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Technical Specification for Hydro cyclone

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1- General

1-1 Introduction

The plant is “Designed” to accommodate the “Maximum” conditions.

1-2 Scope

This specification defines the minimum requirements for the design, manufacture, inspection and testing of Hydro cyclone in Copper-Moly concentrate plant project. In addition to requirements of this criteria, work shall be done in accordance with recognized and accepted theories, methods, codes, standards and good engineering practice. It should be noted that all Engineering (Detail Design), Procurement and Construction activities must be done by Contractor, based on Project Design Criteria, Specifications and engineering documents approved by Employer. Contractor should be assured about using last revision of all documents. All activities must be done base on contract documents by contractor and should be submitted to Employer for review and approval.

1-3 Regulations and reference documents

The work shall be done in accordance with the national and local laws and regulations. For subjects not covered by regulations or specifications, the design and construction shall be based on good engineering and working practice and shall be subject to approval by EMPLOYER in written.

The contractor shall inform the EMPLOYER in case of any deviation from the requirements of these criteria and specification which is considered necessary, in order to comply with national/local regulations.

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1-4 Occupational Health and Safety

The Contractor shall adopt safe systems of work which minimize the risk to health and safety. All persons working on the site shall be competent to carry out their tasks and duties safely and in a manner that will not endanger their own health nor the health of others. Persons, when first employed on the site, shall be subject to appropriate pre-employment occupational health checks, instructed on the hazards inherent in the site, precautions to be taken, the form of construction, and emergency procedures and fire safety. Such instructions shall be given whenever there is a material change in the working arrangements. The Contractor shall maintain a record of all persons instructed and each person shall be required to sign such record confirming that instruction has been received. No person shall be permitted on site without being inducted as set out above. The Contractor shall prepare a written statement of Safe Systems of Working which shall be issued to all persons at site.

1-5 Quality Management and Records

- The project shall be administered using an accredited Quality Management System conforming.
- References to the agreement of materials, workmanship, methods, etc. throughout this Specification shall be interpreted as requiring the agreement of the Employer.
- The Contractor shall maintain all records necessary under this Specification, including quality records as appropriate.
- Copies of all site records shall be available to the Employer.
- The Contractor shall supply the Engineer with all information necessary for the Health and Safety File including as-built drawings and records, maintenance schedules, operation and maintenance manuals, within the time specified in the contract, after substantial completion of the Works. Information shall be provided in the agreed format.

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1-6 Codes & Standards

The latest revision and edition of the following codes and standards shall constitute minimum requirements of this specification, where applicable. In any case of discrepancy between the codes and standards and specifications, the requirements shall be considered according to EMPLOYER written approval.

ABMA	Anti-Friction Bearing Manufacturers Association
ANSI	American National Standards Institute (For flange connections, couplings, fasteners, etc.)
ASLE	American Society of Lubrication Engineers
ASME	American Society of Mechanical Engineers
AWS	American Welding Society
AGMA	American Gear Manufacturers Association
ISA	Instrument Society of America
ISO	International Organization for Standardization Including:
ISO 12944	Paints and varnishes — Corrosion protection of steel structures by protective paint systems
ISO 2768	General tolerances
HI	Hydraulics Institute
MPTA	Mechanical Power Transmission Association
OSHA	US Occupational Safety and Health Administration
SSPC	Steel Structures Painting Council
UBC	Uniform Building Code
IEC60027	Letters, Symbols to be used in Electrical Technology
IEC60072	Rotating Electrical Machines
IEC60050-411	International Electro technical Vocabulary Rotating Machines
IEC60072	Dimensions and Output Rating for Rotating Electrical Machines

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IEC60085	Thermal Evaluation and Classification of Electrical Insulation
IEC60445	Identification of Equipment Terminals and of Terminations of System Certain Designated Conductors Including General Rules of an Alphanumeric
IEC60072-1	Frame Size and Dimension
IEC60034-1	Duty & Rating Class
IEC60034-6	Performance
BS EN 13920	Welding — General tolerances for welded constructions — Dimensions for lengths and angles — Shape and position
EN 10204	Metallic Products-Types of Inspection Documents
BS 4999	General Requirement for Rotating Electrical Machines, Winding Termination
BS 5512	Dynamic Load Ratings and Rating Life of Rolling Bearing
BS 6121	Mechanical Cable Glands
NEMA	MG1-1998 Motor and Generators

1-7 Measurement units

SI units shall be applied to the measuring units

1-8 Language

All drawing design information, Documentation, Operation, and Maintenance Instructions and correspondence shall be in English.

2- Design Data

2-1 Working Time

The working time is as follows:

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2-2 Site Condition

For Site

Description	Value
Calendar days per year	365
Production days per year	330
Number of shifts per day	2
Working hours per shift	8
Utilization factor	0.85

Condition Refer to Document no. 12002-D-PR-DOC-303-GNL-001

3- Design requirement's – Work Included

3-1 General

Cyclones and related systems as specified in attached data sheets shall be supplied considering the requirements indicated in this Specification. The supply of cyclones shall consist, but not be limited to the following main components:

- The nest of cyclones with underflow launder, overflow launder, cyclone feed pressure distributor with pressure gauge, cyclone isolation knife gate slurry valves, pipework, cyclones and supports assembled as one module.
- Commissioning spare parts appropriate to cyclones.
- Spare parts sufficient for the first two years of operation.
- Special tools.
- Supply of vendor data including drawings, installation, commissioning, operation and maintenance manuals.
- The Package shall be designed for the process duties and rated performance as defined on the data sheets. The supplied equipment shall be designed for continuous service and shall perform satisfactorily over the entire range of

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operating and environmental conditions. The normal and rated operating conditions shall be as stated on the data sheets.

- The supplied equipment shall be designed to ensure the safest possible operation and shall be supplied with all safeguards and warning notices required for personnel protection. Safety requirements covered under the referenced International Codes and Standards and local regulations shall be strictly complied with.
- All equipment items, shall be supplied fitted with a stainless-steel nameplate. The VENDOR shall submit nameplate drawings for approval. The drawings shall show the proposed material, dimensions, thickness, method of fixing and wording.
- All layouts and outline drawings shall show dimensions of major sub-assemblies as well as clearance required for lifting, assembly and disassembly. These documents shall be sent to CONSULTANT for getting his approval before start any execution activity.
- The Hydro cyclone quantity in each cluster shall be configured so that the process requirements can be met.
- In each cluster, it shall be predicted at least 20% more cyclones for standby.
- In addition, the Supplier shall make available appropriate process engineers to assist the commissioning, testing and fine-tuning of the cyclones on site.

3-2 Supplier's Responsibilities

Supplier's responsibilities should include but are not limited to, the following:

- Coordinating and resolving all engineering information related to equipment rating, design manufacture, testing and installation.

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- On-time manufacture, assembly, shop testing and delivery of the equipment package.
- Coordinating with purchaser on all information related to equipment standardization and spare.
- Coordinating with purchaser on all information related to equipment standardization and spare parts interchangeability.
- Furnishing complete set of special tools necessary for the assembly and disassembly of the equipment package.
- Operating, commissioning spares and first filling. Should also undertaking supply of spare parts for a period of fifteen years after purchase date.

3-3 Mechanical components/ requirements.

- Segmented housing in mild steel and exchangeable liners with min. 20 mm thick Poly Urethane liner.
- vortex finder mild steel, gum rubber lined,
- gum rubber apex inserts,
- Inlet and overflow adapters lined coupling
- Feed Header complete, basically consisting of:
- radial (or rectangular) feed header with diaphragm pressure gauge
- pulled nozzle design for minimizing turbulence and wear
- distributor head with rubber lined cover connections to feed Header
- material of construction: mild steel
- Collector lander
- All wetted parts Poly Urethane and gum rubber lined. Shore hardness 40+/-5.
- One Auto Valve for each cyclone in cluster

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- One Pressure Gage and one pressure transmitter in each cluster
- One sampling point in each cluster

3-4 Lifting

Lifting attachments shall be provided, where required, to facilitate handling during transportation and erection at site. Preferably, the equipment baseplates/modules and their lifting points shall be designed to enable a single point lift, such that slings do not foul any part of the equipment. The lift weight shall be factored by 2.0 for the design of the lift points.

3-5 Boundary Limits

- It shall be indicated all piping, electrical and instrument interface terminal points on the package General Arrangement/Layout drawings.
- The drawing shall include a table showing all piping terminal points data, including connection identification reference number, size, rating, facing and allowable loadings (forces and moments).
- Summary:
- Inlet and outlet connections
- Utility system connections
- Electrical equipment/instrument junction boxes
- It shall be indicated all materials and equipment described in this specification and any other items which may be considered necessary for efficient and safe working of the Hydro Cyclone Package, assembled to the maximum extent possible and ready for hook-up to service connections.
- It shall be specified shall specify the required feed slurry pump's pressure.

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3-6 Piping's and Fittings

- It shall be indicated all necessary piping within the confines of the package. Auxiliary piping carrying external services shall terminate with block valves at the skid edge of the baseplates and shall be designed to permit ready disconnection of piping from the package.
- All piping shall meet the requirements of ASME B31.3.
- Flanged joints shall be provided only where disassembly is necessary for maintenance purposes.
- All piping shall be adequately supported for service and shipment conditions. All CONTRACTOR connections shall be anchored at the skid edge.
- Valves are required on all connections. All valves shall be supplied with end closures.
- The piping arrangement shall provide adequate clearances for installation, removal, access or maintenance of equipment components or piping accessories.
- Clearance shall be provided for adjustment of instruments. The elevation of devices requiring adjustment shall not exceed 1800mm above the standing surface.
- All pipework shall be of carbon steel to ASTM A53-B. Flanges shall be in accordance with ANSI B16.5 Class 150 and of ASTM A105 material.
- Cyclone isolation on-off valves shall be knife gate valves with resilient seats, suitable for use with slurries and manually actuated. Alternatively, a rubber sleeve pinch valve suitable for use with slurries and manually actuated may be used. Inductive proximity switches shall be on each isolation valve to indicate valve "open" or "closed" status.

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- Pipework bends shall have a minimum bend radius of 3 x pipe diameter.
- Pressure gauges, with stop-cocks and protectors (suitable for use with slurries) shall be provided on each pressure distributor.
- A blank flanged nozzle, DN 50, shall be provided on each pressure distributor for the installation of a pressure sensor with 3-20mA signal, by others.

3-7 Controls and Instrumentation

- The VENDOR shall supply those controls and instrumentation that are required to ensure safe, economic operation of the equipment, either locally or remotely via the Plant PCS/ESD systems.
- The local control panel(s) shall contain displays that indicate the operational status of the Package and any alarms or shutdowns. Alarms and trips shall be stored in chronological order to inform the Operator of source of the problem.
- The VENDOR shall provide any systems required to self-check the condition of the package and provide all controls, interlocks and devices required to ensure safe operation under all modes of operation.
- Cyclone isolation on-off valves shall have inductive proximity switches of the three-wire type suitable for operation from a 24V dc supply, and for direct connection to a PLC or DCS input module shall be on each isolation valve to indicate valve “open” or “closed” status. Electric cabling shall be installed, long enough to extend to the periphery of the cyclone nest plus 6m. The cabling shall be coiled and temporarily fixed appropriate for transport to site.

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3-8 Bonded Rubber Lining

4.8.1 Applications

- Wear resistant rubber lining shall be provided for:
- Pipework,
- Pressure distributors,
- Underflow launders,
- Overflow launders.
- Rubber lining shall be 10mm thickness and hot pressurized autoclave vulcanized for proper adhesion to the pipework, distributors and launders.

4.8.2 ASTM Specifications

Work shall conform with the requirements of ASTM Specifications including:

ASTM-D2000	Standard Classification System for Rubber Products
ASTM-D395	Standard Test Methods for Rubber – Compression
ASTM-D412	Standard Test Methods for Rubber – Tension
ASTM-D413	Standard Test Methods for Rubber – Adhesion
ASTM-D471	Standard Test Methods for Rubber – Effect of Water
ASTM-D816	Standard Test Methods for Rubber – Cements
SSPC-SP 1	Solvent Cleaning
SSPC-SP 5	White Metal Blast Cleaning

Installation shall conform to all design drawings, Specifications or standards referenced in this Specification, its attachments, and other procurement documents to the extent noted.

Materials

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Materials shall be sourced from established Manufacturers and proven on similar service.

The lining materials will be required to resist abrasion and corrosion effects of the copper tailings and water slurry.

Rubber shall be:

Type Natural rubber
Grade AMR 5
Hardness 55+5 shore A Durometer
Elongation 500% minimum
Tensile Strength 22000 kPa (3200psi)
300% Modulus 6300 kPa (915psi)
Angle Tear (Die C) 4910 kg/m (275lb/in)
Compression Set 15%
Yenzley Resilience 70
Thickness 10mm

Filler materials shall only be used where necessary due to fit-up and surface preparation conditions, and only with CLIENT approval.

4.8.3 Fabrication

Prior to installation of the liner, each fabricated item shall be inspected to ensure that all welds on flat surfaces are ground flat and sharp edges and corners are rounded off. A minimum radius of 20 mm shall be provided where rubber is wrapped around edges or corners.

All fabrication errors that would cause difficulty in bonding liners or would cause voids shall be corrected prior to application of the lining.

Items shall be tested for water-tightness before rubber lining preparations are begun.

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4.8.4 Surface Preparation

Welding after start of surface preparation is prohibited.

The metal surfaces shall be cleaned and free from oil, grease and chemicals.

Cleaning the surface can be accomplished by using steam, flame, or solvent.

All surfaces to be lined shall be thoroughly prepared by sandblasting to white metal SSPC-SP-5, then cleaned to remove all traces of grit. Application of the lining shall start immediately following the sandblasting to ensure against the setting of atmospheric corrosion.

4.8.5 Application

The rubber lining shall not have blisters, porosity, tears or any other defects which could materially affect its performance.

The adhesive system used must affect complete and uniform adhesion of rubber to steel and of rubber to rubber. Use a minimum 75mm (3 inch) overlap on adjacent sheets.

All seams shall be laid straight and shall not exceed a number consistent with good rubber lining practice.

Rubber lining will extend through all openings and completely cover all flange faces. All nozzles will have the flange face rubber turned into the tube so as to affect a 25mm (1 inch) minimum lap. Flange free linings shall be butted to ensure flat sealing surfaces and bolt holes dressed.

4.8.6 Submittals

Supplier shall submit test reports covering physical properties of lining materials.

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4.8.7 Quality Assurance – Inspection and Testing

A representative test sample shall be prepared for each autoclave batch or large item of work, using identical lining procedures. The sample shall be cured with the work and positively identified by lot number.

Samples shall be tested for the following in accordance with applicable ASTM standards:

Physical properties after ageing

Bonding of lining to metal base

The surface of the lining shall be inspected for visual defects related to mechanical damages, blisters, adhesion failures, or unsatisfactory seaming.

CLIENT reserves the right to inspect, test or have tested, and review installation procedures of all items during the manufacturing process. This shall include the monitoring of any Subcontractors that the Supplier may employ.

4.8.8 Cementing and Curing

Adhesive strength of rubber to steel shall be not less than 18kg (40 pounds) as determined by standard dead weight method in accordance with ASTM Specification D-413.

CLIENT reserves the right to request test panels be prepared and vulcanised concurrently with the work.

4.8.9 Repairs

Local areas with minor defects may be repaired. Repairs shall include cutting away defect areas, replacing with new material, and recurring, all in accordance with accepted procedures.

Items with defects in inaccessible areas such as pipe spools, shall be rejected.

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4.8.10 Preparation for Shipment

All lined fabrications shall be properly protected against physical damage and damage by sunlight to the lining during storing and shipment.

All nozzles shall be closed properly and protected with a plastic cover, or plug or plywood flange.

3-9 Replaceable Wear Parts

Cyclones shall be fitted with easily replaceable wear parts to ensure the cyclone performance can be maintained and the periods of times of operation, between replacements are as long as is possible. Details of wear lives are to be on the Data Sheets which are part of the Order Documentation.

Cyclones shall be supplied with all special tools necessary for the assembly and dismantling of the units. The tools shall be appropriate for proper erection, commissioning and maintenance of the cyclones.

3-10 Cyclone Materials

- i. Materials shall be as indicated in the data sheet materials for parts.
- ii. The surfaces shall be cleaned respect to manufacturer's standard methods, which will be reviewed and approved by purchaser.

3-11 Identification Nameplates

Each cyclone nest shall be fitted with a permanent stainless steel identification plate, securely mounted with permanent fixing screws, in a prominent position and neatly, clearly and indelibly engraved to display at least the following data:

- Equipment Number and Title
- Manufacturer's name
- Model number

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Serial number

Size and mass

Date of manufacture

The identification stainless steel plate shall be a minimum 150mm long x 75mm wide x 3mm thick.

Component Identification: for reference purposes individual cyclones in each nest shall be identified by position. Individual cyclone positions shall be numbered in sequence clockwise in plan from a reference position, which is shown on the drawings. The Supplier shall mark these numbers on or about the Cyclones. The numbers shall be easily readable by an operator and marked in a conspicuous manner.

4- Maintenance

- The hydro cyclone will be designed in order to minimize maintenance and make unavoidable maintenance safe, quick and easy.
- In order to minimize the frequency of maintenance, the temporary table of inspection and maintenance of hydro cyclone components, contained in the offer documentation, must be drawn up in terms of previous engineering experience and subsequent improvements.
- Every component must be easy to handle and equipped with hooks to allow them to be properly balanced when lifted.
- Components which need frequent maintenance must be easily accessible and they must not need special tools.

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5. Inspection and Testing

5-1 General

- The Package shall be subject to inspection at all stages of manufacture by the CONTRACTOR'S duly authorized agents and/or representatives.
- VENDOR shall provide access in their shops and sub-vendors' shops to CONTRACTOR'S representatives at any time during the manufacture of the equipment. For all witnessed tests the CONTRACTOR shall be given the agreed notice period.
- Inspection and witnessed tests by the CONTRACTOR and third parties shall not relieve the VENDOR of any guarantees, responsibilities or obligations to provide satisfactory equipment.

5-2 Quality Plan

- The VENDOR shall provide a quality/ inspection and test control plan, which sets out specific quality practices and activities relevant to his entire scope of supply. The requirements regarding the format and content of the quality plan shall be agreed with the CONSULTANT. It shall include as a minimum; inspection and test activities, procedure references, acceptance criteria, documentation and certification to be provided. The above shall also apply to major sub-vendors.
- The final inspection and test plan will be developed jointly between the VENDOR and the CONTRACTOR. The CONTRACTOR'S inspector will define the extent of their participation on the plan.
- The CONSULTANT'S and the CONTRACTOR/ VENDOR'S inspector/ representatives shall confirm compliance with the inspection and test plan by initialling and dating against completed activities, before shipment of the package.

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The plan may be supplemented by other inspection checklists and outstanding work lists.

- The requirements for dossier compilation shall be agreed with the CONSULTANT.

5-3 Scope of Inspection and Testing

- Inspection and testing shall be performed in accordance with written procedures prepared by the VENDOR and approved by the CONSULTANT. Test procedures shall include a schematic of testing arrangement with details of instrumentation used during test.
- The VENDOR shall advise in his quotation any other tests included for in his basic scope of supply.

5-4 Certification

- The VENDOR shall provide quality records appropriate to all inspection and test activities. The records shall be referenced against appropriate activities within the inspection and test plan.
- VENDOR shall collate all such quality records and certification for submission to the CONTRACTOR as a certification dossier. Note that, where necessary, certificates shall be stamped as approved by the third-party inspector.

6. SURFACE PREPARATION & RUST PREVENTION

Painting system should be carried out in accordance with manufacturer's standard.

Supplier should submit detailed rust prevention and painting procedure and application list for the equipment package, to approve by employer.

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Supplier should propose procedures to prevent rusting of warehouse stored equipment, during long term storage installation, and during long term suspension of operation.

Least painting requirement should be as project PAINTING SPECIFICATION.
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7. NAMEPLATE

Each equipment shall have a nameplate made of stainless-steel material giving at least the following information (where applicable):

- Project Title
- Company
- Size and Model
- Total weight (kg)
- Serial number
- Rated Capacity
- Rated speed
- Maximum casing working pressure (barg) (MAWP)

The nameplate shall be of stainless steel and relevant information shall be punched into the same.

8. REFERENCES

- The design criteria to be employed are based on heavy-duty industrial application, handling abrasive materials in dusty and humid environment. All weights, dimensions and measures apply to the metric system.
- The equipment is designed to the latest knowledge of engineering. Maximum reliability and operation and ready replaceability of all parts subject to wear are

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particularly important. **VENDOR** should submit his calculation sheet for sizing the hydro cyclone cluster.

- In the event of a conflict of technical requirements within the material requisition documents, the order of precedence shall be:
- This Specification
- Data Sheets
- Material Requisition
- Mentioned codes & standards
- Purchase Order
- The design of the Hydro cyclone cluster package, which are not covered by the specified code(s) or this specification shall be carried out according to the **VENDOR'S** standards and shall be agreed with the **CONSULTANT**.

9. DOCUMENTATION

- Relevant drawings and documentation shall be provided by the **VENDOR** in accordance with the requirements of the "Vendor Documentation Requirement Schedule" (VDRS), contained in the Material Requisition. The documentation shall be submitted strictly in accordance with the timings indicated on the VDRS.
- The **VENDOR** document type catalogue, which forms part of the VDRS, describes specific requirements regarding content, format and submission details for drawings, data sheets and manuals etc.
- Review of **VENDOR'S** drawings, calculations and other documents by the **CONSULTANT** does not relieve the **VENDOR** of the responsibility for correctness under the terms of the order.

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- In addition to the number of Installation and Operating Instructions specified in the VDRS, one approved copy of these documents shall be packed with the Package for delivery to Site. The equipment manifest should include these documents.

Note1: Scope of this document shall be designed based on all “engineering document” and submitted to client for review and approval by contractor.

Note2: It should be noted that Procurement and Construction activities of this equipment must be done based on approved engineering document. All equipment shall be supplied based on approved TBE document.

Note3: Contractor should be assured about using last revision of all document.

10. SPARE Parts

The VENDOR shall submit the following with his quotation:

- A set of spare parts for commissioning and start-up.
- A priced list of critical spares for unplanned maintenance (insurance spares).
- A priced list of recommended spares for 24 month's operation.

11. SPECIAL Tools

The VENDOR shall submit, with his quotation, his recommendations for one set of special tools required for installation and maintenance of the supplied equipment.

12. Site Services (Packing, Preservation and Transportation)

- The equipment shall be painted in accordance with the VENDOR'S standard which shall be proven and established for the service conditions.

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- Packaging and protection for shipment shall be performed in accordance with the approved procedure. Particular attention shall be given to the protection of flanges, which shall have substantial wood, metal or plastic blanks bolted on. If the CONSULTANT gives a concession allowing the use of screwed terminations, then they shall be plugged or capped. Transport to site will be by road and sea. Some of the journey will be on rough tracks (un-metalled road).
- The VENDOR shall submit details of his standards and procedures for any necessary temporary corrosion protection to the CONSULTANT for review. Equipment may be stored at site for up to 12 months.

13. Guarantee and warranty

- The VENDOR shall guarantee the Package for the duty, as specified on Equipment Data Sheets, and for safe and reliable operation.
- The VENDOR shall guarantee the suitability of the materials of construction for the duties required, even if the CONSULTANT has specified the type and grade of material to be used.
- The VENDOR shall guarantee the equipment and components against design fault, defective or improper materials, poor workmanship, and failure during normal usage. The Guarantee period is mentioned in the main contract.