



TRANSNET PIPELINES

WALTLOO DEPOT

PUMP SPECIFICATION

APRIL 2021

K&T PROJECT REFERENCE: 19208

REVISION A



KANTEY & TEMPLER (PTY) LTD
CONSULTING ENGINEERS
REG. NO. 1966/09839/07

TEL: 031 266 6535
FAX: 031 266 5786
WEB: www.kanteys.co.za
E-MAIL: ktdbn@dbn.kanteys.co.za
P O BOX 1621, WANDSBECK, 3631

Engineering African Development



Details of this report

Client Name	Transnet Pipelines
Document Title	Waltloo Depot – Pump Specification
K&T Project Reference	19208
File Name	19208-Spec-Pumps-RT-Rev0.docx
Prepared by	R Thomson

Report Revision Record

Revision	Date	Description
A	26 April 2021	Issued for review

TRANSNET PIPELINES – WALTLOO DEPOT

PUMP SPECIFICATION**Table of Contents**

1.	Introduction	4
2.	Definitions	4
3.	Reference Standards.....	4
4.	Intent of Specifications	5
5.	Description of Site and Access	5
6.	Scope of Specification	5
7.	Details to be Included in the Tender Document	6
8.	Type and Arrangement of Pumps	6
9.	Pump Characteristics	7
10.	Pump Construction	7
10.1.	Pump Casing	7
10.2.	Impellers.....	7
10.3.	Pump Bearings and Lubrication.....	7
10.4.	Glands and Seals	7
10.5.	Fasteners	8
10.6.	Coupling	8
11.	Base Plate / Mounting Plate Construction.....	8
12.	Requirements for Electric Motors.....	9
12.1.	Design.....	9
12.2.	General Design	9
12.3.	Starting Requirements.....	9
12.4.	Rotation Direction.....	9
12.5.	Bearings.....	10
12.6.	Control Panel and Instruments	10
12.7.	Control System and Narrative.....	10
13.	Foundations	10
14.	Name Plates.....	10
15.	Corrosion Protection.....	10
15.1.	Surface Preparation for All Coatings.....	11
15.2.	Protection	11
16.	Inspection and Testing	11
16.1.	Inspection by the Supplier	11
16.2.	Inspection by the Engineer	12
16.3.	Performance Tests	12
16.4.	Hydrostatic Pressure Tests.....	12
16.5.	Inspection of Coatings	12
17.	Documentation	12
18.	Delivery	12
19.	Storage.....	13
20.	Installation	13
21.	Commissioning.....	13
21.1.	Commissioning Procedure	13

21.2.	Responsibility and Period of Guarantee.....	14
22.	Rejections	14
23.	Service Plan	15

1. INTRODUCTION

This document covers the requirements for the supply of pumps as required.

2. DEFINITIONS

ASME –	American Society of Mechanical Engineers
ASTM –	American Society for Testing & Materials and its successor ASTM International
API –	American Petroleum Institute
Engineer –	Kantey & Templer or their representative
ESD –	Emergency Shut Down system
HSSE –	Health, Safety, Security and Environment
ISO –	International Organization for Standardization
Purchaser –	Transnet Pipelines
Supplier –	The successful tenderer
SABS -	South African Bureau of Standards (subsequently renamed SANS)
SANS –	South African National Standards
Site –	The area of the Works
SOQ –	Schedule of Quantities
TPL –	Transnet Pipelines
ULP –	Unleaded Petrol
VRU –	Vapour Recovery Unit
Works –	Refers to the full scope of supply and services

3. REFERENCE STANDARDS

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

SANS 10142-1-	The wiring of premises, Part 1: Low Voltage Installations
API 610 -	Centrifugal Pumps for Petroleum, Petrochemical & Natural Gas Industries
API 674 -	Positive Displacement Pumps - Reciprocating
API 675 -	Positive Displacement Pumps - Controlled Volume for Petroleum, Chemical, and Gas Industry Services
API 676 -	Positive Displacement Pumps - Rotary
API 681 -	Liquid Ring Vacuum Pumps and Compressors for Petroleum, Chemical, and Gas Industry Services
API 682 -	Shaft Sealing Systems for Centrifugal & Rotary Pumps
API 686 RP -	Machinery Installation and Installation Design
ASME VIII -	Rules for Construction of Pressure Vessels
ASME IX -	Qualification Standard for Welding and Brazing Procedures, Welders, Brazers, and Welding and Brazing Operators
ASME B16.5 -	Pipe Flanges and Flange Fittings
ASME B46.1 -	Surface Texture, Surface Roughness, Waviness and Lay
ASME B73.1 -	Specification for Horizontal End Suction Centrifugal Pumps for Chemical Process
DIN EN 1012-2 -	Compressors and Vacuum Pumps - Safety Requirements - Part 2: Vacuum Pumps
ISO 3661 -	End-suction centrifugal pumps -- Baseplate and installation dimensions
ISO 5199 -	Technical specifications for centrifugal pumps -- Class II
ISO 8501 -	Preparation of Steel Substrates
ISO 13709 -	Centrifugal pumps for petroleum, petrochemical and natural gas industries
ISO 21049 -	Pumps -- Shaft sealing systems for centrifugal and rotary pumps
ISO 21360-2 -	Vacuum technology -- Standard methods for measuring vacuum-pump performance -- Part 2: Positive displacement vacuum pumps
SANS 31 -	Metallic products - Types of inspection documents
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
SABS 763 -	Hot dip (galvanized) zinc coatings
SANS 1700 -	Fasteners

SANS 2001-DP2 -	Medium pressure pipelines
SANS 10102 -	Selection of pipes for buried pipelines
SANS 10142 -	The wiring of premises
SANS 10684 -	Fasteners - Hot dip galvanized coatings
SANS 14713 -	Protection against corrosion of iron and steel in structures - Zinc and aluminium coatings

4. INTENT OF SPECIFICATIONS

The specifications are intended to delineate standards and practices which will lead to the production of an efficient, durable and cost effective facility that will meet all the requirements for which it is intended and which will confirm to all statutory requirements and norms in the industry. All specification clauses shall be read and deemed to apply to the items described which are to be priced accordingly.

In all dealings, the supplier shall have the best interests of the end user in mind and shall act accordingly, offering advice and opinions where necessary. The workmanship shall be of the highest quality throughout.

The Engineer shall have the sole right to determine the quality of the materials and workmanship and technical ability of the supplier. Anything which may, in the opinion of the Engineer, is inferior to that specified for the work will be condemned. All condemned material and workmanship must be replaced or rectified, as the case may be, at no cost, to the satisfaction of the Engineer.

5. DESCRIPTION OF SITE AND ACCESS

The area over which the Works are to be constructed lies within:

- 1) TPL's Waltloo Depot. Alwyn Street, Waltloo, Pretoria, South Africa. The GPS co-ordinates of the site are 25°43'34.72" S 28°18'55.41" E.

The site is situated in the Highveld, at an altitude of approximately 1325m above mean sea level.

Access to the site is controlled, and permits for entry must be arranged prior to arrival. The tenderer must understand that permits must be applied for timeously and that no extras will be entertained for delays in obtaining permits should there have been insufficient notification. Personnel and equipment movement on the site will be limited to the construction area and its specific access road, unless there is a valid project specific project reason to move outside this area.

Inductions will be required for all personnel working on site. These inductions are held on particular days and the Supplier must make arrangements with the Purchaser to carry out the inductions at their convenience. Additional project specific inductions will be required, and the tenderer must make similar arrangements for all personnel to undergo this induction. This requirement is limited to personnel involved with site work, i.e. inspection and commissioning of the pumps.

The Purchaser's HSSE requirements will be strictly enforced.

6. SCOPE OF SPECIFICATION

The scope of this specification includes the design, construction and delivery of all pumps required in terms of the scope of supply:

- a) The pump supply shall be inclusive of the pump, driver, spindle, mechanical seal, mounts and guards. These pump set shall be supplied complete.
- b) Automated shut-off of the pump set shall be optional
- c) The delivery to site of the above pump set.
- d) The provision of certified test results for the pump set prior to delivery to the site.
- e) The inspection and commissioning of the final installation and approval thereof to provide a guarantee on the pump set.

- f) The witnessing of a start-up and test run confirming that the pump duty point and operating conditions have been achieved.
- g) The provision of the prescribed manuals and quality control documentation.
- h) Warranty of the facility for a period not less than 24 months.

The pump sets shall be capable of operating permanently or intermittently, on demand, against the performance requirements specified.

7. DETAILS TO BE INCLUDED IN THE TENDER DOCUMENT

For the purposes of this contract all units shall be in accordance with the SI system, no other units shall be accepted. All performance curves and drawings shall be in SI units.

The Tenderer shall submit with this Tender for each pump offered the following characteristic curves:

- Flow vs. Head
- Flow vs. Power
- Flow vs. NPSHR
- Any other relevant performance curves, e.g. Flow vs. Speed

These characteristic curves are to cover the full operating range of the pump concerned and clearly show the rated flow and head.

A layout plan of each proposed pump set is to be provided with the returned tender. This shall clearly indicate the following:

- a) Overall dimensions, including any dismantling length, and the position of the suction and discharge flanges, their size and flange drilling.
- b) The type, make and model number of the driver for electrically driven pumps.
- c) The type, make and model number of the air service unit provided for the pneumatically driven pumps.
- d) The type, make and model number of the proposed couplings, if applicable.
- e) The type, make and model number as well as materials of construction of the proposed mechanical seal, if applicable. A cut away drawing of the stuffing box is to be supplied irrespective of whether the pump offered utilises a mechanical seal or gland packing.
- f) The requirements for any recommended ancillaries not included in the tender.
- g) The anticipated delivery period from date of order.
- h) Any deviations from the Specification in the Tender Document.

8. TYPE AND ARRANGEMENT OF PUMPS

Vertical Spindle Centrifugal Pumps

Centrifugal pumps shall largely be to one or more of the following ASME B73.1, EN 733 (DIN 24255), ISO 5199 - ISO 2858 / EN 22858, API 610 / API 682.

Centrifugal pumps shall be suitable for the product to be pumped. The pumps shall be specified with a single cartridge, mechanical seal with the ability to run dry for a period of 60 seconds.

All centrifugal pumps shall have flooded suctions.

General

All pump connections shall be flanged. Pumps quoted for which are supplied standard with threaded connections shall have flanged connections seal welded to the threaded connections. The supplier is to include the cost for such in their tender.

The pump sets will be selected based on engineering suitability and cost, bearing in mind that the installation is designed for an operational life in excess of 20 years.

The tenderer is considered to be an expert on the specification of the particular pumps offered and shall review all the operating conditions and advise in his tender the best possible type and model of pump for the application, along with any ancillaries considered necessary for adequate pump protection.

9. PUMP CHARACTERISTICS

Attention is drawn to the 1m safety margin for NPSHR required.

10. PUMP CONSTRUCTION

All materials used shall be new and good quality. Material certificates shall be provided as part of the pump set data book.

10.1. Pump Casing

Cast components shall not be warped or distorted in any way and shall not show any increase in dimensions (beyond that shown on the fabrication drawings) likely to cause interference with other components in the erection of the item of equipment for which they were made. The structure of cast components shall be homogeneous and free of non-metallic impurity. If, at critical points of a cast component, there is too great a concentration of impurities or alloy, the component shall be rejected.

The suction and discharge nozzles shall be flanged and not threaded. Allowable flange loading is to be clearly detailed on the returned tender drawings. The flanges shall be such as to take bolts and nuts and not have tapped holes.

All pump casings shall be hydrostatically tested at the manufacturer's workshop, and certificates shall be provided at the time of supply.

The suction and discharge flanges shall be clearly marked as such and the direction of rotation of the pump shall be indicated by an arrow either cast into the pump casing or on a S/S plate riveted to the pump set.

10.2. Impellers

The impellers shall be manufactured in a material compatible with the media to be pumped. Stainless steel impellers are preferred.

10.3. Pump Bearings and Lubrication

The bearings in the pump casing together with the lubricating systems shall be suitable for the particular circumstances of the installation with regards loading, operating temperature, etc. The particular type and system offered by the Tenderer shall be fully specified.

The pump rotating element shall be positively located in the axial direction by means of a thrust bearing.

10.4. Glands and Seals

All pumps pumping fluids other than water shall be fitted with cartridge type mechanical seals. Dry running for a period of 60 seconds shall be allowed for in the selection of the mechanical seals.

Where seals are incorporated as part of the pump offer, the type of mechanical seal offered shall be clearly detailed in the tender document. A P&ID of the mechanical seal shall be supplied with the tender.

In the case of packed glands, full details of the packing required shall be provided.

10.5. **Fasteners**

Fasteners utilised in the internal of the pump shall be manufacture of a material that is corrosion resistant and non-reactive with the media to be pumped. They shall be installed in such a way that they will not seize during the life of the pump operation.

Fasteners utilised external to the pump shall be either Hot Dip Galvanised, or Stainless Steel to suit the pump material. Washers shall be provided under all bolt heads and nuts. The supplier is to pay careful attention to the use of dissimilar materials and the possibility of galvanic corrosion. The threads of bolts and studs shall be cleaned and coated with a graphite/grease compound before assembly.

The threads of all bolts and studs used with the equipment supplied shall be to the same standard. Preference will be given to standard metric sizes. Imperial threads shall only be used with the permission of the Purchaser.

10.6. **Coupling**

Where couplings are required, the coupling shall be specified by the Pump Supplier as the suitable for the application, and complying with the requirements of the pump design code. The coupling shall be designed for the maximum power and torque that can be delivered by the driver, and not the absorbed power of the pump.

11. **BASE PLATE / MOUNTING PLATE CONSTRUCTION**

The base plate shall be manufactured of a material suitable for the pump, such as stainless steel 316L, SANS 50025-2 S355JR or equivalent carbon steel plate.

Construction will be by a suitably qualified welder. Shoddy welding will be rejected by the Engineer at the suppliers cost. Welding shall be in accordance with ASME IX.

The base plate shall be so designed, that it is rigid in all operating conditions of the pump, with only the holding down bolts secured, and without the need for grout. No adverse vibration shall be detectable. Further the design shall ensure that no liquids, either from the pump or external rain is able to pool or pond after grouting in of the base.

The base shall be provided with blocks specifically sited to take the mounting feet of both the pump and the driver. The bolts used to secure the pump and driver to the base plate shall be easily accessible for removal from the base plate, and shall be of the bolt and nut design and not a tapped base plate.

The base plate shall then be drilled and machined to the correct dimensions prior to Hot Dip Galvanising in accordance with SABS 763 and SANS 32. All weld slag etc. shall be removed prior to Galvanising.

After Galvanising, the pads for the pump shall be machined level and smooth, and then immediately coated with suitable grease. The pump shall be mounted flush to the machined pads, and then the motor pads shall be machined to a level of 5mm lower than the pads to take the pump, greased and the motor shall be mounted and aligned by use of a laser instrument, and the print out made available with the data pack, and referenced to the allowable tolerances from the coupling manufacturer.

All shimming material used shall be Stainless Steel to grade 316 and clearly stamped with the thickness of the shim plate. Care shall be taken to ensure that the shim plates do not come into contact with the galvanising, but only the machined surface and the cast iron motor feet. No shim plates will be accepted under the pump.

After alignment the pads shall be wiped clean of grease and painted with an epoxy paint to match the final colour, to prevent corrosion of the machined surfaces.

Coupling guards shall be provided in accordance with the Machinery and Occupational Safety Act and to the approval of the Engineer. The coupling guard shall be of a suitable strength to contain the coupling should it break free during operation.

All parts to be embedded or anchored in concrete shall when necessary be designed with sufficient access to allow easy and efficient grouting around the part.

12. REQUIREMENTS FOR ELECTRIC MOTORS

Low Voltage motors for pumps shall be supplied in accordance with the attached data sheets. Electric motors supplied shall be IEC types. Only WEG, ABB, Actom or Siemens motors shall be used.

12.1. Design

All electric motors shall be rated for zone 1 installation.

Design features aimed at marginally improving motor efficiency at the possible expense of reliability will not be accepted. The motor shall be selected for maximum reliability of both the motor and associated switchgear.

12.2. General Design

Unless otherwise approved, AC motors shall have squirrel-cage rotors and be suitable for direct on-line starting and operation on a three phase supply.

Motor temperatures shall not be permitted to rise higher than the limits specified for the insulating class of the windings, thereby assuring an operating safety margin.

Individual stator conductor turn-to-turn insulation shall be not less than varnish coating on the wire over which mica or glass tape shall be wound.

Motors having attained full load temperature shall be capable of making four starts within the hour, two of which may occur at a minimum interval of five minutes.

12.3. Starting Requirements

Unless otherwise approved by the Engineer, the starting current shall be limited to 6 times the normal full load current. Particular attention shall be paid to the design of two-pole motors, if applicable, to ensure that they comply with modern practice in regard to noise and vibration levels.

The motor starting torque shall be at least 10% in excess of the maximum torque required during the starting period up to 100% speed.

12.4. Rotation Direction

The correct direction of rotation of any unidirectional motor shall be indicated in a permanent manner on the frame.

12.5. Bearings

For the purpose of maintenance, end-shield mounted bearings are preferred.

Suitable seals for bearings shall be provided to prevent ingress of water/dirt into bearing lubricant and windings.

Unless otherwise approved in writing, motor bearings shall be designed so as to allow the motor to run up to 40 000 hours at full speed in either direction.

12.6. Control Panel and Instruments

The Supplier shall have the responsibility to supply the control panel, if required to do so by the contract (i.e. a package unit). The control panel and instruments shall be rated for the applicable zone.

12.7. Control System and Narrative

For package units, the Supplier shall have full responsibility for the control system.

13. FOUNDATIONS

The pump foundation, plinth and anchor bolts shall be provided by others. It is expected that specific foundation requirements for each pump set shall be provided by the Pump Supplier as part of his tender documentation.

14. NAME PLATES

Each pump set shall be provided with a substantial information plate, manufactured of stainless steel, securely fastened with stainless steel screws to the base plate in a readily visible position, and clearly and indelibly marked with the following details:

- Manufacturers name, pump type and serial number
- Contact number of local supplier
- Year of manufacture
- Rated duty of pump in litres per minute
- Head in meters at rated duty
- Pump speed in rpm

Letters and figures for both nameplates shall be engraved, or embossed, NOT STAMPED, and Black Etched after engraving.

15. CORROSION PROTECTION

Corrosion protection shall be as per the project corrosion specification.

The supplier is to note that the pump set is to be installed in an industrial corrosive environment, and that all materials that are susceptible to corrosion are to be suitably coated prior to delivery to site.

Unless explicitly otherwise specified (e.g. for some kinds of fasteners) all surfaces of plant and equipment shall be coated, excluding corrosion resistant parts such as stainless steel shafts, and galvanised base plates.

Labels and components where painting would adversely affect the operation or legibility shall not be painted.

The purpose of the painting shall be to not only prevent corrosion but also to provide an appealing finish. To this end careful preparation must be under taken to ensure that a smooth blemish free finish is obtained.

15.1. **Surface Preparation for All Coatings**

Welds shall be smooth and free from undercuts, protrusions and sharp edges that may protrude through the coating. Weld spatter, slag and loose scale shall be removed and sharp edges ground to a radius.

Deposits of oil, bitumen, coal tar or other contaminants shall be removed by scraping and final wiping with a rag soaked in white spirit.

Blast cleaning shall be carried to achieve a finish of S.A. 2½ in accordance with ISO 8501-1.

Copper tubing and sections of pump and motor shafting exposed to air shall be thoroughly cleaned to a bright finish and covered with an oil resistant lacquer.

All surfaces of equipment normally exposed to air shall be coated with an approved epoxy coat and re-coat able polyurethane finish.

Each coating shall be uniform, smooth and glossy. The application shall be free of all tears, runs, sags, wrinkling, bubbles, blisters, pimples, spikes, orange peel, pinholes, holidays or dust particles.

Flange faces shall be treated on the machined surface with a film thickness not greater than 90 microns.

15.2. **Protection**

The Supplier is to note that he is responsible to deliver the painted pump sets to site in an undamaged condition. He shall take all necessary precautions to ensure that the protective coatings are not damaged.

In order to protect the internal coating system of pumps open ends are to be completely blanked off by sturdy plastic blank flanges or plugs and are to be clearly marked:

"DO NOT REMOVE UNTIL FINAL INSTALLATION"

Plastic sheeting alone will not be acceptable.

Items will be inspected on arrival and unloading at the plant and any repairs necessary shall be at the cost of the Supplier. Such repairs shall comply with all requirements of this Specification.

16. **INSPECTION AND TESTING**

The following Tests shall be conducted prior to dispatch of the pump sets from the supplier's works.

16.1. **Inspection by the Supplier**

The minimum inspection to be carried out by the Supplier shall be that which is necessary to ensure compliance with all clauses of this Specification, since he will be held responsible for non-compliance in any respect and shall be required to repair any defect to the satisfaction of the Engineer.

In order to allow for the commissioning tests (described below) the supplier is to provide the following information:

- Allowable Alignment tolerances
- Expected power to be drawn on each phase
- Expected vibration measurements and testing points on both pump and motor.
- Expected temperature rise on both pump and motor

16.2. **Inspection by the Engineer**

The Engineer or his designated representative has the right to inspect any item covered in the Contract at any time.

Inspection by the engineer shall not relieve the supplier of any of his obligations under this contract.

16.3. **Performance Tests**

Performance tests and certificates in full accordance with the applicable design code shall be provided for each pump set prior to delivery to site. Following these tests, the supplier shall furnish, at a minimum, certified curves showing capacity vs. head and power absorbed. These shall be used for comparison with the installation test results.

16.4. **Hydrostatic Pressure Tests**

All pieces of equipment subject to water, oil or air pressure shall be tested at a pressure not less than one and one half times the design pressure (maximum shut-off head + maximum allowable suction head). Each piece shall withstand the hydrostatic test pressure without exhibiting signs of sweating, undue deformation and stressing, or defect of any kind.

Hydrostatic testing shall be done with blank flanges bolted on the flanges of the piece. The use of tie-bolts or other forms of restraint applied across the blank flanges to restrain the bodies from deflecting under the applied test pressure will not be permitted.

The hydrostatic test pressure shall be maintained for a period of at least five minutes.

16.5. **Inspection of Coatings**

Tests shall include measurement of the following:

Final coating thickness; pinhole detection; paint bonding tests: Paint film to substrate bond-tests shall also be executed.

17. **DOCUMENTATION**

Three copies of the operating and maintenance manuals shall be provided at the time of delivery of the pump sets.

The final documentation shall cover the following:

- Technical specification (including performance curves)
- Drawings/Specification schedules
- Exploded drawings of each component and parts list, including materials of construction.
- Quality plans, Material certification (Heat treatment records, etc.)
- Commissioning records and test sheets. – Delivered within 1 week of commissioning.

The system of units for all documentation shall be the international metric system. (SI)

18. **DELIVERY**

The goods shall be loaded and transported on suitable transport. All items shall be secured on the transport vehicle to avoid damage to the pipe and fittings and their coatings. Goods shall not be allowed to rest directly against each other.

Goods shall be supplied with plastic end caps on all openings.

Goods 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. The goods shall be secured to the wooden container to prevent movement.

All goods shall be firmly secured by suitable padded lashings to prevent movement and damage in transit. The containers and goods shall not be dropped, bumped or subjected to shock or rough handling and any goods damaged during transport or handling may be rejected by the Engineer.

The Supplier shall make allowance for and comply with all the Purchaser's Health Safety Security and Environmental (HSSE) requirements at the delivery point.

The Supplier shall allow for off-loading is so stipulated in the Supplier's Contract.

19. STORAGE

The Supplier shall allow for the storage of the goods at the Supplier's premises for a period of up to 6 months in their offer.

Storage of the goods shall be:

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

The goods shall be stored in an area away from regular vehicle movements and contamination by incompatible materials.

20. INSTALLATION

Pumps supplied as standalone items will be installed and connected to the piping by the Mechanical Installation Contractor who will be appointed under a separate Contract. However, the Pump Supplier may submit an option (priced separately) to manage the installation of the pump sets. This will be considered separately to the supply of the pump sets.

Pumps supplied as part of a package unit shall be installed and connected by the Supplier.

The pump supplier shall remain responsible for all assembly and connection of the pump sets, with the exception of the pipes and electrical feed to the controllers. This includes all panel wiring to the controllers, etc.

21. COMMISSIONING

Once the pump sets have been installed, the Pump Supplier shall be notified and a date agreed between them and the Engineer shall be set for the commissioning.

21.1. Commissioning Procedure

The commissioning shall follow the following basic steps:

- Upon arrival at site, the pump set will be in an installed position with the suction and discharge pipe work disconnected. The Supplier is to satisfy himself that the pump set is properly installed and aligned. Any tools or instruments required to confirm this shall be provided for by the Supplier.
- The suction and discharge pipe work shall then be connected by the Piping Contractor and the Alignment Contractor shall carry out the "pipe on" shaft alignment in the presence of the Pump Supplier. The Alignment Contractor shall be appointed by the Pump Supplier.
- The pump shall then be tested and all relevant flow data recorded in accordance with the performance requirements of the pump.

All readings shall be compared to the reference curve provided. Should any of the readings be unacceptable to the engineer, the supplier shall immediately institute measures to ensure that satisfactory remedial work is undertaken, and handover / commissioning of the pump will not be accepted until such time as the pump set can comply with the specifications as stated.

21.2. **Responsibility and Period of Guarantee**

After the commissioning, the guarantee period will be deemed to have started and will continue for a period of 24 months. The responsibility of the Pump Supplier concerning his equipment is in no way alleviated by the Commissioning.

The Pump Supplier shall make good, free of all charges, any defects arising during this Period of Guarantee, including the replacement of all defective parts and their installation and re-commissioning. This guarantee shall apply to all defects arising during proper use of the plant, due to faulty design or maintenance instructions, inferior materials or poor workmanship.

Maintenance by the Purchaser's personnel during the Period of Guarantee shall be limited to cleaning and necessary lubrication only as instructed by the Pump Supplier. All other maintenance or adjustments shall be carried out by the Pump Supplier.

Should any component part of any main or ancillary equipment fail to perform in accordance with its intended function during the Period of Guarantee, the Engineer shall have the right to reject the component part and order its replacement with a more reliable part at the Pump Suppliers expense. The replacement part shall be guaranteed for a further twelve months or to the end of the Period of Guarantee, whichever is the later.

After the period of 24 months the final commissioning and handover will take place.

The procedure as described above for the initial commissioning will be repeated and no deterioration in the performance and efficiency of the pump must be noted.

Test results shall be included in the Operating and Maintenance Manual.

If either party insists on a recalibration of any item of equipment, then the cost of the recalibration shall be borne by that party if it is found that the instrument did not require recalibration.

22. **REJECTIONS**

The Engineer reserves the right to reject any pump set, at the time of the Works test, the Acceptance Test on Site or after, during the Period of Maintenance in the following cases:

- Efficiencies at the Duty Points defined or average efficiency lower than the guaranteed efficiency by more than 5%.
- Discharge rate, at any Duty Points defined, lower than those guaranteed by more than 5%.
- Any sign of cavitation.
- Any sign of vibration.

- Any deviation from these specifications not agreed previously in writing.

The Engineer reserves the right to reject any part of the equipment if the above mentioned corrections are not forthcoming. Rejection implies the recovery, by the Engineer, of all monies paid to the Supplier who shall remove, at his own expense, all the plant supplied by him when ordered to do so.

23. SERVICE PLAN

The continued reliable operation of the fire pumps is critical to the operation of the facility. It is also recognised that the Purchaser's personnel may not have the correct facilities or specialised skills to maintain the pumps in "as-new" condition. The Pump Supplier is to propose a service agreement for a period of not less than 60 months from commissioning of the pumps. This shall be evaluated separately to the supply contract, but shall be considered of high importance in terms of assessing the future reliability of the pump installation.