. removal of temporary spools)
- Operating and Maintenance manuals not approved

- **Category 3** (Pre-completion Defects Register)

The *Contractor* corrects all Category 3 Defects on the Pre-completion Defects Register. The *Supervisor* signs the Defects as corrected before the *Project Manager* signs and issues the Completion Certificate.

Typical examples of Category 3 items are:

- Painting Outstanding
- Pipe wrapping
- Reinstatement of the Site to the original condition
- The specified Site Levelling and clearing is incomplete
- Incorrect operating levels in diesel, foam concentrate or water tanks.
- Defects identified in the *works* due to non-compliance with the Works Information

- **Category 4** (Minor Defects)

The *Contractor* adds the Category 4 minor Defects that do not prevent use of the *works* to the Defects Certificate and corrects them within the Defect Correction period.

Typical examples of Category 4 items are:

- Final CAD as-built drawings unavailable
- Pipe banding identification outstanding
- Localised paint remedial works and touch-ups
- Final tidying up of the site
- Handover documentation outstanding
- Final model review outstanding
- SAP Equipment Registration List outstanding
- Defects with the demolition of the existing fire system
- Defects identified prior to the Defects Date

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3.11. Defects Register

The Defects Register is a live electronic document of all Defects that are identified by the Project Team, and comprises all Defects identified during the *works.*

It includes Defects on the Pre-commissioning Defects Register, the Pre-operation Defects Register, the Pre-completion Defects Register and the Defects Certificate.

The Defects Register contains the following non-exhaustive list of headings:

- Punch Date
- Discipline
- Defect Description
- Applicable Drawing Number
- Location
- Plant/Material Reference (Pump or JB number etc.)
- Defect Classification (Category 1, 2, 3 or 4)
- Defect Category Description (Label/tag, trunking, QA etc)
- Progress and Planned Defect Correction Date
- Defect Corrected and Sign-off column

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4 COMMISSIONING DOCUMENTATION

The *Contractor* makes available to the Project Team on site, full size hard copies of the Commissioning Documentation listed in the following sub-sections.

4.1 Design and Drawings

The latest revision of all designs, specifications, datasheets, and drawings that have been approved by the *Project Manager,* that include but are not limited to process and instrumentation diagrams (P&ID's), HAZOP and HAZAC reports, isometrics, specifications, wiring schematics, datasheets, control narratives, general arrangement drawings, as-built drawings etc.

4.2 Operating and Maintenance Manuals

The *Contractor* makes available the Operating and Maintenance Manuals for all Plant and Materials as required by the relevant stage of commissioning and handover.

4.3 Work Packs

The *Contractor* submits the format of the Works Packs to the *Project Manager* for approval and creates them for the testing and inspection of each Working Area.

The Work Packs include all the relevant documents necessary to inspect, test and verify the performance of a system or item.

All Work Packs carry the minimum following documents where applicable:

- As-built Process and Instrumentation Diagram (P&ID)
- Quality Control Plan (QCP)
- Quality Assurance documentation required by the QCP (material certificates etc.)
- Isometric, Equipment drawing, wiring schematics, etc. whichever is applicable
- Hydraulic Test Certificate
- Check Lists
- Latest revision of the Defects Register for the Working Area

4.4 Defects Register

The *Contractor* submits the format of the Defects Register to the *Project Manager* for approval.

The *Contractor* prepares, owns, and updates the Defects Register on a weekly basis and submits updates to the *Project Manager.*

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The *Contractor* provides a printed A3 colour copy of the updated Defects Register to each member of the Project Team during each inspection and commission activity.

The *Contractor* scans and files hard copies of Defects Registers with corrected Defect items that have been approved by the *Supervisor* and refers to the scanned copies on the master Defects Register for verification by the *Project Manager.*

4.5 Schedule of Commissioning Design Set-points

The *Contractor* prepares and issues to the *Project Manager* a schedule of the commissioning design set-points to be used as verification by the *Project Manager* during Commissioning.

The schedule includes the following minimum information;

- Equipment tags as indicated on the P&ID's
- Pump speeds (RPM)
- Pump design flow rates
- Pump design discharge pressure
- Pump design suction pressure
- Orifice plate hole diameters
- System design flow rates (per pipeline header downstream of control valves)
- Design set pressures of all control valve
- Design flow rates of all control valves
- Valve status list (locked open, locked close etc.)

4.6 Certificates

The *Contractor* updates and maintains the Discipline Readiness Certificates, Ready for Commissioning Certificate and Ready for Operations Certificate within the respective Work Packs

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5 DESCRIPTION OF ACTIVITIES

The *Contractor* and *Supervisor,* together with the *Employers* nominated representative (e.g. an approved inspection authority or AIA), carry out inspections during construction to the approved quality management plan that monitor and audit the *Contractor's* work practices and quality system.

The *Contractor* advances construction to a level where Commissioning can safely commence. The *Contractor* performs an internal inspection of the *works* and corrects the Defects on the *Contractors* own internal Defects Register prior to inviting the Project Team to inspect the *works* for Defects. The *Contractor* gives the *Project Manager* access to the internal Defects Register when asked to do so.

The *Contractor* expedites commissioning of the major Plant in parts to identify any major Defects early-on and resolves them prior to Commissioning. This may include first completing the portion of the *works* within the pump house that will enable the start-up of the pump-sets and the operation of the fire control system.

In some instances, it is only possible to identify certain Defects as the Project Team progresses through the various Commissioning stages.

5.1 Pre-Commissioning Defects Register

The *Contractor* compiles the Pre-commissioning Defects Register per Working Area. The Project Team supervise or participates during the inspection during preparation of the Pre-commissioning Defects Register.

The Project Team includes any outstanding documentation on the Pre-commissioning Defects Register prior to Commissioning that is required by law or by the Works Information. The *Contractor* corrects the Defects prior to the commencement of Commissioning.

The *Contractor* includes the Pre-commissioning Defects Register with the Ready for Commissioning Certificate as well as a list of applicable drawings.

5.2 Discipline Readiness Certificate

The *Contractors* appointed engineering professionals together with the *Employers* appointed engineering professionals, inspect the Plant and Materials for conformance to the Works Information prior to signing the Discipline Readiness Certificate. The *Contractor* adds the defects identified by the engineering professionals to the Pre-commissioning Defects Register.

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5.3 Ready for Commissioning Certificate

The *Project Manager* issues a Ready for Commissioning Certificate to the *Contractor* when the Project Team are satisfied that the Work Packs are suitably complete, the requirements of the Quality Plans have been fulfilled to a stage where it is safe to commission, and the Defects listed on the Pre-commissioning Defects Register have been corrected. Additional requirements are shown on the template of the RFC Certificate included in Annexure A.

The Project Team members sign the RFC Certificate when the checklist is complete.

5.4 Commissioning

The *Contractor* commissions the *works* in part or combined. The *Contractor* recommissions the individual areas of the *works* as a combined system if required to do so. The *Contractor* prepares Ready for Commissioning Certificates for each part of the *works* that will be commissioned.

The *Contractor* flushes all Plant and Materials, removes temporary Plant and Materials, installs the final Plant and Materials, and then reinstalls temporary Plant and Materials if signing of the RFC Certificate and the RFO Certificate do not happen concurrently.

The *Contractor* initiates the first start-up of the major Plant, such as the pump-sets and fire control system, and flushes all Plant and Materials at full flow using the main pump-sets as the first step of commissioning.

The *Contractor* removes in-line Plant and Materials that may be damaged during the flushing exercise and replaces it with temporary Plant and Materials, such as cotton reel spools.

The *Contractor* provides the necessary Plant and Materials at the end of all open-ended piping systems to prevent any foreign objects within the piping system from becoming airborne.

The *Contractor* removes temporary Plant and Materials and reinstalls the final Plant and Material after the flushing activity is complete, and if necessary, upon signing of the RFO Certificate.

The *Contractor* introduces the normal process fluid and under supervision and instruction by the *Project Manager,* performs the necessary tests of all Plant and Materials, and demonstrates to the *Employer* that the system performs as is intended and is free of Defects.

The *Contractor* provides and undertakes all calibration, adjustment, testing and setting of the various Plant and Materials, verification of the performance of the Plant and Materials that include ultra-sonic flow measurement, rotational speed and sound pressure level recordings and other tests as described in the Works Information.

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5.5 Pre-Operation Defects Register

During the Commissioning activities, the Project Team identifies performance or other Defects that are added to the Pre-operation Defects Register. The *Contractor* corrects the Defects on the Pre-operation Defects Register.

The *Contractor* includes the Pre-operations Defects Register with the Ready for Operation Certificate as well as a list of applicable drawings.

5.6 Ready for Operation Certificate

The *Project Manager* issues a Ready for Operation Certificate to the *Contractor* when the Project Team are satisfied that the Defects listed on the Pre-operation Defects Register are corrected and the requirements shown on the template of the RFO Certificate included in Annexure B are met.

The Project Team members sign the RFO Certificate when the checklist on the RFO template is complete.

The *Employer* hands over the Working Areas to the *Contractor* for the decommissioning and demolition of the existing firefighting system after the RFO Certificate is signed.

5.7 Pre-Completion Defects Register

The *Contractor* invites the Project Team to perform the final tests and inspections of the various Working Areas that have not undergone a prior inspection before Completion. The *Contractor* adds Defects to the Pre-completion Defects Register that are to be corrected prior to the issue of the Completion certificate.

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6 RESPONSIBILITIES

Prior to Commissioning, the *Contractor* has prime responsibility for the *works* being constructed.

At the beginning of commissioning and handover, the responsibility for co-ordination of the commissioning and handover plan rests with the *Project Manager* and the *Contractor* for Commissioning activities.

During Commissioning, the *Contractor* adopts responsibility for the facilities on behalf of the *Employer* but is guided by the *Project Manager* by virtue of his understanding and control over the Site, and access to the various resources that make up the Project Team. The *Contractor* contributes significantly by virtue of his command of development information, supplier links, and contractual arrangements with the original equipment manufacturer (OEM) suppliers.

6.1 Pre-commissioning Defects Register

The *Contractor* completes the *works* in total or in part and provides the *Project Manager* with written notice in accordance with the *Contract* and Works Information to inspect the whole or part of the *works* for Defects in preparation of the Pre-commissioning Defects Register.

The *Contractor* timeously completes all Defects listed on the Pre-commissioning Defects Register to prevent the delay of Commissioning.

The *Contractor* notifies the *Project Manager* once the Defects listed on the Pre-commissioning Defects Register are corrected for inspection by the Project Team. The *Supervisor* signs Defect items that have been corrected by the *Contractor.*

6.2 Ready for Commissioning Certificate

The applicable engineering professionals and the Engineering Manager appointed by the *Contractor* sign the Discipline Readiness Certificate after they have inspected the Plant and Materials, and the Defects identified by them have been corrected. The *Contractor* invites the *Employers* engineering professionals to inspect the Plant and Materials afterwards and corrects the identified Defects before the *Project Manager* signs the Discipline Readiness Certificate.

The *Project Manager* provides the *Contractor* with the Ready for Commissioning Certificate when the requirements of the Ready for Commissioning Certificate are met.

During Commissioning, the *Contractor* oversees and prevents damage to and unsafe use of the Plant and Materials that may result from improper use by the Project Team.

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During Commissioning, the *Contractor* mobilises suitable supervision, number of personnel and Equipment, commensurate with the skill and experience level required to correct any failures of Plant and Materials.

The *Contractor* leads the resolution of initial performance failures to meet the design and performance criteria defined in the accepted Basis of Design, including;

- Safety and operational defect
- Process design errors
- Detailed design errors
- Plant and Material selection errors
- Plant and Material performance Defects
- Construction Defects

The *Contractor* resolves the above Defects and any others prior to reinitiating Commissioning.

6.3 Commissioning

The *Contractor* makes available all necessary calibrated Equipment, Personnel, Plant, Materials, and results to Commission the new system and validate the performance criteria are being met.

The *Contractor* provides the necessary water, foam concentrate, diesel, and other consumables necessary to commission the new fire system and refills the storage tanks to the normal operational levels as specified in the Works Information.

The Project Team witness Commissioning to verify the system performance.

The *Contractor* makes use of the Sites effluent and stormwater system to contain the discharge from the fire system during Commissioning and provides additional effluent handling measures if necessary to contain the volume discharge requirements of the *Contractors* commissioning plan.

The *Contractor* directs fire water and foam pre-mix from the Sites spill containment areas to the spill basin and returns the level in the spill basin to the normal design operating level before the end of each day of commissioning activities.

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6.4 Ready for Operations Certificate

The *Project Manager* provides the *Contractor* with the Ready for Commissioning Certificate when the requirements of the Ready for Commissioning Certificate are met.

The *Contractor,* together with the *Employers* team, provide training to the *Employers* on-site operational team on the operation of the new fire system.

The *Contractor* maintains the availability and operation of the existing fire system up to completion of the Ready for Operations Certificate.

6.5 Completion

The *Contractor* invites the *Project Manager* and *Supervisor* to verify that all items listed on the Defects Register are complete.

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ANNEXURE A – RFC CERTIFICATE TEMPLATE

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Transnet Pipelines
Transnet Pipelines – Ready for Commissioning (RFC)
Certificate for a Plant

NOTICE OF READY FOR COMMISSIONING (RFC) FOR A PLANT		Certificate Number:	
Unit / Plant / Asset Title:		**Plant / Asset Ref:**	
System Title:		**System No:**	
Sub-System Title:		**Sub-System No:**	
Equipment / Item Description:		**Equipment Item Number:**	
Ref. Drawing No(s):		**Rev:** N/A * ☐	

The main *Contractor* advises that the total scope of work for above referenced Plant has been completed and that the Plant has met the conditions of "Ready for Commissioning":

- the mechanical equipment and piping systems have been certified as mechanically completed ☐
- the security system and equipment installations have been tested and certified as complete ☐
- the construction environmental authorization requirements have been met and complied with ☐
- control systems facilities have been certified as complete ☐
- electrical distribution equipment and infrastructure have been certified and the installation complete ☐
- all adjacent plants are aware of the impending start-up ☐
- fire and safety facilities have been certified as complete ☐
- Communications facilities have been certified as complete ☐
- all associated civil work and structural steelwork have been certified complete ☐
- insulation and painting are complete ☐
- medical station mobilised and informed of impending start-up ☐

* All Category 1 Defect items have been signed-off, however there are exception items that have been included in the master punch list for completion which will not affect RFC ☐
Refer to Defect Register with reference number:

* Applicable readiness certificates available with below references; ☐
- Mechanical Readiness -
- Electrical Readiness -
- Instrumentation and Control Readiness -
- Civil Works Readiness -

* Corrective Actions and timing for open Category 2, 3 and 4 Defect items have been agreed. ☐
Refer to Defect Register with reference number:

All construction & engineering related documentation including manufacture data books, O&M manuals & red-lined documents will be available, from the *Contractor* until final Project Handover as per the Project Handover Procedures

The *Employer* confirms acceptance that the Plant is "Ready for Commissioning: (RFC) and that transfer of care, custody and control to The *Employer* is affected for the complete Plant.
Transnet Pipelines, as *Employer*/user of machinery, is legally responsible for the complete Plant under the Occupational Health & Safety Act 85 of 1993 (as amended).

**Note: The responsible persons must ensure that any other applicable signatories are included on the form, and are responsible for obtaining these signatures.

	RESPONSIBILITY (CONTRACTOR)	COMPANY	NAME	SIGNATURE	DATE
ADVISED BY	Project Manager				
	Engineering Manager				
	Lead Fire Engineer				
	Construction Manager				
	Health and Safety Manager				
	Quality Control Manager				
	Environmental Officer				
	Electrical Contractor				
	Instrumentation Contractor				
	Mechanical Contractor				
	Structural Contractor				
	Pump-set Supplier				
	Water Tank Supplier				

Transnet Pipelines
Transnet Pipelines – Ready for Commissioning (RFC)
Certificate for a Plant

ACCEPTANCE OF READY FOR COMMISSIONING FOR A PLANT OR SYSTEM					
	RESPONSIBILITY (EMPLOYER)	**COMPANY**	**NAME**	**SIGNATURE**	**DATE**
ACCEPTANCE BY THE *EMPLOYER*	*Project Manager*	TPL			
	Supervisor				
	GMR 2.1	TPL			
	Site Agent	TPL			
	Depot Manager	TPL			
	Electrical	TPL			
	MC & I	TPL			
	Operations	TPL			
	Mechanical & Piping	TPL			
	Fire Protection	TPL			
	Security	TPL			
	Environmental	TPL			
	Cathodic Protection	TPL			
	Civil & Structural	TPL			

*Refer to attached document list of drawings / marked-up drawings and documents for additional reference

ANNEXURE B – RFO CERTIFICATE TEMPLATE

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Transnet Pipelines
Transnet Pipelines – Ready for Operation (RFO)
Certificate for a Plant

READY FOR OPERATION CERTIFICATE FOR A PLANT		Certificate Number:	
Unit / Plant / Asset Title:		**Plant / Asset Ref:**	
System Title:		**System No:**	
Sub-System Title:		**Sub-System No:**	
Equipment / Item Description:		**Equipment Item Number:**	
Ref. Drawing No(s):		**Rev:** N/A * ☐	

The above plant is considered to have met the conditions for "Ready for Operation", namely safe and controlled start-up.

- all equipment and piping is properly stencilled, including sample points ☐
- safety file complete ☐
- fire-fighting services, equipment and facilities including fire/gas alarms and public address systems, are available ☐
- safety procedures have been communicated and all safety equipment is in place ☐
- emergency procedures have been discussed, communicated and are understood ☐
- effluent and rundown facilities are available to support start-up ☐
- copy of hand marked-up master drawings (including instrument loop drawings, electrical one-line diagrams and P&ID's transferred over to Operations ☐
- feedstocks meet specification and adequate suppliers are available to support start-up ☐
- work permit procedures are in place ☐
- Occupational Health & Safety Act 85 of 1993 (as amended) requirements have been explained and are understood by all parties ☐
- applicable personnel have been trained in start-up and operating procedures ☐
- all laboratory facilities in place and laboratory mobilised ☐
- waste handling facilities are available to support start-up ☐
- the requirements of the Environmental Management System have been fulfilled and measurement activities for environmental impact assessment are in place ☐

All commissioning activities have been addressed, and include:

- an appropriate standard of cleanliness attained for all applicable equipment and piping ☐
- all relief valves set and installed ☐
- all orifice plates measured and correctly installed ☐
- all applicable rotating machinery run-in ☐
- all applicable electrical testing and livening completed ☐
- best efforts made to meet, or approach, plant operating conditions by simulated or actual means ☐
- all trips tested ☐
- all underground systems operational ☐
- Record of Commissioning of Systems signed-off ☐
- all specific requirements available for start-up eg. start-up strainers ☐
- all equipment lubricated ☐
- tightness testing complete and plant leak-free ☐
- all applicable equipment dried out ☐
- all blinds installed for safe start-up ☐
- all control loops function tested and tuned ☐
- all lock-out devices in position and key control procedure in place ☐
- all production logs operational ☐

* Applicable Process Systems, Utility System and Technical Systems RFC Certificates available ☐
* All Categories 1 and 2 Defect items have been signed-off;
Refer to Defects Register with reference number: ☐
* Corrective Actions and timing for Defects Register items have been agreed.
Refer to Defects Register: ☐

The Maintenance Disciplines have confirmed clearance for operation. Agreement that safe start-up activities may commence, as agreed by the signatory parties below.

Subject to the attached open Category 3 and 4 Defects being rectified by the stipulated due date, Transnet Pipelines hereby accepts the above referenced total Plant as complete in all regards of installation and agrees that safe start-up activities may commence.

**Note: The responsible persons must ensure that any other applicable signatories are included on the form and are responsible for obtaining these signatures.

**Refer to attached document list of drawings / marked-up drawings and documents for additional reference*

	RESPONSIBILITY (*CONTRACTOR*)	COMPANY	NAME	SIGNATURE	DATE
ADVISED BY	Project Manager				
	Engineering Manager				
	Lead Fire Engineer				
	Construction Manager				

	Health and Safety Manager				
	Quality Control Manager				
	Environmental Officer				
	Electrical Contractor				
	Instrumentation Contractor				
	Mechanical Contractor				
	Structural Contractor				
	Pump-set Supplier				
	Water Tank Supplier				

ACCEPTANCE OF READY FOR OPERATION					
	RESPONSIBILITY (EMPLOYER)	**COMPANY**	**NAME**	**SIGNATURE**	**DATE**
ACCEPTANCE BY THE *EMPLOYER*	*Project Manager*	TPL			
	Supervisor				
	GMR 2.1	TPL			
	Site Agent	TPL			
	Depot Manager	TPL			
	Electrical	TPL			
	MC & I	TPL			
	Operations	TPL			
	Mechanical & Piping	TPL			
	Fire Protection	TPL			
	Security	TPL			
	Environmental	TPL			
	Cathodic Protection	TPL			
	Civil & Structural	TPL			

*Refer to attached document list of drawings / marked-up drawings and documents for additional reference

FIRE SYSTEM SPECIFICATION

CONTAINERISED PUMP-SET SOLUTION

Document number	PL 919
Version number	1
Classification	Unclassified
Effective date	1 January 2026
Review date	1 July 2029

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SUMMARY VERSION CONTROL

VERSION NO.	NATURE OF AMENDMENT	PAGE NO.	DATE REVISED
1	New Specification	ALL	1 January 2026

Note: Only latest amendments and/or additions are reflected in italics in the body of the document.

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DOCUMENTATION SIGN-OFF SHEET

I, the undersigned hereby approve this procedure.

ROLE	CAPACITY/ FUNCTION	SIGNATURE	DATE
Compiled by:	**Pieter Jacobs**		
Approved by:	**Papa Moratwe**		

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1 INTRODUCTION

The *Employer* does not solely rely on the available municipal water supply to meet the performance requirements of the firefighting equipment that has been selected to operate in the event of a fire and have therefore opted to include in the firefighting system two fire pump-sets, connected with its corresponding water tanks, each with identical performance specifications and duty points. The pump-sets will be arranged in a duty stand-by configuration to provide the system with a suitable level of redundancy.

In addition to the discharge of water during a fire event, the deployment of foam pre-mix is also required. Foam concentrate pumps will be provided on each of the pump-sets to provide the required foam concentrate to the system.

In summary, each pump-set (one assigned as a duty pump-set and the second as a stand-by pump-set) will comprise of the following major equipment components;

- An engine control panel (ECP)
- The diesel engine as the shared driver for the fire water pump and the foam concentrate pump
- A fire water pump
- A foam concentrate pump

The pump-set and associated equipment included in this specification, will all be housed within a single, or across two, modified 6m or 12m shipping containers, populated and pre-commissioned at the *Contractors* premises prior to site delivery.

Where the terms ‘Pump-set’, ‘containerised pump-set’, ‘containerised solution’ and ‘equipment’ are used in this specification, they shall be interpreted to mean Plant and Materials as defined in NEC3 Clause 11.2(12).

It is important to note from the outset that *Employer* has elected to design the firefighting system to introduce foam into the water system at an induction ratio of 3%.

Properties of the foam concentrate can be found in the Foam Concentrate Specification, document PL915. The *Contractor* shall review the properties of the foam concentrate when determining the suitability with the equipment.

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2 OVERVIEW OF SPECIFICATION

The *Contractor* is responsible for the design, procurement, supply, fabrication, assembly, pre-delivery testing, delivery to site, installation, final assembly, on-site testing, quality assurance (QA) documentation and commissioning of one (1) duty and one (1) stand-by firefighting containerised pump-set solution, and all auxiliary and associated equipment in accordance with this specification and to the satisfaction of the *Employer* or his designated representative(s).

The total number of pump-sets called for under this specification is two (2).

This specification is divided into several sections that provide individual specifications of each of the major equipment components i.e. the container, the primary driver, the fire water pump, the foam concentrate pump and the ECP.

A separate section also provides the specifications and performance testing criteria for the containerised fire pump-set as a complete unit.

The design and specifications listed under each section applies in its entirety to each pump-set. A summary of selected sections is provided below;

- Section 5 - External and supplementary applicable standards and specifications.
- Section 7 - General information about the arrangement and how the duty and stand-by pump-sets will interface with one another. Also, within this section will be site specific information and information regarding the nature of the installation and installation constraints.
- Section 8 - Specifications of the shipping container used to house the pump-sets and ancillary equipment
- Section 9 - Specifications of the primary driver for the fire water pump and foam concentrate pump.
- Section 10 - Specifications applicable only to the fire water pump.
- Section 11 - Specifications applicable only to the foam concentrate pump.
- Section 12 - Specifications applicable to the ECP.
- Section 13 – Specifications and performance requirements applicable to the complete pump-set i.e. tolerances, testing and commissioning.

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The remaining sections within this document do not require further explanation and additional details can be found within the respective section.

3 BATTERY LIMITS

The battery limits of this specification are outlined below.

- The walls of the containerised solution
- The firewater pump suction and discharge flanges
- The foam concentrate pump suction and discharge flanges
- The supply and installation of the essential electrical supply within the Pump House building is covered elsewhere, however the *Contractor* makes provision for the essential electrical supply cable to enter the container and connection to the essential electrical supply distribution board (DB) within the container
- The supply and installation of the normal electrical supply within the Pump House building is covered elsewhere, however the *Contractor* makes provision for the normal electrical supply cable to enter the container and connection to the normal electrical supply distribution board (DB) within the container
- The supply and installation of the normal electrical supply motor control centre (MCC) within the Pump House building is covered elsewhere, however the *Contractor* makes provision to interface the normal electrical supply motor control centre (MCC) with the Jockey Pump Control Panel (JPCP) installed within the containerised solution.
- The supply and installation of the fire control panel (FCP) battery back-up and fire control panel (FCP) within the Pump House building is covered elsewhere, however the *Contractor* makes provision to interface the fire control panel (FCP) with the engine control panels (ECP's) installed within the containerised solution
- The supply and installation of level switches for the diesel tanks is covered elsewhere
- The supply and termination of electrical and instrumentation / control cables between the essential electrical supply distribution board (DB), the normal electrical supply distribution board (DB), the normal electrical supply motor control centre (MCC) and the fire control panel (FCP) that is located within the Pump House building is covered elsewhere.
- The normal electrical supply distribution board (DB) for socket outlets, engine heaters and other electrical systems required within the containerised solution is included in the scope of the containerised solution
- The essential electrical supply distribution board (DB) for lighting, engine control panels and other electrical systems required within the containerised solution is included in the scope of the containerised solution

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- The supply and installation of earthing and bonding system and infrastructure required within and throughout the containerised solution for the effective earthing and bonding of electrical equipment, electrical routing infrastructure, electrical motors, electrical motor chassis, piping, piping supports, etc, is included in the scope of the containerised solution

4 DEFINITIONS

Where acronyms and/or the below terms are used in this specification, the following definitions shall apply;

Abbreviation	Definition
A	Amperes (Electrical)
AC	Alternating Current
AFC	Approved for Construction
ANSI	American National Standards Institute
AR-SFFF	Alcohol Resistant Synthetic Film-Forming Foam
BOQ	Bill of Quantities
CAD	Computer Aided Design
CD	Compact Disc
DB	Distribution Board
DOL	Direct Online
DWG	Drawings
ECP	Engine Control Panel
ECM	Engine Control Module
EHDP	Equipment Handover and Document Procedure
FAT	Factory Acceptance Test
FCP	Fire Control Panel
GA	General Arrangement
hr	Hour
HSSE	Health, Safety, Security and Environmental Plan
IP	Ingress Protection
ISO	International Standards Organisation
kPa	Kilopascal
kVA	Kilovolt Ampere
kW	Kilowatt
LV	Low Voltage
L/min	Litres per minute

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Abbreviation	Definition
m^3	Cubic metres
mm^2	Square millimetres
MCC	Motor Control Centre
MSL	Mean Sea Level
MWT	Medium Wall Thickness
NFPA	National Fire Protection Association
NPSH	Net Positive Suction Head
O&M	Operating and Maintenance Manual
OEM	Original Equipment Manufacturer
PDF	Portable Document Format
PLC	Programmable Logic Controller
PQR	Procedure Qualification Record
QA	Quality Assurance
WPS	Weld Procedure Specification
RF	Raised Face
RFSO	Raised Face Slip-on
RPM	Revolutions Per Minute
SABS	South Africa Bureau of Standards
SANS	South African National Standards
SLD	Single Line Diagram
STD	Standard
Transnet Pipelines	*The Employer*
UL	Underwriters Laboratory
V	Voltage (Electrical)
VA	Volt Ampere (Electrical)
W	Watt (Electrical)
WPQ	Welder Performance Qualifications
Employer	The *Employer* is the *Employer* as defined in the *Contract Data*
Contractor	The *Contractor* is the *Contractor* as defined in the *Contract Data*

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5 ENGINEERING STANDARDS

Although not bound in nor issued with this document, the following standardised specifications as amended shall form part of this specification;

5.1.1 Applicable Standards

ASME Section IX Boiler and Pressure Vessel Code	Qualification Standard for Welding and Brazing Procedures, Welders, Brazers, and Welding and Brazing Operators
ISO 1940-1	Mechanical Vibration – Balance Quality Requirements for Rotors in a Constant (Rigid) State – Part 1: Specifications and Verification of Balance Tolerances
ISO 668	ISO 668 – Series 1 freight containers – Classification, dimensions and ratings
ISO 9906	Rotodynamic Pumps – Hydraulic Performance Acceptance Tests – Grades 1, 2 and 3
PL 631	Specification for Low Voltage Switchgear and Distribution Boards
PL 647	Requirements for the Supply of 110VDC Battery Charger
PL 648	Requirements for the Supply of 50VDC Battery Charger
PL 666	Electrical Design Criteria
PL 711	Specification for Equipment Cabinets to House Electronic Equipment
PL 727	Cable, Racking and Trenching & Earthing Installation Codes of Practice
PL908	Jockey Pump-set Specification
PL909	Pressure Gauge Specification
PL 912	Piping Supplying and Installation Specification
PL 913	Control System Specification
PL 915	Foam Concentrate
PL 916	ECP FCP Control Narrative
PL 917	Equipment Handover and Document Procedure
SANS 455	Covered Electrodes for the Manual Arc Welding of Carbon and Carbon Manganese Steels

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SABS 1200 A	General
SABS 1200 L	Medium Pressure Pipelines
SANS 10114-1	Interior lighting Part 1: Artificial Lighting of Interiors
SANS 10142-1	The wiring of premises Part 1: Low-voltage installations
SANS 10400	The application of National Building Regulations
SANS 121	Hot Dip Galvanised Coatings on Fabricated Iron and Steel Articles – Specifications and Test Methods
SANS 10162	Steel Design Codes: Part 1 - 4
SANS 10160	Loading codes: Part 1 - 8
SANS 1200A (1986)	General
SANS 2001-CS1	Structural steelwork
SANS 50025 / EN 10025	Hot rolled products of structural steels
SANS12944	Paints and varnishes — Corrosion protection of steel structures by protective paint systems
SANS 50025	Hot Rolled Products of Structural Steel
OSHAct 85 of 1993	Occupational Health and Safety Act.
SABS 086-1	Installation, inspection and maintenance of equipment used in explosive atmospheres
SANS 10131	Above-ground Storage Tanks for Petroleum Products
SANS 10139 – 2007	Fire Detection and Alarm Systems for Buildings – System Design, Installation and Servicing
SANS 10400	The National Building Regulations
SANS 9906 - 2016	Rotodynamic Pumps – Hydraulic Performance Tests – Grades 1,2 and 3

5.1.2 Referenced Standards

PL100	Transnet Pipelines Drawing Office Standard (PL100)
PL101	Transnet Pipelines Drawing Office Standard (PL101)
PL102	Transnet Pipelines Drawing Office Standard (PL102)

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PL103	Transnet Pipelines Drawing Office Standard (PL103)
TPL-TECH-DO-WI-001	Transnet Pipelines Handover of As-built and Other Documents from Technical Projects to Drawing Office Work Instruction

6 LOCATION

The *Contractor* shall take cognizance of the following data of the equipment location when preparing the offer;

City	*Contractor* to indicate on data sheet.
Depot	*Employer – Contractor* to indicate on data sheet.
Area	*Contractor* to indicate on data sheet.
Hazardous Area Classification (SANS10089 Part 2 and SANS 10108)	*Contractor* to indicate on data sheet.

6.1 Equipment Numbering

The *Contractor* shall provide two (2) pump-sets that meet or exceed the minimum requirements of this specification.

Where the XX represents the *Employers* depot number. The pumps shall be labelled in accordance with the *Employers* site location depot number in conjunction with the approved P&ID's with this specification as follows;

Duty Fire Water Pump:	XX-P181A
Duty Foam Concentrate Pump:	XX-P181B
Stand-by Fire Water Pump:	XX-P182A
Stand-by Foam Concentrate Pump:	XX-P182B

The pump-sets ECP shall be labelled in accordance with this specification as follows;

Duty Pump-set:	XX-P181-C-3
Stand-by Pump-set:	XX-P182-C-4

The containerised solution shall be marked and identifiable from within the pump house as well as externally from the pump house in accordance with this specification as follows;

Duty Containerised Solution:	XX-P181 – Duty Pump-set
Stand-by Containerised Solution:	XX-P182 – Stand-by Pump-set

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7 GENERAL

The container shall serve as a protective enclosure for the pump-set and ancillary equipment components, providing a weatherproof, vermin proof, secure, and fire-resistant housing. It shall facilitate easy installation, maintenance, and operation of the equipment while allowing for national shipping.

The container and modifications shall comply with ISO 668 for basic container dimensions and strength and SANS 10400 for compliance to the National Building Regulations, including a 60-minute fire resistance rating.

The fully assembled containerised system shall be factory-tested for structural integrity, leak-tightness, fire pump performance, and functionality before shipment. Include hydrostatic testing of piping and operational testing of ventilation, electrical, and any fire suppression systems.

The *Contractor* shall take cognisance of the following information during the pricing and execution of the scope of work, and the *Contractor* shall make provision for costs associated with meeting all the requirements of this specification, whether implicitly or explicitly implied.

7.1 Configuration Options:

Containerised solution configuration varies by site and follows the Works Information specifications.

7.1.1 Two 6 m containers

For medium to larger pump-sets, using two interconnected 6m containers, with provisions for piping, electrical, and control interconnections between them.

7.1.2 Single 12 m container

For smaller pump-sets, with provisions for piping, electrical, and control interconnections.

7.2 Common Baseplate

The primary driver and associated starting and cooling systems, flexible couplings, fire water pump, foam concentrate pump and auxiliary drive unit as well as the ECP shall all be mounted on a common baseplate.

The baseplate shall be fabricated from mild steel to SANS 50025 with minimal bolt on sections. Bolt-on sections shall only be permitted where essential to ensure practical assembly and dis-assembly of major equipment components.

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All welding shall be fully continuous fillet with a minimum weld size of 6mm. All welding shall be in accordance with the American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code Section IX, and welding electrodes shall be to SANS 455:2005.

All welding on the baseplate shall be done in accordance with an approved WPS and the procedure shall be qualified by a Procedure Qualification Record (PQR). All welders shall be qualified to the weld procedure. Copies of the WPS, PQR and welder performance qualifications (WPQ's) shall be included in the project QA file.

All equipment mountings shall be secured to the baseplate with castle nuts and brass split pins. Loctite must also be applied to the threads of all equipment mount bolts.

All structural steel and the baseplate shall be hot-dipped galvanised to SANS 121. No fabrication or modification to the structural steel and the baseplate shall take place once galvanised.

Defects that arise due to damage to the baseplate shall be prepared in accordance with the following procedure;

- Zincfix two pack, solvent free, zinc rich amine cured epoxy coating or similar approved shall be used
- All surfaces to be coated shall be dry, clean and free from contamination
- The surface shall be mechanically abraded using grinding or flapper discs to achieve a 40–50-micron blast profile as an alternative to achieving this profile using abrasive blast cleaning
- Surfaces shall be abraded by a minimum radius of 25mm around the defect using 180 grit abrasive water paper and water as a lubricant. The defect shall be exposed to bare metal, but the size should be kept as small as possible.
- Immediately after abrasion, the surface shall be wiped clean, and the premixed repair material shall be applied within the abraded area. The repair 'patch' shall not overlap the unabraded galvanizing.

The *Contractor* shall submit drawings of the baseplate to the *Employer* for review, comment and acceptance prior to fabrication.

The baseplate shall be designed to prevent the accumulation and pooling of liquids. The baseplate shall be designed and sized to provide suitable access to the mounted equipment for maintenance.

Each baseplate shall be provided with an easily accessible earth lug. The earth lug shall be welded to the baseplate, and the lug material shall be austenitic stainless steel and shall not be painted. The lug shall be minimum 6mm thick, 80mm long by 60mm wide with radiused corners and shall have a 15mm diameter threaded hole drilled in the centre of the lug.

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The baseplate shall also be designed with no modifications required to accommodate the speed modification to the foam concentrate pump when foam concentrate induction ratios of 3% are introduced.

The baseplate shall be provided with lifting lugs designed to carry the maximum load of the entire baseplate complete with all equipment called for under this specification when mounted and filled with all initial fill requirements.

The baseplate shall be designed to prevent the accumulation and pooling of liquids.

7.3 Atmospheric Conditions

The pump-set will be installed within an enclosed shipping container. The *Contractor* shall familiarise themselves with the design atmospheric conditions for the site as specified in the Works Information and shall indicate accordingly on the data sheet submitted to *the Employer* for acceptance. *The Contractor* shall include with their datasheet the following conditions that were used during the design of the pump-set:

- The maximum air temperature.
- The minimum air temperature.
- The minimum air pressure.
- The maximum relative humidity.
- Any other relevant factors.

7.4 Corrosive Environment

In accordance with SANS 12944, the corrosivity category for the pump-sets is described using the atmospheric-corrosivity categories. Six categories used to classify the environment is given in the table below. The *Contractor* shall indicate on the data sheet the corrosivity category that will be complied with when submitting to the *Employer* for acceptance.

All sites shall be generally classified as C2 except for sites that are within 20 km of the coast that shall be classified as C5-M, and the Witbank site that shall be classified as C5-I.

Category of corrosivity	**Exterior**	**Interior**
C1 Very low		Buildings with heating and clean atmospheres.

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Category of corrosivity	Exterior	Interior
C2 Low	Atmospheres with low levels of contamination. Rural areas.	Unheated buildings with possible condensation.
C3 Medium	Urban and industrial atmospheres, with moderate SO2 contamination. Coastal areas with low salinity.	Manufacturing plants with high humidity and some contamination.
C4 High	Industrial areas and coastal areas with moderate salinity.	Chemical industries, swimming pools.
C5-I Very high (industrial)	Industrial areas with high humidity and with an aggressive atmosphere.	Buildings or areas with almost permanent condensation and high levels of contamination.
C5-M Very high (marine)	Coastal and marine areas with high salinity.	Buildings or areas with permanent condensation and high levels of contamination.

7.5 Foundation Design

Each container will be placed on concrete strip footings with cast-in holding down bolts designed and constructed by others. The *Contractor* will provide the maximum static loads for which the foundations are to be designed for, as well as a drawing indicating the required support locations.

7.6 Access to the Site

The *Contractor* shall familiarise themselves with the physical, administrative and logistical site access constraints prior to submission of their offer, and all costs associated with overcoming these constraints for the installation of the containerised solution shall be deemed to be included in the offer.

7.7 Delivery of Equipment to the Site and Installation

The *Contractor* shall make provision in their offer for the delivery, offloading to a safe location on site as required and approved by the *Employer*, and installation into the final position of all equipment called for under this specification.

The *Contractor* must note that no on-site storage is available for equipment specified. If equipment cannot be delivered directly from the OEM, the *Contractor* is responsible for arranging approved temporary storage, with the *Employer* present at delivery and storage locations. All storage and insurance costs are to be borne by the *Contractor*.

The *Contractor* shall make provision for safe storage and insurances for the equipment at the OEM or *Contractor*s facilities from the issue date of the Shop Release Certificate (SRC) that is issued by the *Employer* to the *Contractor* before it is delivered to site. During storage of the equipment at the

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Contractors facilities, the equipment shall be housed within a weatherproof enclosure and shall be protected against damage.

The SRC will only be issued by the *Employer* to the *Contractor* upon deemed completion of all Factory Acceptance Test (FAT) punch items. The *Employer* shall determine when punch items are deemed complete.

The delivery address of all equipment shall be the site address as contained within the Works Information.

The *Contractor* shall make provision for all Plant, Equipment, Insurances, Personnel, Materials and Costs required to load at the OEM's facilities, transport to site, offload at the destination, handle, and install into final position all equipment called for under this specification.

The *Contractor* shall verify the position of the containers with the *Employer* prior to installation.

Upon final installation of the equipment, The *Employer* will then be invited by the *Contractor* to inspect the installation to ensure that the final installation meets with the *Employers* requirements.

7.8 Health, Safety, Security and Environmental

The *Contractor* shall make provision for compliance with the *Employer's* Health, Safety, Security and Environmental (HSSE) requirements whilst working on the site.

7.9 Language

All documentation and correspondence communicated under this specification shall be in the English language, including the reading material of equipment that is procured from international suppliers.

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8 SHIPPING CONTAINERS

This section outlines the requirements for the shipping container(s) used to house the following pump-sets and other ancillary equipment.

- Duty pump-set
- Stand-by pump-set
- Jockey Pump
- Jockey Pump Control Panel (JPCP)
- Normal electrical supply distribution board (DB)
- Essential electrical supply distribution board (DB)
- Instrumentation junction box (JB)
- Lighting
- Normal and forced ventilation equipment
- Diesel tanks
- Suction and discharge piping and associated in-line equipment
- Isolation valves and pressure gauges
- Pipe supports
- Electrical and Instrumentation cable routing infrastructure
- Earthing and bonding

The container(s) shall accommodate one (1) or both pump-sets, utilizing either a single 6m (20ft) or 12m (40ft) ISO shipping container, or two (2) such containers as needed based on equipment sizing and layout.

The design shall prioritize modularity, transportability, safety, and compliance with relevant fire protection standards.

The container(s) shall be modified from standard ISO shipping containers to form a self-contained pump room, ensuring protection from environmental elements, fire hazards, and operational stresses. All modifications shall maintain the container's structural integrity for shipping and handling via standard container transport methods (e.g., crane, truck, or ship).

8.1 Dimensions and Type

8.1.1 Container Size:

- 6m (20ft) High Cube
- 12m (40ft) High Cube.

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- External dimensions per ISO 668: 20ft (L: 6.058m, W: 2.438m, H: 2.896m High Cube); 40ft (L: 12.192m, W: 2.438m, H: 2.896m High Cube).

8.1.2 Internal Clearances

Minimum internal height of 2.6m (High Cube) to accommodate equipment mounting, personnel access, and overhead piping/ducting. Provide at least 0.6m clearance around equipment for maintenance.

8.1.3 Load Capacity

Designed to support the total weight of installed equipment (e.g., pumps, engine, ECP, fuel tank) plus dynamic loads from operation, with a minimum floor load rating of 500 kg/m², or the heaviest equipment item, whichever is greater.

8.2 Construction Materials

8.2.1 Frame, Walls and Roof

Structural steel profile beams fully welded and dimensioned to handle equipment loads, vibrations, and transport stresses, fitted with corrugated steel cladding in between.

Preferably, the roof must be inclined (minimum 2% slope) for stormwater drainage.

Removable or openable sections shall be provided for equipment installation and removal.

8.2.2 Floor

The floor shall liquid-tight and fabricated from steel sheet (minimum 4mm thickness) and coated with a non-slip bituminous surface throughout.

The floor shall be reinforced for equipment mounting with bolted base plates.

8.3 Corrosion Protection

The following specification (or equal approved) for external and internal protection of the container shall be followed;

- Sandblast to SIS SA 2½ (near white metal blast).
- Apply twin pack ethyl based inorganic zinc silicate-based primer with minimum dry film thickness 75 microns.
- Apply polyamide cured high build epoxy undercoat with minimum dry film thickness 60 microns.
- Apply twin pack polyurethane enamel finishing coat with minimum dry film thickness 35 microns

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- Total minimum dry film thickness 170 microns.

Notwithstanding the above minimum requirements, the corrosion protection system shall be guaranteed for a minimum life of 20 years.

8.4 Insulation

Thermal insulation shall be designed and added where necessary when combined with the available ventilation, to limit the maximum internal temperature at any given time to the least of 49^0C, as required by the OSHAct, or as required by the equipment OEMs, and always above 0^0C.

Acoustic insulation shall be designed and added if necessary to reduce noise to less than 85 dBa externally.

8.5 Piping

All piping shall be supplied, manufactured, tested and installed in accordance with PL 912 Piping Supplying and Installation Specification.

Piping for fire water and diesel shall be carbon steel, whereas piping for foam concentrate shall be stainless steel 316.

Piping shall not be less than 25NB in size.

Cut-outs at container openings must be provided and sealed to prevent water ingress, allow pipe movement, and avoid vibration transfer from rotating equipment. The sealing method shall be submitted to the *Project Manager* for Acceptance. External piping connection points should be flanged outside the container and fitted with blind flanges.

Discharge lines from water pumps shall exit vertically through the roof the container.

8.6 Inline and Branch Equipment

The *Contractor* shall refer to the applicable Process and Instrumentation Diagram (P&ID) to establish the piping, inline and branch equipment required within the container, but will typically include the following for each pump-set:

- Suction line gate valve for duty water and stand-by water pumps
- Discharge line butterfly valve for duty water and stand-by water pumps
- Discharge line non-return valve for duty water and stand-by water pumps
- Suction line gate valve for jockey pump

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- Discharge line butterfly valve for jockey pump
- Discharge line non-return valve for jockey pump
- Isolation ball valves complete with pressure indicators for the following:
    - Duty fire water pump suction and discharge
    - Stand-by fire water pump suction and discharge
    - Duty foam concentrate pump suction and discharge
    - Stand-by foam concentrate pump suction and discharge
    - Jockey pump suction and discharge
- Isolation ball valve for isolation of the jockey pump pressure transmitter and testing station
- Three-way valve for testing the pump pressure transmitter
- Three-way valve complete with pressure indicator for testing the jockey pump.

All valves and other equipment shall be supplied in accordance with the specifications listed in Section 5.

8.7 Pipe Supports and Holding Down Bolts

All hot rolled structural steelwork shall conform to EN10025-2-S355JR and with the recommendations of SANS 10162 and SANS 2001 CS1.

All materials, welding, and fabrication shall comply with current and relevant British or South African Standards

All holding down bolts shall be Grade 4.8 anchor bolts. All holding down bolts, nuts, and washers shall be hot-dip galvanised, with nuts tapped oversized following galvanising.

All fillet welds shall be 6mm continuous conforming to SANS 10044/SABS 044, and shall be clean, smooth surfaces achieving the full strength of joined sections.

Welding shall only be performed by suitably qualified welders and site welding is prohibited. The ends of hollow sections shall be moisture-sealed with suitable welding.

All edge distances and bolt dimensions comply with SANS 10162 standards except where deviations are expressly indicated.

8.8 Fire Protection

Walls, roof, doors, and penetrations shall be rated for at least 60 minutes fire resistance.

One (1) portable 9kg dry powder fire extinguishers shall be mounted inside near the pedestrian door.

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All materials shall be non-combustible, with no flammable linings or coatings.

8.9 Access and Doors

The main entrance shall be a fire-rated steel door with keyed lock for security. Where the main entrance door opens onto a pump house provided with access control, entrance doors to the container are not required.

End service doors shall be provided for equipment access and maintenance, operable from inside without a key.

8.10 Ventilation and Environmental Control

The ventilation system shall provide the minimum number of air changes per hour as required by the OSHAct and also protect against equipment overheating.

The pump house ventilation shall be designed to limit the maximum internal temperature at any given time to the least of 49^0C, as required by the OSHAct, or as required by the equipment OEMs.

8.11 Electrical and Ancillary Systems

Supply and install a dedicated surface mounted essential electrical supply distribution board (DB) within the container to reticulate essential electrical supply within and throughout the containerised solution to the following infrastructure (but not limited to):

- Light switch and light fittings
- Engine control panels

Supply and install a dedicated surface mounted normal electrical supply distribution board (DB) within the container to reticulate normal electrical supply within and throughout the containerised solution to the following infrastructure (but not limited to):

- Socket outlets
- Engine heaters

Supply and install a dedicated surface mounted instrumentation junction box (JB) for the interface and connection between the following circuits within the container:

- FCP to ECP interface
- FCP to diesel tank level switches

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Due to the environment in which the electrical distribution boards and junction box will be installed, it is required that each of these electrical distribution boards and junction boxes be rated minimum IP66 with bottom cable entry and exit only. The electrical distribution boards shall be located within an easily identifiable and accessible positions with no obstructions or hazards imposed upon the operator.

The electrical and instrumentation cable routing and cable routing infrastructure installation within and throughout the entire containerised solution shall be neat, of the shortest possible route and pose no to minimal obstructions to either operators or other services within the containerised solution. The electrical and instrumentation cable routing and cable routing infrastructure installation shall furthermore not present any tripping or safety hazards.

The light fitting installation throughout the containerised solution shall ensure that the specified and required light levels are achieved throughout the containerised solution. All light fittings, light switches, socket outlets, etc. must be rated minimum IP66.

The containerised solution must be equipped with an earthing and bonding system inclusive of associated infrastructure for the effective earthing and bonding of electrical and instrumentation equipment, electrical and instrumentation routing infrastructure, electrical motors, electrical motor chassis, piping, piping supports, etc. The earthing and bonding system must allow for the shortest possible earthing and bonding connection of equipment. The earthing and bonding system must furthermore be connected to the main earthing and bonding system of the respective site.

The entire electrical installation within and throughout the containerised solution shall furthermore comply with the latest editions of SANS 10142-1 and PL 666. All electrical cable penetrations are to be sealed with fire-rated and Ex. Rated cable glands.

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9 PRIMARY DRIVER

The primary driver called for under this specification is a diesel engine. The diesel engine shall be the primary driver for the fire water pump and foam concentrate pump.

The driver shall be started automatically by the engine control module upon receipt of a signal from the Fire Control Panel (FCP) or started manually at the ECP.

9.1 Type of Driver

The driver shall be a diesel engine of the four or two stroke, compression ignition mechanical injection type capable of being started without the use of wicks, cartridges, heater plugs or ether, with inclined (Vee) or straight vertical multi-cylinders.

The driver shall be naturally aspirated, turbocharged or supercharged or both. Preference will be given to turbocharged drivers with intercoolers.

Preference will also be given to diesel engines manufactured by Mitsubishi or Volvo Penta; alternatives will be considered but are subject to approval by the *Employer*.

9.2 Materials of Construction

The driver shall be designed for intermittent starts after idle periods without starting of approximately two weeks.

The design life of the driver shall be 30 years.

The materials of construction of the driver shall be designed and selected to operate for a minimum of 7000 intermittent hours throughout the design life expectancy.

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9.3 Corrosion Protection System

The following corrosion protection system shall be applied to the driver in accordance with the deemed corrosivity categorisation for the site as specified in Section 7.4.

Category of corrosivity	Corrosion Protection System
C1 Very low	Vendors normal external corrosion protection system acceptable
C2 Low	Vendors normal external corrosion protection system acceptable
C3 Medium	Vendors normal external corrosion protection system to be submitted for *Employers* acceptance
C4 High	Corrosion protection system to be applied as per Section 9.3.1.
C5-I Very high (industrial)	Corrosion protection system to be applied as per Section 9.3.1.
C5-M Very high (marine)	Corrosion protection system to be applied as per Section 9.3.1.

9.3.1 Project Corrosion Protection System

Provided that the OEM's normal external corrosion system meets or exceeds the below corrosion protection system, the following specification (or equal approved) for external protection shall be followed;

- Sandblast to SIS SA 2½ (near white metal blast).
- Apply twin pack ethyl based inorganic zinc silicate-based primer with minimum dry film thickness 75 microns.
- Apply polyamide cured high build epoxy undercoat with minimum dry film thickness 60 microns.
- Apply twin pack polyurethane enamel finishing coat with minimum dry film thickness 35 microns
- Total minimum dry film thickness 170 microns.

Notwithstanding the above minimum requirements, the corrosion protection system shall be guaranteed by the OEM's for a minimum life of 20 years.

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9.4 Direction of Rotation

The direction of rotation of the primary driver shall be anticlockwise when viewed from the flywheel end of the crankshaft.

9.5 Power Output

The driver shall be sized to meet the power output requirements of this specification whilst driving the foam concentrate pump at the design speed to introduce 3% foam concentrate into the water system.

The driver shall have sufficient power to drive the fire water pump and foam concentrate pump continuously at full load at the site elevation for a continuous period of minimum 6 hours.

During operation, the power output of the driver shall not be limited, reduced or conditioned in any way to conform to any emission control standards or for any reason whatsoever.

Power available shall be understood as the net power at the drive shaft after de-rating for speed, altitude and temperature and for engines and auxiliary drives such as fans and cooling water pumps.

9.6 De-rating

The driver shall be de-rated for both altitude and temperature

The *Contractor* shall use the following design information during de-rating of the driver;

Pump-set Installed Altitude above MSL	*Contractor* to indicate on datasheet
Maximum External Air Temperature	Evidence to be provided from the South African weather service for location. *Contractor* to indicate on datasheet
Maximum Pump House Room Internal Temperature	*Contractor* to indicate on datasheet. Refer to Section 7.7

Type of Engine	**Altitude Deration**
Naturally Aspirated	3.5% every 300 metres above 150 metres above sea level
Turbo Charged	1.5% every 300 metres above 150 metres above sea level
Inter-cooled Turbo Charged	1.0% every 300 metres above 150 metres above sea level
	Temperature Deration
Naturally Aspirated	2.0% every 5.5 ^{0}C above 30 ^{0}C ambient
Turbo Charged	3.0% every 5.5 ^{0}C above 30 ^{0}C ambient
Inter-cooled Turbo Charged	1.0% every 5.5 ^{0}C above 30 ^{0}C ambient

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Notwithstanding the above altitude and temperature de-rating requirements, the OEM's altitude and temperature de-rating requirements shall take precedence provided that the calculated driver power output after de-rating is less when compared to the above requirements.

The driver shall have 10% power in excess of that absorbed by the foam concentrate pump and the fire water pump at 110% of both of the pump duty points after deductions for altitude, temperature and ancillary components using the continuously rated curve at the engine selected speed which shall not exceed the maximum speed as specified in Section 8.7.

9.7 Rotational Speed

The maximum speed of the driver shall not exceed the RPM values for the engine size and type as per the table below;

Engine Size	Maximum Speed
Two or Three Cylinder	2600 RPM
Four Cylinder Naturally Aspirated	2400 RPM
Four Cylinder Turbocharged	2200 RPM
Six Cylinder Naturally Aspirated	2400 RPM
Six Cylinder Turbocharged	2200 RPM
8 Cylinder	1800 RPM

The rotational speed of the driver shall match that of the fire water pump. The driver shall accept full load within 15 seconds from the receipt of the signal to start.

9.8 Governor

The speed of the engine shall be controlled by the engine control module located within the ECP. Refer to Section 11 for more details.

Notwithstanding this requirement, the engine shall also be fitted with an overspeed shut down device that will be arranged to shut down the engine at 20% above the rated engine speed. This overspeed device shall be manually reset to normal operation position and shall be clearly marked on the engine.

9.9 Fuel System

The fuel injection equipment shall be suitable for operation with the commercial brands of diesel fuel available in South Africa.

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The *Contractor* shall provide all fuel filters and water separators as required by the OEM. The fuel filters and water separators shall be readily available within South Africa.

The driver shall not have any manual device fitted which could prevent the engine starting. Where any device is fitted, it shall automatically return to the rest position for automatic starting.

9.10 Fuel Tank

A dedicated fuel tank and fuel supply and return lines shall be provided for each driver in accordance with SANS 10131. The fuel tank shall be located within the container if spacing permits. Fuel tanks shall be self-bunded (i.e. double-walled tank).

The fuel tank will be designed, supplied and installed by the *Contractor* and is included under the scope of *works* to be executed under this specification. The design and drawings of the fuel tank are to be presented to the *Employer* for acceptance prior to fabrication.

The fuel tank shall be rectangular and constructed of 3mm mild steel and supported by four steel legs at a height and respective dimensions approved by the *Employer*. The tank, fittings and all components (excluding drum pump) shall be externally powder coated black in colour. The *Contractor* shall submit to the *Employer* the proposed corrosion protection specification for acceptance and the *Contractor* shall update the corrosion protection specification with the comments received from the *Employer*.

The usable capacity of each tank shall be sufficient to accommodate 150 minutes of continuous operation (calculated by 60 minutes continuous operation with 2 x 45-minute weekly tests) at the OEM specified fuel consumption rate with the driver operating at the specified speed.

5% additional volume shall be provided for sump (i.e. the outlet nozzle of the fuel tank shall be set above the sump volume but at a minimum bottom of pipe to tank floor height of 50mm) and 5% additional volume shall be provided for breathing.

The diesel tank shall be provided with the following ANSI Class 150 RFSO nozzles;

- 25NB (minimum size) Outlet
- 25NB (minimum size) Return Inlet
- 15NB sump outlet complete with a diesel water trap filter with sight bowl.
- 25NB Filling nozzle flange for outlet of drum pump
- Nozzle for instrument level switch

The fuel tank shall be filled using a manual hand operated drum pump (K1 Pattern Semi Rotary Hand pump with 20mm connection or approved equivalent) supplied and installed by the *Contractor*.

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The drum pump shall be permanently fixed to the diesel tank and the inlet to the pump shall be provided with a 1.5 metre long flexible rubber hose suitable for use with diesel. The rubber hose shall be provided with stow away clip or bracket that fixes onto the diesel tank.

The outlet of the drum pump shall be fitted with a carbon steel pipe to ASTM A106 Gr B and socket welded 3000LB fittings to ANSI B16.11 to match the drum pump outlet size.

A suitable Rochester type or similar approved fuel gauge shall be provided that indicates the empty level (top of tank sump level) and the tank full level (150 minutes fuel storage as specified above)

Threaded connections shall be kept to a minimum and shall only be used where approved by the *Employer*.

A suitably sized goose neck breather that is fitted with wire mesh to prevent ingress of foreign material shall be provided on the tank.

The usable volume of the tank shall be indicated on a label with the following information as follows;

DUTY (STAND-BY) PUMP-SET XX-P181(2)	
Fuel Gauge Reading	**Firefighting Duration**
100%	150 minutes
70%	105 minutes
40%	60 minutes
0%	At top of sump height (tank outlet nozzle centreline)

The face of the gauge must be marked to match the % level shown in the table.

All labels shall be submitted to the *Employer* for acceptance.

All labels shall be of the Traffolyte engraved type that are permanently fixed to the panel with stainless steel screws. The use of adhesive to attach the labels to the panel shall not be permitted.

All label text shall be in uppercase Arial font.

The tank label title representing the pump-set numbering shall be in accordance with Section 6.1. The label must be located above the fuel gauge with a white background with black text of height 12 mm.

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9.11 Fuel Lines

Dedicated fuel supply and return lines of minimum 25NB diameter shall be provided for each driver.

The fuel tank supply and return lines will be designed, supplied and installed by the *Contractor*.

The pipelines will be routed from each of the fuel tanks to a point near the diesel engine.

The *Contractor* shall supply and install a flame resistant re-enforced stainless steel braided flexible hose, that shall not extend past the base plate, from each driver as well as provide and install a suitable connection to connect the flexible hose to an ANSI Class 150 flange that will be the termination point for the fuel supply and return lines for each pump-set.

9.12 Pre-heaters

Thermostatically controlled 240 volt heaters shall be fitted to the cooling water manifold to enable the engine to start and run under load as required by this specification.

The engine shall be capable of being started from cold against no load at a pump room temperature of 4 ^{0}C.

Power for the heaters shall be taken from the normal electrical power DB within the pump house and shall be protected by a suitable circuit breaker.

The cooling water jacket heater is to be provided to control the engine jacket temperature at 49°C (or at a temperature as specified by the OEM).

The OEM's recommendations for engine oil heaters shall be followed to ensure the requirements of this specification are met.

The *Contractor* shall provide full details of any arrangements to ensure easy starting in cold weather.

9.13 Oil Circulation Pump

If required by the OEM to meet the starting requirements of this specification, the oil circulation pump shall be driven off the mains power supply from the ECP.

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9.14 Starter Motor

The type of starter motor shall be electric. The starter motor shall be powered by batteries that comply with the requirements of this specification.

The starter motor shall be of the axial displacement type having no retaining catches or inertial features.

The pinion must rotate at reduced speed during the process of engagement with the flywheel gear ring, but during the initial engagement the pinion and armature shaft assembly must mesh by moving axially towards the gear ring.

Repeat engagement facilities must be provided and controlled by the engine control module should the starter pinion fail to engage with the engine flywheel ring.

Battery charging, voltage generators, alternators and pressure switches on the engine lubricating system or water pump outlet, as a means of de-energising the starter motor are not permitted.

The starter motor in combination with each battery power supply shall have a design capability to rotate the engine for at least 12 cycles of not less than 15 seconds cranking and not more than 15 seconds rest.

9.15 Air Filtration

A two stage chassis mounted industrial air filter, with the initial stage a pre-cleaner of the cyclonic type shall be provided unless qualified accordingly prior to contract award. The unit shall include replacement paper elements and a restriction indicator.

9.16 Cooling System

The driver shall be radiator cooled, and the radiator shall be mounted on the common baseplate.

The heat from the primary circuit of the radiator shall be dissipated by air movement through the radiator created by a fan included with and driven by the engine. The fan shall be guarded for personnel protection.

The fan shall displace the air through the radiator to be exhausted from the room via louvers built into the container walls when closed.

The radiator shall be suitably sized for the cooling required after consideration is given to the inlet air temperature within the container and the provided container ventilation and shall be made of suitable corrosion resistant materials for the location specified.

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Each engine shall be provided with a temperature gauge to indicate the cooling water temperature, as well as a cooling water level sensor to provide low cooling water alarm.

The fluid level within the radiator shall be clearly visible and fillable from ground level.

9.17 Exhaust System

Each driver shall have an independent exhaust system.

Provision shall be made on the exhaust manifold, exhaust piping and the silencer to avoid hazard to all operating personnel or to flammable material adjacent to the engine. Exhaust pipes shall be installed with clearances of at least 250 mm to combustible materials.

The exhaust pipe shall be covered with high temperature insulation or otherwise guarded to protect personnel from injury.

The exhaust pipe shall be flexibly connected to the engine to take up any vibrations that may cause failure. The exhaust back pressure shall not exceed the OEM's recommendations.

The exhaust pipe shall not be any smaller in diameter than the engine exhaust outlet and shall be as short as possible.

The exhaust piping and silencer shall be manufactured from stainless steel grade 316.

It is required that the noise level be kept to a minimum and an effective silencing system of the residential type shall be provided to limit noise to 85 dBa when measured 1 metre from the engine or exhaust.

The exhaust silencer shall be mounted horizontally and arranged to exclude water with the tail pipe external to the container, pointing horizontally at a height above natural ground level to be approved by the *Employer*, away from all occupied buildings and fitted with a flap and internal bird proofing mesh.

The silencer shall be mounted above the primary driver and fitted to a support frame with a stainless steel removable strap. The silencer shall not be welded to the support frame.

Provision shall be made to neatly seal the exhaust penetrations through the container wall.

9.18 Guards

All exposed moving parts including the flexible coupling shall be protected by suitable guards which comply with the Occupational Health and Safety Act (as amended) and shall be easily removable.

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Inspection areas constructed of a suitable mesh, grating or covering with holes shall be provided for and built into the guards to facilitate inspection without the need to completely remove the guard.

9.19 Oil Filtering System

An oil filtering system shall be provided as per the OEM's recommendations. The oil filter shall be easily accessible for maintenance.

9.20 Oil Change Pump

The engine shall be fitted with a manual two-way reversible oil change pump to facilitate easy emptying and filling of oil from the engine sump. The pump shall be permanently fixed into position and shall be easily accessible and operable when the engine is hot. Oil will be deposited from the discharge of the pump into a separate container provided by the *Employer*, it is not necessary to provide containment for the discharged oil.

9.21 Nameplate

The engine supplier shall provide a nameplate made of grade 316 stainless steel, securely fixed to the engine in a prominent position with the following information embossed onto the nameplate in 5mm high Arial font text:

- Make or Manufacturer
- Model
- Type
- Serial Number
- Power Available to drive the fire water pump and foam concentrate pump (kW)
- Direction of Driver Rotation
- Rotational Speed (RPM)
- Max Torque (Nm) at the stated rotational speed
- Fuel Consumption at Maximum Load
- Date of Manufacture
- Grade of fuel

The information on the nameplate shall not be engraved.

9.22 Stop Signal

The engine shall only be stopped by the following conditions;

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- Activation of a stop button located on the ECP
- Activation of an emergency stop button located on the ECP
- Engine overspeed during any run condition
- Any engine alarm conditions (high water temperature, low oil pressure etc.) when the engine is run with engine protection enabled (refer Section 11)

9.23 Dismantling and Assembly

All wearing parts that require replacement shall be easily removed and replaced with the engine in position.

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10 FIRE WATER PUMP

10.1 Type of Driver

The details of the fire water pump driver are specified in Section 9.

10.2 Type of Pump

The fire water pump called for under this specification is a separately coupled horizontal split case or end-suction centrifugal pump.

Preference will be given to pumps manufactured by SPP and KSB amongst the Contractor. Alternatives will be considered but are subject to approval by the *Employer*.

10.3 Balance Tolerances

The pump shaft and impeller shall be dynamically balanced to ISO 1940-1 with balance quality grade G6.3 and shall be supplied with a balancing certificate.

The permissible residual specific unbalance based on the specified quality grade and service speed shall be in accordance with the 'white area' of Figure 2 of ISO 1940-1.

10.4 Materials of Construction

The pump shall be designed for intermittent starts.

The design life of the pump shall be 30 years.

The materials of construction of the pump shall be designed and selected to operate for a minimum of 7000 intermittent hours throughout the design life expectancy.

Fire Pump Materials of Construction	
Part	**Material**
Bearings	Stainless steel
Casing	Ductile Cast iron
Case wear rings	Bronze
Gland	Bronze
Gland packing	High grade graphite cotton
Impeller	Bronze
Lantern rings	Bronze or stainless steel

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Fire Pump Materials of Construction	
Part	**Material**
Mechanical seals	Carbon ceramic
Shaft	EN8 steel
Shaft sleeves	Bronze
Stuffing box bushes	Bronze

10.5 Corrosion Protection System

The following corrosion protection system shall be applied to the pump in accordance with the deemed corrosivity categorisation for the site as specified in Section 7.4.

Category of corrosivity	**Corrosion Protection System**
C1 Very low	Vendors normal external corrosion protection system acceptable
C2 Low	Vendors normal external corrosion protection system acceptable
C3 Medium	Vendors normal external corrosion protection system to be submitted for *Employers* acceptance
C4 High	Corrosion protection system to be applied as per Section 10.5.1.
C5-I Very high (industrial)	Corrosion protection system to be applied as per Section 10.5.1.
C5-M Very high (marine)	Corrosion protection system to be applied as per Section 10.5.1.

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10.5.1 Project Corrosion Protection System

Provided that the vendors normal external corrosion system meets or exceeds the below corrosion protection system, the following specification (or equal approved) for external protection shall be followed;

- Sandblast to SIS SA 2½ (near white metal blast).
- Apply twin pack ethyl based inorganic zinc silicate based primer with minimum dry film thickness 75 microns.
- Apply polyamide cured high build epoxy undercoat with minimum dry film thickness 60 microns.
- Apply twin pack polyurethane enamel finishing coat with minimum dry film thickness 35 microns
- Total minimum dry film thickness 170 microns.

Notwithstanding the above minimum requirements, the corrosion protection system shall be guaranteed by the manufacturer for a minimum life of 20 years.

10.6 Direction of Rotation

The direction of pump rotation shall be indicated on a stainless-steel plate that is permanently secured to the casing of the pump.

The directional arrow shall be embossed onto the plate and shall not be engraved or etched.

10.6.1 Horizontal Split Case

Dependent on the layout of the containers, the two horizontal split case water pumps shall rotate in the opposite direction relative to one another to achieve the layout of the equipment as shown on the pump house drawings. This shall be accomplished by use of a gearbox (Refer to Section 10.16).

If required by the layout, the duty pump-set shall rotate in the same direction as the driver and the stand-by pump-set shall rotate in the opposite direction to the driver.

10.6.2 End-suction

End-suction pumps shall always rotate in the same direction as the driver.

10.7 End Connections

The suction and discharge pipeline sizes will be determined by the *Contractor.*

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To accommodate discrepancies in pipeline suction sizes and pump flange sizes, reducers will be installed. Pump suction and discharge flanges that are larger than the pump suction and discharge pipeline sizes will not be accepted.

The preferred flange connections design specification is ANSI Class 150 RF, but others will be considered to suit availability and cost.

The inlet and outlet of the pump end connections shall be indicated as such on a stainless steel plate that is permanently secured to the pump casing.

The text ‘INLET’ or ‘OUTLET’ shall be embossed onto the plate with a minimum text height of 5mm in Arial font and shall not be engraved or etched.

10.8 Process Fluid Characteristics

The process fluid will be potable water at standard temperature.

The following fluid characteristics were used in the hydraulic analysis.

Temperature (°C)	Density (kg/m³)	Dynamic Viscosity (cP)
25	997	0.89
35	994	0.72
45	990	0.59

10.9 Pump Duty Points

The *Contractor* shall determine the pump rated capacity and the total rated head that are to be indicated on the datasheet.

The pump shall provide a pressure of at least 50 kPa higher than the required pump duty point specified on the pump data sheet.

10.10 Strainer Specification

A strainer will not be positioned on the pump suction line. The *Contractor* shall ensure that the water tank and piping systems are free from any foreign objects that could cause damage to the pump.

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10.11 Suction Conditions

Where required, reducers will be provided for and installed by the *Contractor* to match the pipeline sizes to the pump suction and discharge flanges.

The small end of the reducer will be welded to the pump connection flanges and the large end of the reducer will be welded to the discharge and suction piping system. i.e. if reducers are required, they will be fitted immediately upstream of the pump suction inlet flange.

The pump will take suction from shared atmospheric water reservoirs.

A vortex inhibitor will be installed on the pump suction that will draw water from the bottom of the reservoir. The design of the vortex inhibitor will be generally in accordance with NFPA 20. The pump-set shall operate satisfactorily when the reservoir is at its lowest operating level.

Full bore isolation gate valves will be installed on the pump suction pipeline.

The *Contractor* shall determine the minimum required straight line pipeline length upstream of the pump inlet.

10.12 Net Positive Suction Head (NPSH)

The *Contractor* shall specify the NPSH available and the NPSH required on the pump data sheet. The NPSH available shall be calculated on the basis that the reservoir is at the minimum operating level.

The pump required NPSH shall always be a minimum of 1.0 m below the available NPSH.

10.13 Pump Discharge Operating Conditions

The pump will not start up against a closed head, however, under normal start-up and running conditions, the pump discharge pressure shall be maintained by a pressure control valve. The pressure control valve will be designed, supplied and installed by the *Contractor*.

The pressure control valve will enable the circulation of water from the water pump casing back to the water tank during weekly testing where the pump is run against a closed head, and during normal operation of the fire system. During the weekly testing of approximately 45 minute duration, the pump will recirculate water to the water tank at the minimum required pump flow rate. The recirculation control valve will be sized to match the minimum required pump flow rate.

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10.14 Guards

All external rotating or moving components shall be suitably covered with guards in compliance with the requirements of the OSHAct.

The guards shall be fixed in position and shall be easily removable during maintenance and inspection. Each guard shall contain a suitably sized viewing port fabricated of a mesh or grid that will facilitate visual inspection of the moving component without the need to remove the guard.

10.15 Coupling

An elastomeric flexible coupling shall be provided between the driver and the water pump. The selected elastomer shall be compatible with the fuel of the primary driver.

The coupling between the driver and the pump must allow each unit to be removed without disturbing the other.

The flexible coupling shall not be selected to compensate for misalignment.

10.16 Gearbox

Speed reduction gearboxes between the driver and pump will only be considered under exceptional circumstances and when the benefit of using a gearbox is suitably motivated such as to accommodate the layout of the pump-sets. Preference will be given to technical offers that do not require gearboxes.

Where gearboxes are required to reverse the direction of rotation of the primary driver to accommodate the direction of rotation of horizontal split case centrifugal pumps, they shall not be speed reduction gearboxes. The rotational speed of the fire water pump shall match the specified speed of the primary driver at all times.

10.17 Shaft Sealing System

Rotating shafts through the pump casing shall be gland packed using a minimum of five packing rings with a lantern ring. The lantern ring shall take cooling water from the pump discharge or via an internal bore. An external fluid supply will not be provided.

The leakage from the gland packing shall be piped by the *Contractor* to a point external to the container or to a sump within the pump house as directed by the *Employer*.

The drainage piping shall be fabricated from 25NB galvanised SABS 62 medium wall thickness (MWT) screwed piping and galvanised fittings that shall be joined using hemp and stag only. PTFE tape as a

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joint sealing method shall not be accepted. The drainage piping shall have a fall of minimum 1:100 from the gland packing drip collection point to the discharge point and shall be supported off existing steel structures using galvanised u-bolts with a maximum support span of 3.5 m.

10.18 Pressure Gauges

Pressure gauges mounted to the pump casing are not required. Pressure gauges will be fitted on the pump suction and discharge piping. All pressure gauges in the auxiliary system shall be in accordance with the Pressure Gauge Specification, PL 909.

10.19 Bearing Thermometers

Bearing thermometers are not required under this specification. The *Contractor* shall specify the expected normal operating bearing housing temperature as well as the maximum permissible bearing housing temperature during pump operation.

10.20 Nameplate

The supplier shall provide a nameplate made of grade 316 stainless steel, securely fixed by rivets or pins to the pump in a prominent position with the following information embossed onto the nameplate:

- Supplier Name
- Make or manufacturer
- Model
- Serial number
- Design Process Medium
- Impeller diameter (mm)
- Rated capacity in (m^3/hr or l/min) at speed (RPM)
- Rated discharge pressure (kPa) at speed (RPM)
- NPSH required
- Direction of rotation
- Date of manufacture

10.21 Dismantling and Assembly

The pump shall be easily dismantled and assembled without the need to remove other components of the pump-set. Common wearing parts shall be maintainable with the pump in position.

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10.22 OEM Performance Test

The specified pump duty point of the fire water pumps shall be tested at the OEM's shop in accordance with SANS 9906-2016 Accuracy Grade 2U (ISO 9906-2012) and shall be supplied with a test certificate.

The OEM performance test shall be a signed factory test as defined by SANS 9906-2016 and shall be non-witnessed.

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11 FOAM CONCENTRATE PUMP

11.1 Type of Driver

The details of the foam concentrate pump driver are specified in Section 9.

The foam concentrate pump shall be connected to the driver by a system of v-belts and pulleys designed by the *Contractor* to satisfy the rotational speed requirement of the foam concentrate pump.

11.2 Type of Pump

The foam concentrate pump called for under this specification is a separately coupled progressive cavity screw pump of the single or multiple helical screw design.

The suction inlet shall be in the horizontal plane on the non-driven end of the pump, and the discharge shall be in the vertical plane towards the ceiling of the container on the driven end of the pump. The suction inlet shall be kept as low as possible to the baseplate at all time to minimise the suction height outlet of the foam concentrate pump.

11.3 Balance Tolerances

The pump rotor and belt and pulley system shall be dynamically balanced to ISO 1940-1 with balance quality grade G6.3 and shall be supplied with a balancing certificate.

The pulleys shall also be statically balanced.

The permissible residual specific unbalance based on the specified quality grade and service speed shall be in accordance with the ‘white area’ of Figure 2 of ISO 1940-1.

11.4 Materials of Construction

The pump shall be designed for intermittent starts.

The rotor and stator materials of construction shall be selected to be compatible with the process fluid.

The design life of the pump shall be 30 years.

The materials of construction of the pump shall be designed and selected to operate for a minimum of 7000 intermittent hours throughout the design life expectancy.

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11.5 Corrosion Protection System

The following corrosion protection system shall be applied to the pump in accordance with the deemed corrosivity categorisation for the site as specified in Section 7.4.

Category of corrosivity	**Corrosion Protection System**
C1 Very low	Vendors normal external corrosion protection system acceptable
C2 Low	Vendors normal external corrosion protection system acceptable
C3 Medium	Vendors normal external corrosion protection system to be submitted for *Employers* acceptance
C4 High	Corrosion protection system to be applied as per Section 10.5.1.
C5-I Very high (industrial)	Corrosion protection system to be applied as per Section 10.5.1.
C5-M Very high (marine)	Corrosion protection system to be applied as per Section 10.5.1.

11.5.1 Project Corrosion Protection System

Provided that the vendors normal external corrosion system meets or exceeds the below corrosion protection system, the following specification (or equal approved) for external protection shall be followed;

- Sandblast to SIS SA 2½ (near white metal blast).
- Apply twin pack ethyl based inorganic zinc silicate based primer with minimum dry film thickness 75 microns.
- Apply polyamide cured high build epoxy undercoat with minimum dry film thickness 60 microns.
- Apply twin pack polyurethane enamel finishing coat with minimum dry film thickness 35 microns
- Total minimum dry film thickness 170 microns.

Notwithstanding the above minimum requirements, the corrosion protection system shall be guaranteed by the manufacturer for a minimum life of 20 years.

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11.6 Direction of Rotation

The direction of rotation of the pump shall suit the suction inlet and discharge outlet arrangement as specified in Section 11.2, as well as the location of the foam concentrate pump with reference to the driver.

Cognisance shall also be given to the direction of rotation of the respective duty and stand-by driver.

The direction of pump rotation shall be indicated on a stainless-steel plate that is permanently secured to the pump casing above either end of the pump shaft.

The directional arrow shall be embossed onto the plate and shall not be engraved or etched.

11.7 End Connections

The suction and discharge pipeline sizes will be determined by the *Contractor*.

To accommodate discrepancies in pipeline suction sizes and pump flange sizes, reducers will be installed. Pump suction and discharge flanges that are larger than the pump suction and discharge pipeline sizes will not be accepted.

The preferred flange connections design specification is ANSI Class 150 RF.

The inlet and outlet of the pump end connections shall be indicated on a stainless-steel plate that is permanently secured to the pump casing.

The text ‘INLET’ or ‘OUTLET’ shall be embossed onto the plate with a minimum text height of 5mm and shall not be engraved or etched.

11.8 Process Fluid Characteristics

The process fluid is foam concentrate at ambient temperature.

The *Contractor* shall size the foam concentrate pump for the foam concentrate that will be supplied in accordance with the Foam Concentrate Specification, document PL915.

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11.9 Pump Duty Points

The *Contractor* shall determine the pump rated capacity and the total rated head that are to be indicated on the datasheet.

The foam concentrate pump shall be sized and selected to operate at one duty point with the v-belt and pulley system configured to operate at 3% when delivered to site.

It is permissible for the pump to provide a flow rate that is a maximum of 10% higher than the stated design flow rate. Flow rates lower than the design flow rates will not be acceptable.

11.10 Strainer Specification

A strainer will not be installed on the pump suction. The *Contractor* shall ensure that the foam concentrate tank and piping systems are free from any foreign objects that could cause damage to the pump.

A suction strainer will be fitted on the foam concentrate pump that is used to fill the foam concentrate tank and it is therefore assumed that the process fluid will contain no abnormal particles.

The supply and installation of the foam concentrate tank filling pump is not included in the scope of supply as called for under this specification.

11.11 Suction Conditions

Where required, reducers will be provided for and installed by the *Contractor* to match the pipeline sizes to the pump suction and discharge flanges.

The small end of the reducer will be welded to the pump connection flanges and the large end of the reducer will be welded to the discharge and suction piping system. i.e. if reducers are required, they will be fitted immediately upstream of the pump suction inlet flange.

The pump will take suction from a dedicated foam concentrate tank.

A vortex inhibitor will be installed on the pump suction that will draw water from the bottom of the foam tank. The design of the vortex inhibitor will be generally in accordance with NFPA 20. The pump shall operate satisfactorily when the tank is at its lowest operating level.

Full bore isolation ball valves will be installed on the pump suction pipeline.

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11.12 Net Positive Suction Head (NPSH)

The *Contractor* shall specify the NPSH available and the NPSH required on the pump data sheet. The NPSH available shall be calculated on the basis that the tank is at the minimum operating level.

The pump required NPSH shall always be a minimum of 1.0 m below the available NPSH.

11.13 Pump Discharge Operating Conditions

The pump will start up against a pressure control valve. Under normal start-up and running conditions, the pump discharge pressure shall be maintained at the pump duty point by a pressure control valve that will recirculate foam concentrate to the foam storage tank.

The pressure control valve will be designed, supplied and installed by the *Contractor*.

11.14 Guards

All external rotating or moving components shall be suitably covered with guards in compliance with the requirements of the OSH Act.

The guards shall be fixed in position and shall be easily removable during maintenance and inspection. Each guard shall contain a suitably sized viewing port fabricated of a mesh or grid that will facilitate visual inspection of the moving component without the need to remove the guard.

11.15 Belt Pulley System

The *Contractor* shall design the belt pulley system that will transmit power from the shaft of the primary driver to the shaft of the foam concentrate pump to obtain the required rotational design speed of the foam concentrate pump. Only v-belts will be considered, and the engines OEM pulley system shall not be modified. Timing belts and flat belts will not be accepted.

All mounted pulleys shall be easily removable without causing damage to the connecting shaft. The *Contractor* shall provide the pulley diameter that will be required to achieve the pump speed.

11.16 Shaft Sealing System

Rotating shafts through the pump casing shall be sealed by a mechanical seal. The process fluid shall be used as the lubricating fluid between seal faces. An external fluid supply will not be provided.

A stainless-steel drip box shall be provided below the seal to contain any leakage from the seal under abnormal operating conditions or seal failure.

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11.17 Pressure Gauges

Pressure gauges mounted to the pump casing are not required. Pressure gauges will be fitted on the pump suction and discharge piping by the *Contractor*.

11.18 Bearing Thermometers

Bearing thermometers are not required under this specification. The *Contractor* shall specify the expected normal operating bearing housing temperature as well as the maximum permissible bearing housing temperature during pump operation.

11.19 Nameplate

The supplier shall provide a nameplate made of grade 316 stainless steel, securely fixed by rivets or pins to the pump in a prominent position with the following information embossed onto the nameplate:

- Supplier Name
- Make or manufacturer
- Model
- Serial number
- Design Process Medium
- Rotor Length (mm)
- Rated capacity in (m^3/hr or l/min) at speed 1 (RPM)
- Rated discharge pressure (kPa) at speed 1 (RPM)
- Rated capacity in (m^3/hr or l/min) at speed 2 (RPM)
- Rated discharge pressure (kPa) at speed 2 (RPM)
- NPSH required
- Date of manufacture

11.20 Dismantling and Assembly

The pump and belt pulley system shall be easily dismantled and assembled without the need to remove other components of the pump-set. Common wearing parts shall be maintainable with the pump in position.

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12 ENGINE CONTROL PANEL

The duty and stand-by pump-set shall each be provided with a dedicated Engine Control Panel (ECP) mounted on the respective pump-set frame.

Each ECP shall comprise of a fully enclosed panel with a mounted engine control module (ECM), lamps, key switches, labels, components, gauges, buttons, batteries, battery chargers and any other equipment as required by this section of the specification.

12.1 System Design

The system shall be designed and constructed as a hard-wired system with the exception of the engine control module (ECM) that will be supplied as an OEM unit. All other functions/aspects of control shall be performed by individual components to fulfil the control requirements, separately mounted in the ECP.

The *Contractor* shall supply a suitable engine control module (Deep Sea Electronics controller module DSE-E800 or approved equivalent by the *Employer*) for each pump-set to meet the requirements of this specification.

The ECP of each pump-set will interface with the Fire Control Panel (FCP) via suitable terminations as per the *Employers* approved vendor list. The FCP will be designed and installed in accordance with PL 913, Fire Control System and Instrumentation Design, Supply and Installation Specification and Scope of Works, the scope of which is excluded from this specification.

The *Contractor* shall ensure successful integration between the FCP and ECP.

The wiring and cabling will be completed as per SANS 10142-2 and TPL Specifications PL727.

All electrical isolators shall be lockable.

An emergency switch shall be provided to shut down the engine in all events and is to be hard wired. The emergency switch when activated shall not reduce the speed of the engine in stages.

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12.2 FCP and ECP Interface

The FCP and ECP interface that includes the engine protection philosophy, start and stop signal and starting arrangement shall be designed and constructed as per the requirements defined in the ECP FCP Control Narrative document, document PL 916.

All signals from FCP to ECP will be via potential free contacts in the FCP.

All signals from ECP to FCP will be via potential free contacts in the ECP.

12.3 Engine Running and Crank Termination Control

Engines shall be provided with a speed-sensitive switch to signal engine running and crank termination.

An engine run event will be transmitted to the FCP if an engine run condition is satisfied.

12.4 ECP Power Supply

The ECP will source its power from the battery charging system.

The ECP shall incorporate over-voltage protection to prevent any malfunction or damage which might occur from source power surges.

A circuit breaker shall be provided between the battery units and the ECP to allow for electrical isolation of the ECP. The circuit shall be lockable.

12.5 ECP Battery Chargers

The battery chargers will source their power from the essential electrical supply distribution board (DB) located within the container which in turn sources its power from the essential electrical power supply distribution board (DB) located in the Pump House building.

The diesel engine located on the firefighting pump-set is also equipped with an alternator that will provide alternative power to the battery chargers.

Each individual ECP shall be provided with two individual battery chargers and battery banks separated with a suitably sized quint. The ECP will draw power from both systems equally.

The specification of battery chargers shall be Blue Ginger or equivalent approved by the *Employer*.

The means of charging the batteries must be by a fully automatic continuously connected constant voltage, variable current charge having automatic trickle and boost charge facilities.

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The mains supply voltage, battery voltage and charging current shall be indicated via a suitable panel mounted indicator (panel meter with an accuracy of +-2%)

The charger alarms for each battery charger and battery unit set should indicate as a minimum mains voltage or battery failure.

The battery charger shall restore to the battery 100% of the batteries reserve capacity or ampere-hour rating within 2 hours.

The charger shall be so designed that it will not be damaged or blow fuses during the cranking of the engine.

The type of the batteries shall be furnished according to the battery charging unit OEM's requirements, however sealed maintenance-free batteries shall be supplied and be suitable for use in an occupied building.

The circuits of the batteries must not be linked so that power may be transferred from one to the other.

The charger shall operate even when the battery is totally flat. The battery charger must be short circuited protected.

The charge shall float a fully charged battery continuously.

The charger shall be designed to be protected against damage when an attempt is made to charge a reverse connected battery.

The battery charger at its rated voltage shall be capable of recharging a completely discharged battery at a maximum rate without damaging the battery.

The battery charger specifications shall be clearly identified.

12.6 Battery Starting

All batteries shall be engraved with the date of installation.

The batteries shall be provided with a non-conductive cover to prevent objects falling onto the battery terminals or other inadvertent damage. The battery cover must be mechanically secured.

Each engine shall have two storage battery units. Each battery unit shall be marked and clearly identified as "Battery Unit 1" and "Battery Unit 2" in accordance with the labelling requirements of Section 12.7.

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Each battery unit shall have twice the capacity at 4 ºC to maintain the cranking speed recommended by the OEM of the primary driver through a 3 minute cycle in accordance with the starting sequence and arrangement specified in Section 8.14 (i.e. six 15 second start attempts for each pump-set with 15 seconds rest in between each start attempt) without AC power being available for battery charging. Over and above this, each battery unit shall also be sized to maintain power to the ECP for a duration of 15 minutes.

The *Contractor* shall provide a certificate confirming that each battery complies with this requirement.

Storage batteries shall be supported above the floor on stillage's, located side by side and not stacked, secured against displacement, and located where they will not be subject to excessive temperature, vibration, mechanical damage or flooding with water. They shall be readily accessible for servicing.

Non-essential loads shall not be powered from the batteries.

The main battery contactors supplying current to the starter motor shall be capable of manual mechanical operation in the event of control circuit failure.

12.7 Labels

All labels shall be of the Traffolyte engraved type that are permanently fixed to the panel with stainless steel screws. The use of adhesive to attach the labels to the panel shall not be permitted.

All label text shall be in uppercase Arial font.

Each Engine Control Panel shall have a label representing the label numbering in accordance with Section 6.1 and located at the top centre of the control panel door with a white background with black text of height 12 mm.

All components, lamps, key switches and buttons shall have labels with a white background with black text of height 6 mm.

All cautionary labels shall have a red background with white text of height 12 mm.

A cautionary label shall be provided that bears the following text;

"IMPORTANT NOTICE: THIS MACHINE SHOULD ALWAYS BE LEFT IN AUTO MODE WITH THE KEY REMOVED".

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12.8 Instrument and Cable Tagging and Numbering

All instrument and cables shall be suitably tagged.

The instrument and cable tags must be permanently fixed, may not be fixed by adhesive and must not be susceptible to degradation in the environment in which it is installed.

Tags may not be handwritten and may not be of paper or cardboard construction.

Cables shall be tagged with Grafoplast TRASP® or similar approved identification system.

Cables must be identified in accordance with the *Employers* specifications.

12.9 Panel Construction

Except as modified by the requirements or concessions in this document, the panel design and construction must comply with the requirements of the *Employer's* standards including PL631 and PL711.

Components, pilot lights, push buttons and any other equipment fitted to the panel shall not reduce the IP rating of the panel.

The panels shall be signal red, powder coated carbon steel to colour RAL 3001 with a minimum IP rating of 66 and shall be lockable. The panel may be subject to discharge from water sprinkler systems within the container should the *Employer* chose to install at a later date.

The panel shall have sealed gland plates on the bottom of the panel.

Cable glands shall be used for entry of cables into all panels via gland plates. Cable glands shall be suitable for the service, cable type and size and not compromise on IP rating. Cable glands shall be located in such a way so as to allow the tightening and loosening of any gland at any time.

All equipment installed in panels, with the exception of face mounted items on the operator panels, shall be installed on a backing plate mounted to but separate from the back or sides of the panel.

The panels shall have 20% additional space for the installation of relays and terminals.

No trunking run shall have a cable loading of more than 80% for the completed design and installation.

All wiring connections outside of dedicated equipment connections shall be made in accordance with the *Employers* specification.

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All components shall be DIN rail, if components are panel mounted, they shall not compromise the IP rating of the panel.

The two battery chargers shall be housed within the panel together with all components.

Two spare 10A fuse-dis-connectors must be provided in the panel from which outgoing 24 VDC supply feeds can easily be terminated.

Side access panels are not permitted.

During ECP start attempt and run an amber flashing beacon on the respective ECP shall be active.

12.10 Location

The location of the Engine Control Panel shall be suitably mounted off the pump-set baseplate where heat is at a minimum. The Engine Control Panel shall be protected against vibration and shall be positioned adjacent to the pump-set in accordance with the model approved by the *Employer*.

As the pump-sets may not be identical in their arrangement (i.e. position of Engine Control Panel and foam concentrate pump), the *Contractor* shall confirm with the *Employer* which pump-set arrangement shall be assigned as the duty pump-set.

12.11 Engine Over speed

The engine over speed shall be designed and implemented as per the requirements defined in the ECP FCP Control Narrative document, document PL 916.

The engine control module shall stop the engine in the event of over speed under all running conditions. The over speed trip setting shall be 10% above rated engine speed. The ECM shall be manually reset to clear the over speed condition prior to permitting subsequent engine starting.

During normal start-up of the engine, the speed of the engine shall not reach the over speed setting.

12.12 Two Stage Engine Shutdown

The two-stage engine shutdown shall be designed and implemented as per the requirements defined in PL 916 (ECP FCP Control Narrative document).

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12.13 Panel Face Mounted Instruments

The following components shall be face mounted on the Engine Control Panel.

- Emergency Stop Push Button of the self-latching and twist to reset type
- Battery Charger Number 1 Alarms
- Engine control module with integrated start and stop push buttons
- Battery Charger Number 2 Alarms
- Oil Pressure Gauge
- Oil Temperature Gauge
- Water Temperature Gauge
- Alternator charger rate ammeter Gauge
- Battery Charger 1 Charging Rate Ammeter
- Battery Charger 2 Charging Rate Ammeter
- Battery Charger 1 Voltage Meter
- Battery Charger 2 Voltage Meter
- Key Operated ‘Auto/Maintenance’ Switch
- Low Oil Pressure Pilot Light
- High Oil Temperature Pilot Light
- High Water Temperature Pilot Light
- Low Coolant Level Pilot Light
- Start Failure Pilot Light
- Lamp test push button

12.14 Gauges, Push Buttons and Pilot Lights

All indicating gauges shall be red lined to show alarm levels and shall be minimum 60 mm in diameter.

Gauges of different sizes will not be accepted. Display units of all gauges shall be degrees Celsius, amperes (Amps), volts (V) and kilopascal (kPa) for the selected application.

All pilot lights and push buttons shall be 22 mm in diameter incorporating LED indication in the required colour and the indicating colour shall be evident without the LED lit. The push buttons shall only illuminate when pressed or when the Lamp test push button is pressed.

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13 CONTAINERISED SOLUTION

The *Contractor* shall read the below requirements in conjunction with the PL 917 Document, Equipment Handover and Document Procedure (EHDP).

13.1 Tolerances

13.1.1 Alignment Tolerances

During the installation of the containers, the *Contractor* shall line and level each pump-set using brass shims and steel wedges.

Once the containers have been installed onto the prepared foundations, and prior to the connection of any pipework external to the container, the *Contractor* shall perform and include in the QA file, a laser alignment certificate of the fire water pump. The *Employer* must be invited to witness the laser alignment of the water pump.

Installation and alignment shall be as per the OEM's recommendations.

During installation and connection of the external pipework to the fire water pump and foam concentrate pump flanges, the OEM shall make themselves available on site as necessary to witness the pipe-on and pipe-off exercises that shall be performed by the *Contractor*, and at the end of the pipe-on pipe-off exercise, the OEM shall be satisfied and issue a certificate in this regard, that the suction and discharge pipework for both the foam concentrate pump as well as the fire water pump has not imposed any undue stresses and forces on the pump.

Prior to the commencement of on-site commissioning, the *Contractor* shall perform and include in the QA file a second on-site laser alignment certificate of the fire water pump to confirm that the alignment of the fire water pump has not be displaced during the installation of the pipework. The *Employer* shall be invited to witness the second laser alignment test as well.

13.1.2 Equipment

The centreline and elevations of all pump inlet and outlet nozzles shall be located within a tolerance of ±0.5 mm to the dimensions as shown on the AFC container drawing.

13.2 Static Tests

Notwithstanding the OEM's hydrostatic test of the firewater pump and the foam concentrate pump, the *Contractor* shall perform for each pump called for under this specification, a 30-minute hydro-static test that is witnessed by the *Employer*.

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The test pressure shall be no less than the greater of 1.5 times the pump shut-off head or the OEM's hydrostatic test pressure.

Once the test pressure has stabilised, the pump casings shall maintain the test pressure for the duration of the test and during the test there shall be no leakage from the pump.

The hydrostatic test shall be performed and witnessed during the FAT of the pump-sets and shall be performed with the pumps assembled as a part of the pump-set and not in isolation on a test bench prior to final assembly.

13.3 Equipment Handover and Document Procedure

The *Contractor* shall comply with the *Employer's* Equipment Handover and Document Procedure, document PL 917, during the testing and handover of the containerised pump-sets.

13.3.1 Shop Performance Test

Each pump-set called for under this specification shall be simultaneously subject to a shop performance test that is arranged and performed by the *Contractor* and witnessed by the *Employer* or the *Employers* designated representative at an approved pump test facility.

The fire water pump, foam concentrate pump and primary driver shall be tested as a unit and the site suction and discharge pipework conditions of the fire water pump shall be simulated during the shop performance test, with the use of flow conditioners and straighteners where necessary to obtain a good velocity distribution at the pressure measuring points.

The duty point (guarantee point) of the fire water pump will be tested during the shop performance test, and the pump-set shall be subject to an endurance test.

It is acceptable to use water as the process medium during testing of the foam concentrate pump.

The shop performance test shall only take place upon completion of the factory acceptance test (FAT).

13.3.1.1 Guarantee Point

In order to verify the specified duty point is being delivered by the pump-set, as an assembled pump-set the fire water pump shall be subject to a performance test in accordance with SANS 9906-2016.

The test shall be conducted at the specified speed of the fire water pump.

The acceptance grade and corresponding tolerance for the duty point (the guarantee point) of the fire water pump shall be determined in accordance with SANS 9906-2016 Accuracy Grade 2U.

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The following test curves shall be provided to the *Employer* after the test for each fire water pump and foam concentrate pump for all stated flows and pressures:

- Total pumping head (metres) vs discharge (m^3/hr or L/min).
- NPSH required (metres) vs discharge (m^3/hr or L/min).
- Pump efficiency (%) vs discharge (m^3/hr or L/min).
- Shaft power (kW) vs discharge (m^3/hr or L/min).

13.3.1.2 Endurance Test

Over and above the guarantee point test above, each pump-set shall be subject to an endurance test. Prior to the endurance test, *the Contractor* shall mark targets on the equipment in locations as directed by *the Employer*. Repeated measurements during the test shall be taken from the target locations.

The pump-set shall be run at the fire water and foam concentrate duty points for a duration of 6 continuous hours, where the following hourly records shall be made;

- Ambient temperature
- Lubricating oil temperature
- Cooling water temperature
- Engine speed
- Foam concentrate pump speed
- Pump gland temperature
- Water pump bearing temperatures
- Foam concentrate bearing temperatures
- Miscellaneous spot temperatures as required by the *Employer*
- Vibration measurements

Equipment and spot temperatures shall be done using a dual infra-red laser thermometer.

After 6 hours of continuous operation, the engine speed, foam concentrate pump speed, the suction and delivery pressure of both the foam concentrate pump and the fire water pump must be recorded at 0%, 25%, 50%, 75%, 100% and 110% of the fire water pump duty point.

13.3.2 Factory Acceptance Tests

Each containerised solution called for under this specification shall be simultaneously subject to a FAT that is arranged and performed by the *Contractor* and witnessed by the *Employer*.

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The FAT shall be a test of the pump-sets, FCP's, electrical infrastructure and all other ancillary equipment specified to ensure compliance before delivery to site. A mock test of the duty stand-by starting sequence shall also be performed.

The minimum information that will be reviewed by the *Employer* at the FAT for each containerised solution is as follows;

- Pump-set dimensional checks and equipment arrangement conformance to the AFC drawings
- Fire water pump direction of rotation (the fire water pump will not be run)
- Foam concentrate pump direction of rotation (the foam concentrate pump will not be run)
- Pump alignment certificates
- Quality Assurance Files
- Design and operation of Engine Control Panel and all associated logic and emergency stops against the ECP FCP Control Narrative
- Instrument hook-ups and calibration ranges
- DFT of corrosion protection systems
- Speed of diesel engines
- Electrical and instrumentation routing infrastructure
- Complete electrical installation
- Earthing and bonding installation
- Other requirements of this specification not specifically listed above

13.3.3 Site Acceptance Testing and Commissioning

Upon successful completion of the containerised solution installation, the containerised solutions shall be subject to a site acceptance test (SAT). The SAT will be arranged and performed by the *Contractor* and witnessed by the *Employer*.

The predominant focus of the SAT will be of the Engine Control Panel and to establish readiness for final commissioning.

The minimum information that will be reviewed by the *Employer* at the SAT for each containerised solution is as follows;

- Pump alignment certificates
- Quality Assurance Files
- Operation of Engine Control Panel and all associated logic and emergency stops against the ECP FCP Control Narrative
- Instrument hook-ups and calibration ranges

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- Speed of diesel engines
- Complete electrical installation
- Earthing and bonding installation
- Other requirements of this specification not specifically listed above

The requirements for commissioning and handover of the containerised solution are documented in the Works Information.

14 DOCUMENTATION

All drawings shall have the title block unique for the project included on the drawing, located at the lower right-hand side of the drawing.

For drawings the minimum size is A3 and the maximum size is A1. A4 may only be used for parts lists and similar documents.

Individual dimensioned General Arrangement (GA) drawings for the following items shall be included in the QA file;

- Valves
- Pressure indicators
- Jockey pump
- Fire water pump
- Foam concentrate pump
- Primary driver
- Diesel tank
- Belt pulley system
- Baseplate
- Coupler
- Engine Control Panel
- Engine Control Module
- Pump-set arrangement
- Electrical installation
- Earthing and bonding installation

Individual detail drawings for the following items shall be included in the QA file;

- Fire water pump
- Jockey pump and control panel

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- Foam concentrate pump
- Mechanical seal
- Primary driver
- Belt pulley system
- Couplers
- Electrical distribution boards (DB's)
- Instrumentation junction box (JB)

The *Contractor* shall submit to the *Employer* an Approved for Construction (AFC) General Arrangement drawing. The drawing shall be stamped or clearly marked in red, 'Approved for Construction'.

The AFC GA drawing shall contain the following information as a minimum;

- Dimensioned plan view on assembled containerised solution including suitable dimensioned sections and elevations
- Section through baseplate showing belt and pulley assembly
- Location of water jacket heater
- Holding down bolt details
- Mass of the following individual equipment;
    - Primary driver
    - Fire water pump
    - Foam concentrate pump
    - Engine Control Panel
    - Baseplate
    - Jockey Pump
    - Diesel tank
    - Miscellaneous
- Total mass of container
- Exhaust details
- Location of Engine Control Panel
- Dimensioned location of all suction and discharge flanges including elevations
- Inlet and outlet flanges of both pumps
- Baseplate centrelines
- Location of earthing points
- Location of lifting lugs
- The technical specifications of each of the following items of equipment;
    - Primary driver showing manufacturer, model number, RPM and kW rating

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- Fire water pump showing equipment number, manufacturer, model number and duty point
- Foam concentrate pump showing equipment number, manufacturer, model number, duty point, RPM, rotation direction and coupling specification
- Mechanical seals showing seal design, manufacturer and model number
- Belt pulley system showing belt and pulley manufacturer, model number, plumber block specification
- Engine control module showing manufacturer and model number
- Batteries
- Drive coupling showing manufacturer, design and model number
- Radiator showing design, manufacturer and model number

- Allowable forces and moments for the fire water pump and foam concentrate pump

The AFC GA shall be updated to as-built status with all changes incorporated upon successful completion of commissioning.

Native final drawings shall be submitted in AutoCAD format with the final handover documentation. Electronic copies in PDF format shall also be submitted on CD.

All electronic drawings must be searchable, and hard/scanned copies must be clear and legible.

15 PROJECT QUAILTY REQUIREMENT

15.1 Quality Control Plan

The *Contractor* shall prepare a quality control plan (QCP) for the design, approval, installation and commissioning of the containerised pump-sets.

The QCP shall be submitted to the *Employer* for Acceptance. The *Employer* will apply hold, surveillance and witness points as deemed necessary. Hold points will require the signature of the *Employer* before proceeding to the subsequent activity on the QCP.

The *Contractor* shall make provision for a duration of 2 weeks as an approval/review period for the *Employer*.

A selection of the *Contractors* scope shall be submitted to the *Employer* for review, approval, construction and comment in accordance with the below table.

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Information to be Provided by the *Contractor*	Issue Status
AFC GA drawing of containerised pump-set	Initially for *Employer* acceptance but ultimately as Approved for Construction
Primary driver kW de-rating calculations	For Acceptance
Foam and water pump system, power and NPSH curves showing the duty points	For Acceptance
Project Quality Control Plan	For Acceptance
Engine Control Panel internal and external layout and GA drawings	For Acceptance
Electrical schematic drawings of the Engine Control Panel, electrical power DB's and jockey pump control panel	For Acceptance
Lighting and small power layout as applicable	For Acceptance
Power distribution diagrams	For Acceptance
Cable schedules	For Acceptance
Internal wiring diagrams of the Engine Control Panel	For Acceptance
Belt and pulley system calculations	For review and comment

15.2 Quality Assurance File

The *Contractor* shall also prepare at the beginning of the project and keep up to date through the project lifecycle a Quality Assurance (QA) file with the following minimum sections;

- Pump-set Specification
- Quality Control Plan
- Design
    - Belt Pulley System
    - Lifting equipment
    - Primary driver kW de-rating calculations
    - Instrument hook-up diagrams
- Purchase Orders
- Equipment Specifications and data sheets
    - Valves and pressure indicators
    - Belt and pulley design data
    - Fire water pump curves
    - Foam concentrate pump curves
    - Primary driver data sheets

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    - Engine control module data sheets
    - Instrument data sheets
    - Process instrument data sheets
    - Light fitting datasheets
- Baseplate design
    - Weld Procedure Specification
    - Procedure Qualification Records
    - Material certificates for all structural steel
    - Galvanising Certificates
- Drawings
    - Valves
    - Baseplate
    - Primary driver
    - Coupler
    - Belt pulley system
    - Fire water pump
    - Foam concentrate pump
    - Mechanical seal
    - Engine Control Panel
    - Pump-set
    - Cable rack routing and sizing diagrams
- Electrical, Control and Instrumentation
    - Cable test certificates (continuity and earth testing)
    - Instrument installation verification against hook-up diagrams
- Equipment and Handover Documentation in accordance with the Equipment and Handover Document *Procedure*, document PL 917.
- *Employer Contractor* Correspondence

The *Contractor* shall prepare and issue to the *Employer* the approved original QA file plus one hard copy. The contents of the approved QA file shall also be submitted on a CD.

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16 EQUIPMENT WARRANTY

The warranty period for all equipment called for under this specification shall be twelve months from the date of the Completion Certificate signed by the *Project Manager*.

The responsibility of the *Contractor* concerning his equipment is in no way alleviated by the issue of the Completion Certificate.

Maintenance by the *Employer* during the warranty period shall be limited to cleaning and necessary lubrication only as included in the operating and maintenance manuals submitted by the *Contractor*. All other maintenance or adjustments shall be carried out by the *Contractor*.

Should any component part of any main or ancillary equipment fail to perform in accordance with its intended function during the warranty period, the *Employer* shall reserve the right to reject the component part and order its replacement with a more reliable part at the *Contractors* expense. The replacement part shall be guaranteed for a further 12 months.

17 OPERATING AND MAINTENANCE MANUALS

An operating and maintenance (O&M) manual for each pump-set shall be prepared and submitted by the *Contractor* and shall be separate from the QA documentation.

The *Contractor* shall prepare and issue to the *Employer* the approved original O&M file plus one hard copy. The contents of the approved O&M file shall also be submitted on a CD.

The O&M manual shall contain the following information as a minimum;

- Numbered spare parts list and associated diagram for the following equipment;
    - Valves
    - Foam concentrate pump
    - Fire water pump
    - Gearbox (if applicable)
    - Coupler
    - Belt and pulley system
    - Primary driver
    - Light switch and light fittings
    - Socket outlets
- Recommended spare parts list with OEM part number and local equivalent part number for the following equipment;
    - Valves

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    - Foam concentrate pump
    - Fire water pump
    - Gearbox (if applicable)
    - Coupler
    - Belt and pulley system
    - Primary driver
- Operating and Maintenance manuals for the following equipment;
    - Foam concentrate pump
    - Fire water pump
    - Gearbox (if applicable)
    - Coupler
    - Belt and pulley system
    - Primary driver
- Service manuals
- Primary driver workshop manual

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