

GENERAL SPECIFICATION

ROTATING MACHINERY

GS EP MEC 021

Rotating Machine Package Specification Motopump
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1. Scope

1.1 Purpose

This specification defines the minimum design, fabrication, inspection and testing requirements for the supply of the motopump (centrifugal type) packages. It is an exhaustive document detailing the scope of supply and the associated design rules requested by TOTAL E&P for the procurement of motopump packages.

1.2 Application

This document applies to the design of all pumps packages driven by electrical motors with a rated power greater or equal to 500 kW.

1.3 General Rules

All deviations from this specification or the documents referred to herein shall be stated in writing in the Appendix 5 of this specification. In the absence of such a statement, it is assumed that the requirements of the specifications are met without exception. Failure to meet the requirements of this specification and referenced documents shall be corrected at Supplier's cost. Exceptions and deviations to the specifications shall be part of Supplier's proposal and will be subject to Company approval.

Where this specification, or any other project document, allows the Supplier to propose an "option", the Supplier shall clearly state the selected option in his bid.

In cases the Supplier provides outsourced equipment, he shall be responsible for the coordination of the Sub-Suppliers, and ensure the full compatibility of all the equipment. In particular, they shall be compatible in terms of safety, environment, operability, dimensions, weight, performance, control, noise and vibration behavior.

Components not mentioned in this specification that are necessary for the operation of the equipment or required by certifying agency, regulatory bodies or by law, shall be Supplier standard components.

The present document remains a General Specification as long as the modifiable forms are not completed. It becomes the Project Specification once these modifiable forms are completed and shall therefore not be considered as a General Specification any more. Then, the General Specification shall be attributed a Project reference number with the associated Project front page.

Preamble shall be completed with the Project description (location, number of machines, etc.).

If Project specificities require amendments to non modifiable parts of this specification or to the documents referred to herein, they shall be considered as deviations and stated in writing in the Appendix 5 of this specification.

This specification will then be issued in two steps:

- Issued "for inquiry"
- Issued "for purchase".

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The applicable documents shall be considered in the following order:

- Local regulations
- Classification Society Rules (If applicable)
- Frame agreement if available - Frame agreement: Applicable ☐ - Not applicable ☐
- This completed specification and associated data sheets
- Referenced General Specifications
- Referenced Project specifications
- Codes and standards.

2. Reference documents

The reference documents listed below form an integral part of this General Specification.

External Documents

Unless otherwise stipulated, the applicable version of these documents, including relevant appendices and supplements, is the latest revision published at the effective date of this document.

Reference	Title
1999/92/EEC (ATEX 118 ¹ /ATEX 137 ²)	European Directive 1999/92/EEC (16/12/99) on minimum requirements for improving the safety and health protection of workers potentially at risk from explosive atmospheres
94/9/EC (ATEX 100a ¹ /ATEX 95 ²)	European Directive 94/9/EC (23/03/94) on the approximation of the laws of the Member State concerning equipment and protective systems intended for use in potentially explosive atmosphere
API Std 610	Centrifugal Pumps for Petroleum, Petrochemical and Natural Gas Industries
API Std 614	Lubrication, Shaft-sealing and Oil-control Systems and Auxiliaries
ASME VIII Division 1	Boiler and Pressure Vessel Code
DIN 55473	Auxiliary means of packaging - Desiccant in bag - Technical delivery conditions.
IP 15	Area Classification Code for Petroleum Installation handling flammable fluids - July 2005 (3 rd edition)
ISO 780	Packaging. Pictorial marking for handling of goods

¹ Reference to Articles 100/118 of the Treaty of Rome

² Reference to Articles 95/137 of the Treaty of Amsterdam

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Reference	Title
NF H00-310	Industrial packagings. Flexible and heat sealing protection materials of low coefficient of water vapour transmission ($P < 0.3 \text{ g/m}^2 \text{ 24 h}$)
NF H00-320	Packaging. Desiccant. Specifications and tests
US MIL STD-2073-1 E	Standard Practice for Military Packaging
US MIL D 3464E	Desiccants, activated, bagged, packaging use and static dehumidification.
US MIL PRF 131K	Performance Specification: Barrier Materials, Watervaporproof, Greaseproof, Flexible, Heat-Sealable

Total General Specifications

Unless otherwise stipulated, the applicable version of these documents, including relevant appendices and supplements, is the latest revision published in the applicable yearly collection.

TOTAL EP General Specification Referential is applicable for the following Project:

The following Company specifications are fully applicable to all purchased equipment as listed in paragraph 3.1 completed by the technical details reported in paragraph 4 and taken into account accepted deviations as listed in Appendix 5. The second level General Specifications mentioned in each individual specification are not applicable if they are not listed in the below tables. The standards, professional documents, regulations and codes mentioned in each General Specification are applicable.

The following list may also be complemented with other specific Project detailed specifications which would include additional requirements, as applicable or deemed necessary by Company or Contractor.

Reference	Title
GS EP COR 350	External protection of offshore and coastal structures and equipment by painting
GS EP COR 354	External protection of onshore structures and equipment by painting
GS EP COR 356	Corrosion Protection of Fasteners for Subsea and Toppide Applications
GS EP ELE 011	Electrical requirements for packaged units
GS EP ELE 031	Design of earthing and bonding systems
GS EP ELE 079	Electrical apparatus for potentially explosive gas atmospheres
GS EP ELE 111	Induction motors
GS EP ELE 121	HV Variable Speed Drive Systems

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Reference	Title
GS EP ELE 141	Power transformers
GS EP ELE 161	Electrical cables
GS EP EXP 217	Requirements to Vendors, Suppliers and EPC'S for spare parts
GS EP INS 101	Instrumentation engineering, supply and construction general requirements
GS EP INS 102	Instrumentation identification
GS EP INS 107	Design and installation of instrumentation links
GS EP INS 110	Instrumentation for package units
GS EP INS 120	Control and Choke Valves
GS EP INS 135	Cyber Security requirements for design and supply of ICSS and Package Systems
GS EP INS 137	On/off valve control panels and actuators functional and construction requirements
GS EP INS 900	Instrument hook-up diagrams
GS EP MEC 101	Driver Power Sizing
GS EP MEC 240	Special Purpose Couplings for Petroleum, Chemical, and Gas Industry Services according to API Standard 671
GS EP MEC 242	Special Purpose Gear Units for Petroleum, Chemical and Gas Service Industries According to API Standard 613
GS EP MEC 270	Supply of Mechanical Seal according to API Standard 682
GS EP MEC 271	Centrifugal Pumps for the Petroleum, Chemical and Gas Industry Services according to API Standard 610
GS EP MEC 281	Lubrication, Shaft Sealing and Oil Control Systems and Auxiliaries according to ISO 10438 / API Standard 614
GS EP MEC 292	Rotating Machines Packages Installation Requirements
GS EP MEC 300	Noise and Vibration of Rotating Machine Packages
GS EP PVV 102	Piping Hook-up Standards
GS EP PVV 112	Piping material classes
GS EP PVV 142	Valves
GS EP PVV 143	Metallic pipes
GS EP PVV 144	Fittings
GS EP PVV 145	Flanges
GS EP PVV 146	Bolting for piping
GS EP PVV 147	Gaskets for piping and vessels

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Reference	Title
GS EP PVV 175	Cleaning of piping and vessels
GS EP PVV 211	Design and fabrication of pressure vessels according to ASME VIII
GS EP PVV 412	Plate and frame heat exchanger
GS EP PVV 415	Design and fabrication of air cooler
GS EP STR 001	Weight monitoring and weighing offshore units
GS EP STR 103	Design and fabrication of skids and equipment supporting structures

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3. Scope of supply and exclusion

3.1 Scope of supply

The Vendor shall be responsible for the design, supply of materials, manufacture, assembly, supply of drawings and data, all Sub-Vendor co-ordination, testing, delivery and guarantees of the below components:

Note 1: The column "Required" indicates the level of requirement of each item, according to the below rule:

- "X" means that the item is a base case requirement.



- "Y" means that the item is an optional requirement specific to the project. "Y" for YES if the option is selected or "N" for NO if the option is not selected.

Note 2: The column "Description" may offer alternative technical choices that shall be fixed prior to the issue "For inquiry" by ticking the appropriate mark box ☐.

#	Item	Description	Required	Tag	Quantity
1	ON SKID EQUIPMENT				
1.1	Pump including but not limited to:				
1.1.1	Pump	As per GS EP MEC 271 and as per data sheet referenced paragraph 5 of this specification.	X		
1.1.2	Mechanical seals and seal system	As per GS EP MEC 270 and as per data sheet referenced paragraph 5 of this specification.	X		
1.1.3	Counter flanges for main process connections	Counter flanges as per GS EP PVV 112 or Project piping classes -if any-.	X		
1.2	Electric motor including but not limited to:				
1.2.1	Main electric motor	As per GS EP ELE 111 and GS EP MEC 101 and as per data sheet referenced in paragraph 5.2 of this specification.	X		
1.2.2	Electric terminal box	HV electric terminal box mounted on the electric motor. The supply of the associated cable glands is defined in the data sheet referenced in paragraph 5 of this specification.	X		
1.2.3	Electric motor cooler	As per data sheet referenced in paragraph 5 of this specification.	X		
1.2.4	All associated instrumentation and auxiliary junction boxes		X		
1.3	Power transmission equipment including but not limited to:				
1.3.1	Gearbox	As per GS EP MEC 242 and as per data sheet referenced paragraph 5 of this specification. ☐	N/A if pump direct driven. ☐	X	
1.3.2	Temperature and vibration probes	As per GS EP MEC 242 paragraph 6.4.2. ☐	N/A if pump direct driven. ☐	X	

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#	Item	Description		Required	Tag	Quantity
1.3.3	LS flexible spacer type coupling	As per paragraph 4.2.3 of this specification. 	N/A if pump direct driven. 	X		
1.3.4	LS coupling guard	As per paragraph 4.2.3 of this specification. 	N/A if pump direct driven. 	X		
1.3.5	HS flexible spacer type coupling	As per paragraph 4.2.3 of this specification.		X		
1.3.6	HS coupling guard	As per paragraph 4.2.3 of this specification.		X		
1.4	Mineral lube oil system (As per GS EP MEC 281 and as per data sheet referenced paragraph 5.6 of this specification) including but not limited to: Note: only in case hydrodynamic bearings are provided.					
1.4.1	Lube oil tank	As per GS EP MEC 281 part 2 paragraph 4.3.13.		X		
1.4.2	Oil mist separator	As per GS EP MEC 281 part 2 paragraph 4.3.5.1.		X		
1.4.3	Main oil pump	Shaft driven, if there is a gearbox or if the main pump runs at constant speed, below 3000 rpm.		X		
1.4.4	Standby oil pump	Driven by AC motor following GS EP ELE 111 .		X		
1.4.5	Lube oil cooler	Lube oil air cooler made of AISI 316 stainless steel as per GS EP PVV 415 and as per GS EP MEC 281 part 2 paragraph 4.5. If any, this cooler shall also be used for synthetic lube oil cooling. 	Lube oil water cooler as per GS EP PVV 412 (oil pressure above water pressure) as per GS EP MEC 281 part 2 paragraph 4.5. If any, this cooler shall also be used for synthetic lube oil cooling. 	X		
		 N/A Off skid				
1.4.6	Oil filters for lube oil	Twin AISI 316 stainless steel oil filters with continuous flow transfer valve for lube oil.		X		
1.4.7	All associated piping, piping accessories and valves	All associated interconnecting piping, piping accessories and valves made in AISI 316/316L stainless steel on the whole system as per paragraph 4.2.7 of this specification. Tubing is not allowed, except for the instruments impulse lines as per GS EP PVV 102 , GS EP INS 107 and GS EP INS 900 .		X		
1.4.8	All associated instrumentation	As per data sheet referenced paragraph 5 of this specification, as per paragraph 4.2.5 of this specification and mounted as per GS EP PVV 102 , GS EP INS 900 .		X		
1.4.9	One local gauge panel	Made of AISI 316/316L stainless steel with instruments as per as per data sheet referenced paragraph 5.6 of this specification.		X		
1.5	Base plate including but not limited to:					
1.5.1	Fabricated steel common base plate	As per paragraph 4.2.2 of this specification.		X		
1.5.2	Baseplate supports	 3 point support	N/A if concrete foundations or multipoint rigid support. 	X		
		4 temporary supports and jacking points as per paragraph 4.2.2.1 of this specification.		X		

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#	Item	Description	Required	Tag	Quantity
1.6	Controls & Instrumentation , including but not limited to:				
1.6.1	Terminal junction boxes	All terminal junction boxes located at skid edge as per GS EP INS 101 and GS EP INS 107 .	X		
1.6.2	Cable glands	Cable glands for departing multi-core cables, defined by Project and blinded off suitably for transport and storage. In case the option is not selected, the gland plates shall be pre-drilled and blinded off.	Option		
		For all other cables, junction boxes shall be provided with cable gland plates and associated cable glands.	X		
1.6.3	Instrumentation cables	All instrument cables between instruments and skid mounted junction boxes / local gauge board indicator as per GS EP ELE 161 and GS EP INS 107 .	X		
1.6.4	Instrumentation Cable trays	All necessary cables trays with covers made of AISI 316 between instruments and skid mounted junction boxes as per GS EP INS 107 . Empty cable trays shall be installed for the departing multi-core cables –supplied and installed by others– between the terminal junction boxes and the skid edge.	X		
1.6.5	Shut down push buttons		X		
1.7	Electrical including but not limited to				
1.7.1	Electrical cables trays	All necessary cables trays with covers made of AISI 316 between all electrical consumers mounted on skid and the skid edge.	X		
2	OFF SKID EQUIPMENT (shipped loose)				
2.1	Variable Speed Drive system including but not limited to:				
2.1.1	HV Variable Speed Drive	As per data sheet referenced in paragraph 5 of this specification and as per GS EP ELE 121 .	X		
2.1.2	Power transformer	As per data sheet referenced in paragraph 5.4 of this specification and as per paragraph 4.17 of GS EP ELE 121 and GS EP ELE 141 .	X		
2.1.3	Harmonic Filter	As per GS EP ELE 121 .	X		
2.2	Mineral lube oil system including but not limited to:				
2.2.1	Lube oil cooler	Lube oil air cooler made of AISI 316 stainless steel as per GS EP PVV 415 and as per GS EP MEC 281 part 2 paragraph 4.5. 	N/A, located on skid. 	X	
2.3	Valves, instruments and piping including but not limited to:				
2.3.1	Minimum flow protection valve	Flow control valve as per GS EP PVV 112 or Project piping classes (if any), GS EP PVV 142 and GS EP INS 120 .	X		
2.3.2	Flame arrestors	As per paragraph 4.2.7.2 of this specification.	X		

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#	Item	Description	Required	Tag	Quantity
2.4	Controls & Instrumentation –only for packages categorized P3 as per paragraph 4.2.5.1 of this specification- including but not limited to:				
2.4.1	UCP	As per GS EP INS 110 , including PLC for control/safety, panel mounted HMI. Full licenses for all software.	X		
2.4.2	ICSS interface	Communication cards, relays, signal convertors, etc. to interface with ICSS and support systems (if any).	X		
2.4.3	Shut down push button	Mounted on the UCP.	X		
2.4.4	VTMS	Vibration and Temperature Monitoring System to control the complete shaft line vibration and temperature sensors integrated inside UCP.	X		
2.4.5	Load sharing control	Software and panel-mounted hardware to control the pumps load sharing, integrated inside the UCP.	Option		
2.5	Spare parts and special tools including but not limited to:				
2.5.1	Special tools	Detailed scope is given in the paragraph 8.2 of this specification.	X		1 set
2.5.2	Spare parts for, commissioning and start up	Detailed scope is given in paragraph 8.1.1 of this specification.	X		1 set
2.5.3	Capital spare parts	Detailed scope is given in the paragraph 8.1.2 of this specification.	X		1 set
2.5.4	Tools trolley	Lockable trolley to carry the motopump package tools and special tools.	X		1
3	MISCELLANEOUS				
3.1	Baseplate anchors and shims	As per paragraph 4.2.2 and Appendix 2 of this specification.	X		
3.2	Off skid equipment anchors and shims	All anchors and shims for all off skid equipment supplied by SUPPLIER.	X		
3.3	Piping	All necessary on-skid tubing / piping.	X		
3.4	Documentation	Set of documents as per Appendix 3 of this specification.	X		1 set
3.5	Package 3D model review	Review of the motopump package 3D models for maintenance areas review as per paragraph 4.2.11 of this specification.	X		1
3.6	Maintenance laptop	Including software for UCP configuration (only for P3 packages).	X		
3.7	Personal protection	As per paragraph 4.2.9.1 of this specification.	X		
3.8	Painting and coating	As per paragraph 4.2.8 of this specification.	X		
3.9	Limit flanges	All limit flanges as per GS EP PVV 112 or project piping classes-if available- equipped with blind flanges for transportation.	X		
3.10	Package packing and preservation	As per paragraph 9 of this specification.	X		
3.11	Earthing network	Earthing design and implementation as per GS EP ELE 031 and GS EP INS 107 .	X		
3.12	Oil conditioner		X		



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#	Item	Description	Required	Tag	Quantity
3.13	Lube oil system flushing kit	Kit made of all necessary flexible hoses for machinery bearings bypass.	X		1 set
3.14	Walkways and ladders	Walkways and ladders to make access to any equipment mounted on the package.	Option		
3.15	Lifting tools for the complete package	Consists of slings, shackles, and spreader bar as per paragraph 4.2.2.4 of this specification and as per GS EP STR 103 .	X		1 set
3.16	Backup	Complete backup hard disk with application software, PLC program, HMI and any firmware prior to shipment (only for P3 packages).	X		
3.17	Software	OEM CD/DVD for any software used with full licenses (only for P3 packages).	X		
3.18	Specific climate considerations	☐ Tropicalization ☐ Winterization ☐ None	X		
4	TESTS				
4.1	Factory tests				
4.1.1	Pump	As per paragraph 7.3 of GS EP MEC 271 .	X		
4.1.2	Electric motor	As per paragraph 7 of GS EP ELE 111 and data sheet referenced in the paragraph 5.2 of this specification.	X		
4.1.3	Gearbox (if any)	As per paragraph 4.3 of GS EP MEC 242 .	X		
4.1.4	Lube oil unit(s) and lube oil cooler(s)	As per part 1 paragraph 7.3 and part 2 paragraph 7.3 of GS EP MEC 281 .	X		
4.1.5	Mechanical seals	As per paragraph 10 of GS EP MEC 270 .	X		
4.1.6	UCP	As per paragraph 7.4 and Appendix 5 of GS EP INS 110 , including communication test with the ICSS (only for P3 packages).	X		
4.1.7	Complete unit tests	As per paragraph 7 of this specification.	X		
4.1.8	Noise and vibration tests	As per paragraphs 4.2.9.2 and 7 of this specification.	X		
4.2	Site Acceptance Tests				
4.2.1	Complete unit tests	As per paragraph 7.6 of this specification.	X		

Vendor shall be responsible for the physical and technical compatibility of the entire package and shall ensure that all equipment and components provided are suitable for the operations intended.



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3.2 Exclusions

The following equipment are not included in the scope of supply:

- Counter flanges, gasket and bolting for connecting flanges at battery limits of Vendor's supply (except pump companion flanges in Vendor's scope)
- All piping outside the package
- Electric and instrument cables outside the package
- All earthing cables outside the package.

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4. Basis of design

This paragraph details the technical specificities of _____ project that are not covered in the Company General Specifications nor in the Project documents.

4.1 Particular specification for rotating equipment

This paragraph indicates where the Company General Specifications Project specificities are covered. The paragraphs mentioned in the following charts refer to TOTAL EP General Specifications Referential **2013**.

GS EP MEC 240		
Paragraph	Data Sheets	Project
5.3	X	
10.3	X	Site conditions as per paragraph 6.1 of this specification.
12.5.2	X	
12.5.3	X	
13.2.2.1		Drawings as per Appendix 3 of this specification.
A.2.5	X	Site conditions as per paragraph 6.1 of this specification.
A.4.1	X	Site conditions as per paragraph 6.1 of this specification.

GS EP MEC 242		
Paragraph	Data Sheets	Project
2.1.4	X	
2.1.6		Control of sound pressure level method: Refer to paragraph 4.2.9.2 of this specification for the maximum allowable sound pressure level.
2.1.10		Refer to paragraph 6.1 of this specification.
2.1.14	X	Refer to paragraph 6 of this specification.
2.1.16	X	
3.1	X	List of accessories to be supplied:
3.3.1.1	X	Gearbox mounted on:
4.1.1	X	

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Paragraph	Data Sheets	Project
4.3.2.2.12	X	
4.3.2.2.16		Additional speeds to be tested: Duration and data to be recorded:

GS EP MEC 270

Paragraph	Data Sheets	Project
7.2.1.4	X	
7.3.1.1	X	
8.5.5.2	X	
9.1.4		Refer to paragraph 4.2.5 of this specification.
9.6.2		Refer to paragraph 4.2.5 of this specification.
9.7.2		Refer to paragraph 4.2.5 of this specification.
9.8.3		Refer to paragraph 4.2.5 of this specification.
10.3.1.1.2	X	
J.7.2.c		Refer to Appendix 4 of this specification.

GS EP MEC 271

Paragraph	Data Sheets	Project
6.1.2	X	For site and utility conditions, refer to paragraph 6 of this specification.
		HPRT (Annex C) applicable ☐ Yes ☐ No
6.1.8	X	
6.1.14	X	
6.1.22	X	
6.1.29.1	X	

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Paragraph	Data Sheets	Project
6.2	X	
6.4.1.2	X	
6.4.3.1	X	
6.8.9		Additional flush port: ☐ Required ☐ Not required
6.8.13	X	
6.8.14	X	This barrier fluid refilling unit installed: ☐ On skid ☐ Transportable trolley
6.10.1.6		Bearing system life calculation: ☐ Required ☐ Not required
6.11.13	X	
6.12.1.1	X	
6.12.1.5	X	
6.12.1.9	X	
6.12.1.12	X	
6.12.4.1	X	
6.12.4.3	X	
7.2.10	X	Refer to paragraph 4.2.3 of this specification.
7.2.15		Ignition hazard assessment: ☐ Required ☐ Not required
7.3.6		Stainless steel spacer plate: ☐ Required ☐ Not required
7.3.14		Refer to paragraph 4.2.2.3
7.4.1	X	
7.4.2.1	X	Refer to paragraph 4.2.6 of this specification.
7.4.2.4	X	
7.5.2.4	X	
8.2.1.1	X	
8.2.1.3	X	
8.2.2.6	X	
8.2.2.7	X	

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Paragraph	Data Sheets	Project
8.2.2.8	X	
8.3.2.6	X	
8.3.3.4	X	
8.3.3.6		NPSHA no more than 110% of specified NPSHA on the data sheet: ☐ Required ☐ Not required
8.3.4.1	X	
8.3.4.3.3	X	
8.3.4.4.1		Refer to paragraph 7 of this specification.
8.3.4.5		Refer to paragraph 7 of this specification.
8.3.4.6		Refer to paragraph 7 of this specification.
8.3.4.7		Resonance test: ☐ Required ☐ Not required
8.4.1		Refer to paragraph 9 of this specification
9.1.3.6		Separated threaded solid bar thermowell: ☐ Required ☐ Not required
9.2.6.1	X	
9.2.6.4	X	
9.2.8.2		Refer to paragraph 9 of this specification.
9.2.8.3		Refer to paragraph 9 of this specification.
9.2.8.4		Refer to paragraph 9 of this specification.
9.3.9.2		Resonance test: ☐ Required ☐ Not required
10.2.5		Refer to paragraph 7 of this specification.
10.3.2.3	X	
C.3.1.1	X	
C.3.1.2	X	
J.4.1.2	X	Residual unbalance check

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Note: Applicable only in case hydrodynamic bearings are provided.

Paragraph	Data Sheets	Project
Part 1		
4.5.2		Environmental conditions are reported in paragraph 6 of this specification.
4.6.2		List of additional inspections required:
5.1.18		List of special requirements for piping, flanges, gaskets, instruments and o-rings, valves:
5.1.32		Valves according to ☐ Vendor ☐ CPY Standard.
6.2.1.3		☐ HA ☐ HOA starting switch for pump motor ☐ Required ☐ Not required
6.2.2.2	X	
6.2.2.4	X	
6.3.8.1	X	
6.4.2		Refer to paragraph 6 of this specification.
Part 2		
4.1.4	X	
4.4.13		Refer to paragraph 6 of this specification.
4.5.4.3		Separate supply of air cooled heat exchanger. Sizing and configuration of connections:

4.2 Particular specification for rotating equipment - Packaging

4.2.1 General considerations / Safety and environment

The complete package shall be designed for _____ years of operation at least.

Environmental conditions for the equipment design are indicated in the paragraph 6 of this specification.

When packages have to be installed in hazardous area zone 2, as per [IP 15](#), they shall be specified for gas group IIA and temperature class T3 (200°C) and [ATEX European directives 94/9/EC](#) and [1999/92/EEC](#) shall be applied.

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In this case, packages shall be certified ATEX **Ex** II 3G and CE marked with the following requirements:

- Any instrumentation component shall be certified ATEX **Ex** II 2G and CE marked. For facilities located outside the European Union (EU countries), alternative IECEx scheme can be applied (IEC Scheme for Certification relating to Equipment for use in Explosive Atmospheres)
- Any electrical component shall be selected in accordance with **GS EP ELE 079**
- Any mechanical component certified ATEX **Ex** II 3G and CE marked.

Any equipment or system required to be left in operation when a safe or a hazardous area zone 2 becomes a hazardous area zone 1 (such as presence of gas, ventilation failure, etc.) shall be certified ATEX **Ex** II 2G and CE marked.

Package and all accessories shall bear their own marking, according to the mode of protection used.

4.2.2 Package configuration

4.2.2.1 Number of package base plate supporting point and type

Supporting shall comply with the requirements of **GS EP MEC 300** and **GS EP STR 103**.

When installed on concrete foundations, package base plate shall be multipoint rigid design with jacking bolts for leveling purpose.

When installed on 3 point supports

- The location of the 3 points shall be subject to Company approval
- Package base plate shall be designed with 4 points for transportation purpose between the supporting facility fabrication yard and the site
- Package base plate shall be designed with 4 jacking points for leveling purpose and transportation support removal and 3 points installation at site.

20 mm thickness stainless steel shim packs and 50 mm thickness stainless steel sole plates of all the packages as well as anchor bolts shall be provided by Supplier.

Contractor shall install, weld sole plates of all the packages in accordance with the Project specifications and Supplier requirements (number, size, location, material, strength and tightening torque).

The supporting structure shall be machined prior to welding the soleplates.

Refer to Appendix 2 for details.

4.2.2.2 Three points base plate package configuration

3 points base plate package shall be designed to accommodate as a minimum the driving and driven machineries with associated ancillaries.

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However, for special applications, Projects may specify the whole scope of supply (with the exception of loose process component) be installed and supported by the package base plate only:

Additional equipment to be installed and supported by the package baseplate:

4.2.2.3 Package base plate construction details

Package base plate design shall conform to **GS EP STR 103** to maintain alignment of the line shaft under all operating condition whether normal, transient and abnormal.

Package base plate shall be designed with either:

- A non slip decking steel plate covering the top of the base plate and a drip pan and gutter all around with 2 drains points of 2" diameter minimum
- or
- Grating covering the top of the baseplate and a steel plate continuously welded at the bottom of base plate recovering any oil spill and drain points of 2" diameter minimum.

The pump, drive motor, gearbox (if any) and lube oil system (if any) shall be installed on a continuously welded, carbon steel base frame.

In any case, the complete shaft line skid mounted package shall be shipped in one piece.

All the equipment supported by the skid shall be contained within the skid projection footprint (meaning that no equipment overhung/projection outside the skid footprint is allowed). Projection outside the skid footprint may be allowed for the main motor HV terminal box but is subject to Company approval. When the main motor HV terminal box projects itself on the skid, an opening shall be done in the skid grating to allow passing the HV power cables depending on their allowable bending radius. This shall be evaluated between Company, Contractor and Vendor during the engineering phase.

4.2.2.4 Package lifting appliances

Package lifting appliances, such as lifting beams or spreader bars, slings, shackles, etc., shall be included in the Vendor scope of supply and designed, tested and certified by an approved authority in accordance with **GS EP STR 103**.

Lifting appliances shall be load tested at 125% of the safe working load and certified. Visual inspections and NDT (dye penetrant and ultra sonic inspections) shall be performed after the load test.

4.2.3 Load couplings

Couplings shall conform to **GS EP MEC 240**.

4.2.4 Installation

The package shall be installed as per **GS EP MEC 292** requirements.

For packages to be installed on a floating structure, Vendor shall indicate the special devices installed to cope with the FPSO motions and accelerations indicated in the paragraph 6 of this

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specification. In any case, Vendor shall clearly indicate his layout requirements to ensure proper operation of the lube oil system and the drain system.

Vendor scope of supply shall include a vibration study according to and if required by **GS EP MEC 300**.

4.2.5 Instrumentation

The package instrumentation shall comply with **GS EP INS 101**, **GS EP INS 102**, **GS EP INS 107** and **GS EP INS 110**.

Thermowell design and instruments hook ups shall comply with **GS EP PVV 102** and **GS EP INS 900**.

Furthermore, machinery protection and monitoring system shall comply with paragraphs 6.4.2.2, 6.4.2.3 and 6.4.2.5 of **GS EP MEC 271**.

Supplier shall provide with its technical proposal a preliminary set of vibration and temperature P&ID and interconnecting diagram.

Junction boxes shall be mounted at 1.6 m above grating.

4.2.5.1 General

The package is categorized as "P3 type Package". In case the package is not fitted with hydrodynamic bearings, the package will be categorized as "P2 type package".

4.2.5.2 Package control system configuration

4.2.5.2.1 Configuration for P3 type packages

Each package unit shall be supplied with its dedicated UCP compliant with **GS EP INS 110** and **GS EP INS 135** requirements.

The SIL requirements for the PLC are listed in the **GS EP INS 110**.

Signals from any on package skid instrument required by the package control or by the ICSS, shall be wired up to dedicated junction boxes located at the package skid edges.

Interconnecting cables between UCP and skid, and in between UCP and ICSS/MCC will be supplied and installed by Contractor. Package Vendor shall adapt the number of terminals in marshalling cabinets and junction boxes to the type of multi-core cables in accordance with Contractor specifications. All spare wires shall be earthed through individual terminals, bonding is not permitted.

In addition, UCP shall include the following systems:

- A vibration monitoring system
- A load sharing control system.

The package shall be installed as per **GS EP MEC 292** requirements including remote access for vibrations analysis system.

4.2.5.2.2 Configuration for P2 type packages

Each package unit shall be supplied according to **GS EP INS 110** requirements.

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Signals from any on package skid instrument shall be wired up to dedicated junction boxes located at the package skid edges.

Interconnecting cables between ICSS/MCC and skid will be supplied and installed by Contractor. Package Vendor shall adapt the number of junction boxes to the type of multi-core cables in accordance with Contractor specifications. All spare wires shall be earthed through individual terminals, bonding is not permitted.

4.2.5.3 Package control system philosophy (for P3 package)

The control system of the package shall perform the main following functions:

- Sequencing
- Control
- Protection
- Monitoring and display and maintenance functions
- Pump load sharing.

4.2.5.4 Sequencing

The sequencing shall include:

4.2.5.4.1 Starting

Initiated by the operator from the UCP or/and from the central control room through ICSS operator working station.

4.2.5.4.2 Loading

The sequencing shall include at least the motopump ancillaries.

4.2.5.4.3 Stopping

The package may be shutdown either manually or automatically.

Manual stop shall be either:

- A normal stop
- An emergency stop.

Automatic stops shall be the responses of the control system to specific malfunction conditions of the packages or of the plant.

Depending on the type of malfunction, these shutdowns shall be:

- Identical to normal stops
- Fast stops identical to emergency stops.

4.2.5.5 Monitoring and display and maintenance functions

Refer to **GS EP INS 110** relevant paragraphs.

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4.2.6 Electrical

The design, manufacture, inspection and testing of electrical equipment provided with the packaged unit shall comply with **GS EP ELE 011**.

4.2.7 Piping, valves and vessels

4.2.7.1 Piping, tubing and pressure vessels

The fabrication, inspection and shipment of pipes, fittings and flanges shall comply with Company piping classes **GS EP PVV 112**, **GS EP PVV 143**, **GS EP PVV 144**, **GS EP PVV 145**, **GS EP PVV 146** and **GS EP PVV 147**.

However, Manufacturer standard piping specifications are acceptable in the package for all utility lines (oil, water, air, nitrogen). Manufacturer standard piping specifications shall be first provided to Company for approval.

All equipment piping systems shall have flanged high point vents and flanged low point drains.

These drains and vents shall terminate with an isolating valve and a blind flange.

All interconnecting piping shall be identified and tagged.

All on-skid piping shall be correctly supported to avoid piping unacceptable vibration.

A single block and bleed valve assembly shall be installed in each instrument take-off connection, except thermowell and vibration probes, and shall be located as close to the parent pipe or equipment as possible.

Double block and bleed valve assemblies instead of single block and bleed shall be provided when normal operating pressure is over 70 barg (normal operating pressure is the highest normal operating pressure of all process cases when the plant operates at steady state conditions).

Take-off connections, including the first valve shall be in accordance with the General Specifications and/or Project piping specification.

Each air-consuming instrument shall be provided with an AISI 316 filter regulator fitted with an AISI 316 pressure gauge and an AISI 316 isolating valve (refer to **GS EP PVV 102**, **GS EP INS 137** and **GS EP INS 900**). Instrument air tubing shall be made of AISI 316L. Fittings and accessories shall be made of AISI 316L stainless steel.

Threaded connections on any pipework or vessels are not permitted, except tapping points on instrument air distribution header(s).

Pressure vessels as defined per **ASME VIII Division 1** paragraph U.1 shall be designed as per **GS EP PVV 211** and shall be certified by an authorized agency agreed by the Company. ASME U stamp is not required.

Any required cleaning of piping systems and/or vessels at Vendor's facilities shall comply with **GS EP PVV 175**.

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4.2.7.2 Vents

All vents, which are interfaced between Supplier and Company, shall be routed to the skid edge or to a more appropriate location to be mutually agreed, and shall terminate by a flange fitted with a blind flange for transportation purpose.

Oil fume vents shall be provided with oil demisters and flanged flame arrestors with internals made of AISI 316L stainless steel.

4.2.7.3 Baseplate drains

All drains which are an interface between the Supplier and Company shall be routed to the skid edge and shall terminate by 2" ANSI 150 # flanges fitted with an isolating valve and a blind flange.

The drains shall be routed to plant hazardous open drain by Contractor.

4.2.8 Painting

Package unit shall be painted according to **GS EP COR 350** or **GS EP COR 354** according to site environment.

For packages to be operated offshore or in coastal environment:

- Package skids and support structures, piping and pressure vessels within the scope of supply shall be painted according to **GS EP COR 350** system P01
- When required by **GS EP COR 350**, paragraph 3.2, components made of stainless steel shall be painted according to **GS EP COR 350**, paragraph 3.2
- Rotating machines shall be painted according to Supplier standard suitable for offshore environment, if approved by Company, or according to **GS EP COR 350** system P14.

4.2.9 Health Safety and Environment

4.2.9.1 Hot surfaces

Any hot surface that can be reached by operators shall be insulated in such a way that their maximum skin temperature be lower than 70°C.

4.2.9.2 Noise level

All definitions, notations, testing methods, calculation methods and calculation procedures shall be in accordance with **GS EP MEC 300**.

All efforts shall be deployed to limit the average sound pressure level around the motopump package (and lube oil air coolers located off the main package skid) at 90 dB(A) at one meter.

However and in any case, no external noise attenuation devices and/or enclosures are allowed on the pump and gearbox.

Supplier shall submit during tender the expected noise map at one meter of the sound pressure levels in dBA per octave bands, and the maximum sound power level for each of the following:

- Pump package
- Lube oil coolers (if located outside the main package skid).

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For centrifugal pumps, the maximum sound pressure levels required shall be respected even during the operation at maximum flow.

4.2.10 Miscellaneous

4.2.10.1 Bolting

Package bolting shall be as follows:

- For diameter above 24 mm, bolting shall be according to **GS EP COR 356** paragraph 6
- For diameter up to and including 24 mm, bolting shall be AISI 321 stainless steel as a minimum
- Piping bolting shall be in compliance with **GS EP PVV 112** and **GS EP PVV 146**.

4.2.10.2 Interconnections

The package shall be designed to maximize factory assembly and testing, thus simplifying and reducing to a minimum installation and commissioning operations.

The package shall be wired and designed to ensure minimum installation operations on site. All external connections shall be brought to skid edge:

- Within interconnecting junction boxes for instruments and controls, except for the electric motors and heaters power cables. Segregation shall be as per **GS EP INS 110** requirements.
- With flanges for piping, as per **GS EP PVV 112** and with counter flanges and associated bolting for pump main flanges (the drawing of these counter flanges shall be submitted to Company for approval).
- Each utility which is interfaced between the Supplier and Company shall be routed through a manifold to a single point.

Interconnecting instruments junction boxes shall be provided with cable gland plates and associated cable glands.

Any structure or item not installed for the transportation shall in any case be fully erected in the Supplier's workshop, match-marked for ease of reassembly at site.

In addition the package shall be suitable for an exposure to firewater (sea water, when located on offshore site) deluge.

4.2.10.3 Name plate's tags and labels

All major equipment shall be identified by AISI 316L stainless steel nameplates attached by AISI 316L stainless steel pins or screws. All operating notices, warning notices and nameplates shall be in the English and language.

4.2.10.4 Rotation arrows

Direction of rotation arrows shall be clearly and permanently marked on all rotating equipment.

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4.2.11 Maintainability and accessibility

For all items within the package, Vendor shall comply with the following requirements:

- Accessibility for operation (position of instruments, legibility of readouts, operation of valves, etc.) and for maintenance. If necessary, an access platform with stairs or ladder shall be provided for equipment that cannot be accessible from the ground.
- Removable gratings or plates shall be provided around the machines to allow access and to protect equipment located in the bottom part of the package.
- Maintainability (disassembly, reassembly, adjustment) with the necessary space and handling devices as appropriate to bring any piece of equipment to dedicated lay down areas.
- Safety instructions.

All the above requirements shall be fully supported by an engineering handling study during Contract execution, for the following components but not limited to: driver, rotors, couplings, electric motors, gears, piping spools, etc.

A design review of the package accessibility and maintainability shall be organized with Company and Contractor prior to package construction. This review shall be supported by Vendor 3D CAD models.

For equipment over 20 kg, jack screws, lifting lugs, eyebolts, or equivalent shall be provided to perform alignment, disassembly and re-assembly.

Equipment/driver alignment must include a minimum of:

- 20 mm AISI 316 stainless steel machined shims
- 3 mm AISI 316 stainless steel final adjustment shims.

These shims are part of the Vendor scope of supply.

4.2.12 Inspections

The inspections shall be conducted according to the Project ITP. As a minimum, the requirements reported in Appendix 4 shall apply. The weight control shall be performed as per **GS EP STR 001**.

4.2.13 Engineering documentation language and units

The engineering documentation shall be developed as follows:

Language: English and

Units:

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5. Data Sheets

5.1 Pump

Reference / Revision: /

5.2 Electric motor

Reference / Revision: /

5.3 Variable speed drive

Reference / Revision: /

5.4 Power transformer

Reference / Revision: /

5.5 Gearbox (if any)

Reference / Revision: /

5.6 Mechanical seal and lube oil system (if applicable)

Reference / Revision: /

5.7 Noise

Reference / Revision: /

5.8 Weight

Reference / Revision: /

5.9 Data sheets templates

Each data sheet requested in the VDR enclosed in the Appendix 3 of this specification shall be filled in by the Vendor in the Company template format.

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6. Site conditions and utilities

6.1 Site conditions

LOCATION

ALTITUDE

CLIMATE

ATMOSPHERIC PRESSURE

Average		mbar
Minimum		mbar
Maximum		mbar

AMBIENT TEMPERATURE

Design (minimum / maximum)		°C
Normal		°C
Minimum		°C
Maximum		°C

WIND

Normal		m/s
Design		m/s
Direction		

RELATIVE HUMIDITY

Minimum		%
Maximum		%

ENVIRONMENT

Dust	
Smoke	
Other	

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BLAST

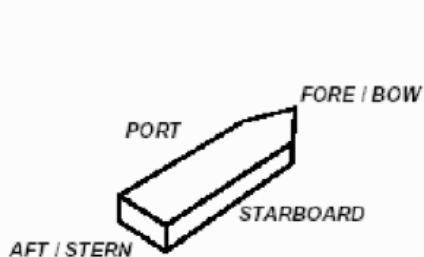
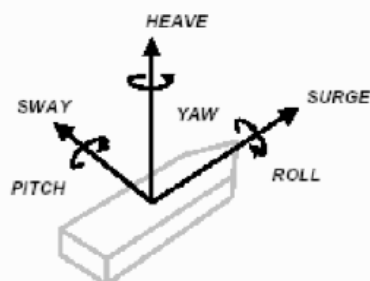
Equivalent static pressure (mbar)

CLASSIFICATION TYPE AREA
OPERATIONAL DESIGN CONDITIONS

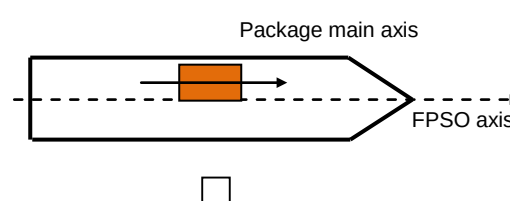
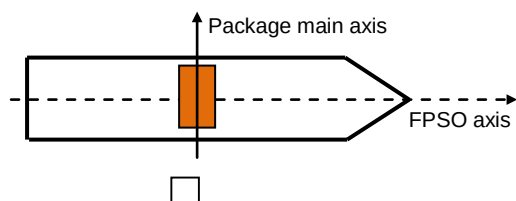
Project Phase:	During towing	On site	On site	
Condition:	Dry	Operating	Damaged	
Longitudinal acceleration (Surge)				m/s ²
Transversal acceleration (Sway)				m/s ²
Vertical acceleration (Heave)				m/s ²
Trim angle (Pitch)				°
List angle (Roll)				°

The motions and accelerations are given in the following way (typical):

Surge	X	Roll / List	Rotation / X
Sway	Y	Pitch / Trim	Rotation / Y
Heave	Z	Yaw	Rotation / Z


FPSO Orientation

FPSO Movement definition
TECHNICAL ROOM ENVIRONMENTAL CONDITIONS

The environmental conditions of technical room in which the UCP will be installed are specified in the document revision .

PACKAGE ORIENTATION ON FPSO


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6.2 Utilities

ELECTRICITY

Refer to:

- Project specification for electrical requirements for packaged units:
rev

- **GS EP ELE 011**

UCP UPS Earthing Regime (if applicable):

UCP Normal Power Regime (if applicable):

INSTRUMENT AIR and NITROGEN

Type	Instrument Air	Nitrogen	
Min/max operating temperature			°C
Operating temperature			°C
Min/max operating pressure			Barg
Operating pressure			Barg
Oil concentration			
Dew point			°C @ barg

COOLING WATER SYSTEM

Type	Sea Water	Fresh Water	
Normal inlet temperature			°C
Minimum inlet temperature			°C
Maximum inlet temperature			°C
Minimum outlet temperature			°C
Maximum outlet temperature			°C
Supply pressure			Barg
Max allowable delta P			Bar
Calorific capacity			kJ/kg°C
Fouling factor			m ² .°C.h/kcal

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7. Testing

The scope of this chapter is to describe the performance tests (pump and motor) and the string test to be carried on the completely assembled motopump package in Vendor facilities before unit shipment.

The scope of these tests is to verify the satisfactory performance of the centrifugal pump and of the complete electrical drive system, to demonstrate the satisfactory mechanical behavior of the complete package train under full load conditions and to demonstrate the functionality of the main auxiliary systems of the package.

The pump performance tests may also be performed prior to the string test with testbed equipment. However, pump performance test during string test shall be privileged.

The following tests shall be carried out on the completely assembled package:

- Pre-test activities
- Centrifugal pump performance test as per **GS EP MEC 271**
- Package full load string test in full speed, full power. This activity shall include the functional test of all the main auxiliary systems of the package and package vibrations measurements if required by **GS EP MEC 300**
- Special tools test
- One fully assembled package shall be weighted before packing and shipment.

The fully assembled and erected motopump package shall consist of the following main Project components:

- Electric motor fully assembled with all the relevant auxiliaries including but not limited to pressurization box, cooler, main terminal box ☒
- HV Variable speed drive system ☒
- Power transformer ☐
- Centrifugal pump(s) fully assembled including all the auxiliary sealing system and lube oil piping (if applicable) ☒
- Increasing/reducing speed gearbox (if applicable) ☒
- Common base plate fully assembled ☒
- Couplings and torque meter (if applicable) ☒
- Mineral lube oil console including lube oil coolers (if applicable) ☒
- Mineral lube oil console interconnecting piping (if lube oil system is installed on common base plate) ☒
- Package Unit Control Panels (UCP) (if applicable) ☒
- All the instrumentation ☒ .

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The following main shop items shall be used for the string test:

- Water coolers for test process cooling
- Automatic acquisition system (for process and machinery data)
- All the equipment necessary for test conduction (piping, throttling valves, motors control center etc.).

Project special tools shall be used for unit erection.

The test procedure shall be issued 8 weeks prior the test (including noise and base plate vibration measurement proposed procedure).

The results of each test shall be recorded in appropriate log sheets provided by Vendor and signed as “witnessed” by all the parties.

After the completion of the tests, Vendor shall issue an official test report including all the above log sheets. Copy of raw data registered during the tests shall be handed over right after each test activity for Contractor inspection record.

The following minimum information shall be clearly indicated in the completely assembled motopump package test procedure for Contractor quick reference during the test:

Electrical motor

Mineral lube oil type (if applicable)			
	Unit	Min	Max
Mineral lube oil pressure (if applicable)	barG		
Mineral lube oil temperature (if applicable)	°C		
Electric motor speed range	rpm		
Electric motor 100% speed	rpm		
		Alarm	Trip
Shaft DE radial vibration unfiltered peak to peak (if applicable)	µm		
Shaft NDE radial vibration unfiltered peak to peak (if applicable)	µm		
Shaft DE bearing housing vibration	mm/s		
Shaft NDE bearing housing vibration	mm/s		
Journal bearing DE white metal temperature	°C		
Journal bearing NDE white metal temperature	°C		
Thrust bearings (if any) white metal temperature	°C		



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Gearbox (if applicable)

Lube oil type			
	Unit	Min	Max
Lube oil pressure	barg		
Lube oil temperature	°C		
Low speed shaft speed	rpm		
High speed shaft speed	rpm		
Gear ratio			
	Unit	Alarm	Trip
Journal bearings white metal temperature	°C		
Thrust bearings white metal temperature	°C		
Low speed shaft radial vibration unfiltered peak to peak DE	μm		
Low speed shaft radial vibration unfiltered peak to peak NDE	μm		
High speed shaft radial vibration unfiltered peak to peaked DE	μm		
High speed shaft radial vibration unfiltered peak to peak NDE	μm		

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Pump

Lube oil type (if applicable)			
	Unit	Min	Max
Lube oil pressure (journal bearings) (if applicable)	barg		
Lube oil pressure (thrust bearing) (if applicable)	barg		
Lube oil temperature (if applicable)	°C		
Lube oil supply header pressure (if applicable)	barg		
Lube oil supply header temperature (set point) (if applicable)	°C		
100% speed	rpm		
Maximum continuous speed	rpm		
Minimum operating speed	rpm		
	Unit	Alarm	Trip
Journal bearings white metal temperature DE	°C		
Journal bearings white metal temperature NDE	°C		
Thrust bearings white metal temperature	°C		
Shaft radial vibration unfiltered peak to peak DE (if applicable)	μm		
Shaft radial vibration unfiltered peak to peak NDE (if applicable)	μm		
Shaft axial displacement	mm		
Shaft DE bearing housing vibration	mm/s		
Shaft NDE bearing housing vibration	mm/s		

Mechanical Seal System

	Unit	Min	Max
API plan			
Mechanical seal leakage	l/h		
Mechanical seal consumption	l/h		

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7.1 Pre-test activities

Before commencing the factory testing of the completely assembled packages, the following minimum pre-test activities shall be carried out:

- Calibration of all Project instruments. Relevant calibration certificates shall be available at the time of the test for Contractor review. Spot checks of instruments calibration shall be required before test commencing
- Instrumentation and electrical equipment insulation and continuity tests
- Control loops check and functional test
- Safety and protection devices operational checks
- Serial link test (if applicable)
- Equipment tagging and labeling check
- Mechanical equipment alignment check
- Leakage tests
- Lube oil system flushing and cleanliness tests according to [API Std 614](#) Annex D.3
- Verification of the dynamic stiffness of the test bench if required by, and as per [GS EP MEC 300](#).
- Direction of rotation check.

The reports relevant to the mechanical equipment alignment check and to flushing and cleanliness checks shall be available for Contractor review during test.

Before commencing the tests the package shall be cleaned by Vendor and shall be visually inspected by Contractor.

7.2 Centrifugal pump [API Std 610](#) performance test

The pump performance tests shall be carried out according to [GS EP MEC 271](#) to demonstrate the satisfactory performance of centrifugal pump.

If more than one identical motopump packages are supplied, this test shall be carried out on all units including spare cartridge if any.

This test shall be carried out operating the pump in a dedicated closed loop.

The test procedure shall include a summary table (see below) clearly indicating [API Std 610](#) performance test conditions for each guaranteed point as well as the corresponding site conditions.

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	Unit	Guaranteed Conditions	Measured Value	Deviation Test/Guaranteed	Limits
Specific Gravity					
Speed	rpm				Exhibit D
Suction Pressure	barA				
Suction Temperature	°C				
Flow Rate	m ³ /h				Exhibit D
Differential Head	m				Exhibit D
NPSH 3%	m				Exhibit D
Discharge pressure	bara				
Discharge Temperature	°C				
Efficiency	%				Exhibit D
Absorbed Power	kW				Exhibit D

The test procedure shall cover as a minimum the following requirements:

- A minimum of 5 test points evenly spaced from shut-off to maximum flow on the speed line corresponding to the guaranteed point. One of the five points shall correspond to the guaranteed point.

In case of multiple guaranteed points, this step of the test shall be conducted for the point having the highest rotating speed.

- A minimum of 5 points evenly spaced from shut-off to maximum flow at maximum continuous speed and at minimum operating speed.

In addition to the readings necessary for the performance test, a complete set of mechanical readings, including vibrations spectra, shall be taken for each test point.

A FFT real time analyzer shall be available during the test allowing checking the vibration spectra anytime.

7.3 Package full load test

This test shall be carried out to demonstrate the satisfactory mechanical behavior of the complete package under full load conditions and to demonstrate the functionality of the main auxiliary systems of the package.

If more than one identical motopump packages are supplied, this test shall be carried out on all units.

This test shall be carried out according to the following test sequence.

1. Cold start up of the unit.

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2. Increase the speed up to pump minimum operating speed (MOS) and take a complete set of mechanical readings. Set the pump discharge valve to place the operating point in the middle of the operating envelope.
3. Increase the speed by 10% increments up to pump maximum continuous speed (MCS) and take a complete set of mechanical readings for each speed increment.
4. Run at maximum continuous speed for minimum 30 minutes. Take a complete set of mechanical readings every 10 minutes.
5. Adjust pump process conditions to perform pump performance test as described in data sheet referenced paragraph 5.1.
6. If the performance test has already been performed with the test bed equipment, then record two operating points at two different speeds to crosscheck the performance results.
7. Set the process conditions for the 4 hours endurance test at full speed full load. For this endurance test, the lube oil (if applicable) shall be at maximum temperature.

During this test a complete set of mechanical readings shall be taken every 15 minutes.

During this test all the Project filters, pumps, fans and coolers shall be subject to a changeover test. No trip of the unit shall occur during this activity.

1. Trip, wait 30 minutes, and restart the unit bringing the speed up to maximum continuous speed. The trip may be obtained simulating a train over speed, a lube oil (if applicable) low pressure etc.
2. Shut down the unit by a normal stop. Record the rundown time of the machine.

The following verifications/measurement shall be performed during the string test:

- Verify correct location of the emergency stops
- Ensure that there is no piping vibration
- Verify cleanliness report of the lubricating oil (if applicable)
- Measure the seal consumption
- Noise emissions shall be measured and recorded according to the testing procedure proposed by Vendor and approved by Contractor. Noise measurement shall be performed in accordance with **GS EP MEC 300** for all equipment.
- Base plate vibrations measurement and recording according to (if required by) **GS EP MEC 300**.

7.4 Electrical

The following electrical parameters shall be recorded during all string tests in all test conditions:

- Motor windings temperature
- Motor bearings temperature
- Motor bearings radial vibrations
- Motor phase/current/voltage.

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7.5 Post test inspections

Post test inspection of the pump shall be as per **GS EP MEC 271**.

7.6 Site acceptance test

All packages shall be submitted to Site Acceptance Tests (SAT) including a performance test done with the field instrumentation and additional, mutually agreed Contractor instruments, in order to check that the packages comply with the Exhibit D guarantees.

Vendor shall submit a site acceptance test procedure for Company approval. The final test program shall be issued at the ex-works delivery.

The test program shall be established using the following requirements as a minimum:

7.6.1 Pre-test activities

As a minimum, the following activities shall be performed prior to SAT.

- Lube oil circuit cleaning and cleanliness test according to **API Std 614** Annex D3 (if applicable)
- Safety and protection devices operational checks
- Calibration of all Project instruments
- Control loops check and functional test
- Serial links test (if applicable)
- Instrumentation and electrical equipment insulation and continuity tests
- Mechanical equipment alignment check
- Test run of the motopump.

These activities are carried out under the responsibility of the Vendor.

Note: These checks shall be part of Company's pre commissioning and commissioning and start-up procedures.

7.6.2 Test conduction

The purpose of this test is to demonstrate that the package exhibits a sound mechanical behavior **and** complies with the Exhibit D guarantees during 72 hours continuous.

In particular, the following activities shall be done during the 72 hours:

- Pump performances evaluation following the below methodology:
 - The test shall be conducted following the **API Std 610** requirements. In case the **API Std 610** requirements cannot be fulfilled, the test conditions shall be agreed with Company
 - The analysis of the guarantee point(s) will be done through the capture of three (3) test points (one on the guarantee flow, one on the guarantee flow minus 4% and one on the guarantee flow plus 4%)

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- The verification of the pump operating range will be done on the iso-speed of the guarantee point. In case of multiple guaranteed points, this step of the test shall be conducted for the point having the highest rotating speed. Five (5) test points will be captured (three on the guarantee point as per the above, one close to mini flow and one at the maximum flow).
- Verification of the mechanical behavior of the complete shaft line running at maximum available power at ambient temperature during the test and maximum continuous speed.

The management of the SAT shall be as per the following scheme:

- SAT preparation by the Contractor (including the coordination with FO to implement the package test procedure in the production environment)
- Package test procedure by the Vendor
- Conduction of the test by FO based on the process conditions requirements given by the Vendor and the Contractor
- The package remains under the Vendor's responsibility during the SAT.

All the equipment necessary to perform the site acceptance tests shall be provided by the Contractor.

In case of any trip caused by any component of the package itself, the complete 72 hours shall be repeated from the beginning. In case of any trip caused by any external source (process, external power supply, etc.), the test shall be restarted from the point of interruption.

7.6.3 Post-test activities

After the SAT, the following activities shall be performed:

- Removal of the temporary strainer.
- Vendor shall supply of a detailed SAT report including as a minimum the following elements:
 - List of the instruments used during the test
 - Test points log sheets
 - Summary chart of the package performances converted from the test to the Exhibit D conditions.

7.7 Acceptance Criteria

The acceptance criteria for pump [API Std 610](#) performance test shall be those indicated in the Exhibit D of the Contract.

The following tables summarize the mechanical acceptance criteria for the centrifugal pump, the gearbox (if applicable), electric motor and the base plate which are applicable to the whole complete unit string test including site acceptance test.

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Centrifugal pump, main electric motor and gearbox (if any) vibrations (when applicable):

Gearbox Low speed shaft radial Vibrations (µm pk to pk)	Gearbox High speed shaft radial Vibrations (µm pk to pk)	Centrifugal pump Radial vibrations (µm pk to pk)	Electric motor Radial vibrations
$25.4 \times \sqrt{\frac{12000}{N}} \times \sqrt{2}$ Or 36 Whichever is less	$25.4 \times \sqrt{\frac{12000}{N}} \times \sqrt{2}$ Or 36 Whichever is less	$\sqrt{\frac{5200000}{N}}$ Or 50 Whichever is less	Refer to GS EP ELE 111

Any stable discrete, non synchronous vibration exceeding 20% of the allowable vibration as defined above shall be cause of rejection of the package.

Any unstable non synchronous vibration shall be cause of rejection of the package.

Centrifugal pump, main electric motor, gearbox (if any) journal and thrust bearing temperatures:

Oil Inlet temperature (°C)	ΔT On bearings return lines (°C)	Bearings metal temperature			
		Gearbox Journal and thrust (°C)	Centrifugal pump Journal (°C)	Centrifugal pump Thrust (°C)	Electric motor Journal (°C)
50	25	90	85	90	75
60	25	100	95	100	85

Absolute vibrations:

- 3 points support:

On bearing housings (mm/s rms)	On connecting point of the main rotating equipment to the baseplate (mm/s rms)	On connecting points of the baseplate to the test bench support (mm/s rms)
Electric motor: 3.5	3.5	3.5
Pump: refer to API Std 610 , table 7 and Fig. 29		
Gearbox: 3.5		
In all directions From 10 Hz up to 1000 Hz		



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- Multipoint rigid supports:

On bearing housings (mm/s rms)	On connecting point of the main rotating equipment to the baseplate (mm/s rms)	On connecting points of the baseplate to the test bench support (mm/s rms)
Electric motor: 2.3	2.3	2.3
Pump: refer to API Std 610 , table 7 and Fig. 29		
Gearbox: 2.3		
In all directions From 10 Hz up to 1000 Hz		

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8. Spare parts and special tools

This paragraph gives the minimum requirements of spare parts and special tools for this project. It shall be read in conjunction with **GS EP EXP 217**.

8.1 Spare parts

The Vendor shall provide the spare part lists on Company SPL forms, fully filled up. Company will provide electronic format of these SPL forms.

All spare parts shall have protective coatings applied and be uniquely packed and tagged.

Packing shall give protection for up to 18 months outside storage.

The Vendor shall be fully responsible for all claims attributable to unsuitable or unsatisfactory packing and protection.

Spare parts shall be separately crated from motopump loose items.

8.1.1 Commissioning and start-up spare parts

Supplier shall include in the scope of supply spare parts for commissioning and start up, covering the whole scope of supply of one motopump package, and taking into account the number of pumping units to be delivered:

- Recommended spare parts for main electrical motor
- Recommended spare parts for gearbox, if any
- Recommended spare parts for pump
- Recommended spare parts for any auxiliaries of the here above machinery's

As a minimum the following spare parts shall be included in the Supplier scope of supply (quantity for 1 or 2 pump trains installed, to double if more than 2 pump trains are installed):

- Ten (10) sets of filter cartridges for any filters of any oil systems.
- For pump:
 - Two (2) sets of O'rings for the pump cartridge.
 - Two (2) off mechanical seal cartridges (Drive End and Non Drive End).
 - One (1) off power coupling.
 - One (1) set of calibrated screws for the power coupling.
 - One (1) set of journal bearings pads.
 - One (1) set of thrust bearing pads.
 - One (1) set of bearing housing dynamic seal.
 - Two (2) off vibration probes.
- For Motor:
 - One (1) set of bearings.
 - One (1) set of bearing dynamic seals.

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- One (1) set of O'rings for bearing replacement.
- For the UCP (if applicable):
 - One (1) power supply card
 - One (1) digital input card
 - One (1) analog input card
 - One (1) digital output card
 - One (1) analog output card
 - One (1) communication interface card.
- For the UCP machinery vibration system (if applicable):
 - Five (5) sensors of each type
 - One (1) monitoring power supply card
 - One (1) monitoring card of each type
- Miscellaneous (if applicable):
 - Five (5) IS barriers of each type
 - Five (5) relays of each type
 - Two (2) fuses of each type
 - One (1) UCP HMI screen.

All parts used during this commissioning/startup phase shall be replaced to complete the Capital spare parts list hereafter.

8.1.2 Capital spare parts

The following Capital spare parts shall be included in the Supplier scope of supply (quantity for 1 or 2 motopump skids, quantity to be agreed if more than 2 pumps).

These parts come in addition to the commissioning spare parts.

- For main electrical motor:
 - One (1) set of bearings
 - One (1) set of bearing housing dynamic seals
 - One (1) set of O'rings for bearing replacement.
- For Water Injection Pump (WIP):
 - One (1) pump complete cartridge, including bearings and mechanical seals, with N2 pressurized and pressure monitored steel container.
- For Pump other than WIP with rated power greater or equal to 500 kW:
 - One (1) complete rotor, consisting of all rotating parts attached to the shaft, except the half-coupling
 - One (1) set of journal bearings

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- One (1) set of thrust bearing
- One (1) off mechanical seal cartridge (Drive End and Non Drive End).
- For gear, if any:
 - One (1) set of low speed and high speed shaft main load couplings
 - One (1) set of bull and pinion gears with N2 pressurized and pressure monitored steel container
 - One (1) set of gearbox journal and thrust bearings.
- For Couplings:
 - One (1) coupling.
- For lube oil system (if applicable):
 - One (1) set of AC lube oil pump and motor, if any
 - One (1) set of DC lube oil pump and motor, if any.
 - One (1) temperature control valve.

8.2 Special tools

All special tools required for the site installation, commissioning and maintenance of the package and their auxiliaries shall be furnished.

All special tools required to perform the following activities shall be provided:

- Erection, operation and maintenance: these tools will remain the property of Company
- Commissioning: These tools will be sent back to Supplier at his own cost.

As a minimum the following shall be supplied:

- For erection, operation and maintenance:
 - All necessary spreader bars and slings to lift into position the unit
 - Jigs for shaft alignment
 - Bolt tensioning or torquing devices for pumps
 - Hydraulic cartridge removal system including rotor handling facilities, i.e. spreader bar, slings, runners, beams, etc.
 - Removal tool kit for any main load coupling
 - Thrust bearing removal kit
 - Electrical motor special tools
 - Driven equipment special tools
 - Recharging kit for any blade accumulator
 - Pump erection tools

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- For PLC based control systems, a programming console with a personal laptop, as applicable, shall be supplied complete with:
 - Development software
 - Application programs
 - Diagnostic software
 - Cord sets i.e. power supply and link with PLC's CPU
 - All rack-mounted control equipment shall be supplied with their extension cards. Cards to be inserted between rack mother boards and control cards for trouble shooting purpose
- For site commissioning and start up:
 - Vibration probe calibrations equipment (wobulator)
 - Portable multi channel analyzer
 - Digital voltmeter
 - Proximitior
 - Portable particles counter
 - Portable electronic RPM counter
 - Millivolt and milliamp sources
 - DC power supply
 - Variable resistor
 - Pneumatic pressure pump.
- Flushing kits for all lube oil systems (if applicable) consisting of:
 - Portable electric pump unit when the pumps of the systems are not AC electrical driven
 - Hoses and flange adapters to bypass all bearings and to establish flushing circuits
 - Flushing blocks for electro-hydraulic servo-valves
 - Screen mesh or equivalent.

A detailed list with comprehensive identification, part number, tool drawing and application tool drawing shall be provided during Contract stage.

Any tools, standard and special, required to perform the pre-commissioning and commissioning activities at the Supplier premises shall be provided.

All special tools shall be properly identified and tagged.

Their functionality shall be described in the operating manuals.

Supplier shall provide a lockable weatherproof container for storage of special tools fitted with shelves and bench with vice.

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9. Preparation for shipment

The purpose of the preservation and shipment requirement is to assure the best economical protection against adverse atmospheric weather, corrosion build up and mechanical damage due to storage and transportation from Vendor (Manufacturers, Packagers and Contractors) premises to Contractor yard and from Contractor yard to Company site.

The **Vendor** and/or Manufacturer shall issue necessary procedures which shall be applied to any equipment to cover:

- The preservation during workshop storage
- The preservation, packing and fastening of equipments during transportation from Vendor facilities to Contractor yard construction
- The preservation during the construction works on the Contractor yard
- The preservation, packing and fastening of equipments during towing from construction yard to Company site.

The procedures shall contain a check list including all preservation and packing tasks.

The hereafter requirements shall also be applied to the capital spare delivered with the Contract. The capital spares shall always be preserved and packed for long term outdoor storage.

9.1 Preservation

The preservation duration will be selected by the Project in the package data sheet and/or equipment data sheets.

Two types of preservation can be applied depending on Project needs: short term preservation or long term preservation.

The considered preservation shall be valid for shipment between:

- Vendor premises and Contractor yard
- Contractor yard and Company site.

The short term preservation shall cover a period up to six (6) consecutive months after processing of the preservation. The considered storage shall be outdoor without protection.

The long term preservation shall cover a period up to twelve (12) consecutive months and be annually renewable during five (5) years.

The desiccant products shall be free of DMF (dimethyl fumarate) content and shall be selected from Silica base. The regeneration of desiccant products is a mandatory requirement and shall be done by heating.

The desiccant products shall conform to the [NF H00-320](#) or [DIN 55473](#) or [US MIL D 3464E](#) standards.

The VCI and VPI shall conform to the [US MIL STD-2073-1 E](#) standard. However necessary care shall be taken to use approved products compatible with the materials needing to be preserved.

All desiccant products locations shall be provided with a metallic label indicating their presence.

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The last mechanical and/or performance runs can be done with anti-corrosion additives mixed with the lube oil. However Vendor shall demonstrate that the anti-corrosion additives shall not compromise the life of the equipment.

All opening shall be closed with metallic blind and gasket to be air and water tight.

Metallic labels with necessary cautions and instruction to remove preservative products prior equipment start-up shall be provided.

The labels shall be made of metal with black marking on yellow back ground.

9.1.1 Electrical motor

After completion of the tests, the following shall be performed as a minimum:

- Draining of liquid such as water, lube oil from systems where required
- Drying of circuits
- Cleaning of reservoirs with lint-free rags
- Spraying of Tectyl™ or VCI in the air system
- Spraying of Tectyl™ or VCI in the water cooling system
- Spraying of Tectyl™ or VCI in the lube oil system
- Insertion of desiccant product in the motor junction boxes, in motor bearing cases, and in coolers by means of perforated metallic baskets fixed to blinds
- Preservation from foreign matters entrance
- Sealing of openings
- Running space heaters
- Circulating instrument dry air or nitrogen
- Regular winding resistance measurement in order to verify equipment integrity.

9.1.2 Gearbox

After completion of the tests, the following shall be performed as a minimum:

- Draining of liquid such as water, lube oil from systems
- Drying of systems
- Cleaning of reservoirs with lint-free rags
- Spaying of Tectyl™ or VCI in the reservoir and casing
- Spaying of Tectyl™ or VCI on the gear teeth
- Insertion of desiccant product inside the gear casing by mean of metallic basket welded to the closing blinds
- Preservation from foreign matters entrance by blinds
- Sealing of openings.

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9.1.3 Pumps

After completion of the tests, the following shall be performed as a minimum:

- Draining of liquid such as water, lube oil from systems
- Drying of systems
- Cleaning of reservoirs with lint-free rags
- Spraying of Tectyl™ or VCI in the reservoir, lube system and casing
- Spraying of Tectyl™ or VCI in the air system
- Spraying of Tectyl™ or VCI in the pump casing
- Spraying of Tectyl™ or VCI in the seal system
- Insertion of desiccant product inside the reservoir, the pump casing and the seal system by mean of metallic basket welded to the closing blinds
- Preservation from foreign matters entrance by metallic blinds
- Sealing of openings.

9.1.4 Instrumentation and electrical auxiliaries

After completion of the tests, the following shall be performed as a minimum:

- Draining
- Drying
- Insertion of desiccant products in instrument junction boxes and in the instrument head
- Sealing of openings.

9.1.5 Control panels (if applicable)

After completion of the tests, the following shall be performed as a minimum:

- Draining of liquid such as water, where needed
- Drying of systems
- Cleaning of panels with lint-free rags
- Packing of all equipments not rack mounted
- Insertion of desiccant product inside the control panel, by means of soft bags
- Preservation from foreign matters entrance by metallic blinds
- Positive locking of all doors
- Sealing of openings.

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9.1.6 Auxiliaries

The package auxiliaries generally include piping, filters, coolers, heat exchangers, heaters, valves, tanks, boosters, structural frames, walk ways, ladders and stairs, equipment needed for the operation of the package and not herewith listed.

- Draining of liquid such as water, lube oil from systems where required
- Drying of circuits
- Cleaning of reservoirs lint-free rags
- Spraying of Tectyl™ or VCI in the air system
- Spraying of Tectyl™ or VCI in the water cooled system
- Spraying of Tectyl™ or VCI in the lube oil system
- Spraying Water resistant wax Tectyl™ and wrapping on all non painted interfaces
- Insertion of desiccant product in the piping system, junction boxes, equipments cases (including ducting) by means of perforated metallic baskets fixed to blinds or soft bags
- Preservation from foreign matters entrance
- Sealing of opening.

9.2 Packing

9.2.1 Weather protection

The design of the packing shall procure an optimal weather protection during oversea transportation and Contractor yard storage.

During the detail engineering phase, Contractor, in conjunction with Vendor, has to issue and submit the preservation and sea fastening procedures to Company representative for approval.

Contractor shall be fully responsible of equipment preservation until provisional acceptance on site.

The weather protection shall be made of heat welded multilayer film (polyester, aluminum, polyethylene) and shall be installed around the package. All lifting appliances and lifting points shall be provided outside the weather protection and shall not be subject to losses of sealing. The film shall conform to the [NF H00-310](#) or [US MIL PRF 131K](#) standards.

Prior to weld and seal the multilayer film, the hereafter sequences shall be applied, but are not limited to:

- A sweeping with Nitrogen shall be performed in order to remove the internal moisture as much as possible to get low residual humidity.
- A set of desiccant bags shall be included to absorb residual moisture and trap during transportation and storage the moisture passing through the multilayer film envelope.
- A moisture indicator (sensitive paper) shall be included inside the envelope prior sealing to perform the traceability of the internal atmosphere during transport and storage.

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9.2.2 Mechanical and infestation protection

The mechanical and infestation protection shall be performed by a use of multilayer wooden plates (plywood).

The multilayer wooden plates shall be sea water resistant in case of overseas transportation. A selection of multilayer wooden plates in accordance with marine immersion resistant, french standard CTBX or equal classification requirements is required.

The construction of the overall mechanical protection shall be done in such a way that internal or external members shall not damage the weather protection.

The construction shall be in such a way that rodents and insects cannot enter inside the box.

All sensitive parts like antifriction bearing, rotor shaft, shall be locked in place and insulated by means of shock absorber. The rotor locking devices shall be labeled with metallic instructions and cautions label with black making on yellow colored back ground labels shall be provided.

9.2.3 Fastening

All devices needed for the fastening, whatever the transportation mode considered (sea, onshore, rails, dirty and/or ice roads), shall be provided external to the mechanical protection. The fastening shall not affect the weather/mechanical protection integrity.

The fastening shall be part of the equipment design engineering phase and shall be provided to avoid any modification and/or welding on the equipment during its installation until completion.

During towing transportation, the 3 points mounted packages shall be locked in position to avoid any failure of the supports.

The AVM's (Anti-Vibration Mount) shall be delivered with the dedicated locking tools and locking devices for transportation.

The gimbals (spherical bearing supports) shall be with the dedicated locking tools and locking devices for transportation.

The use of jacking tools and temporary support tools may be required for installation and/or transportation. The supply of those tools shall be done by the package Vendor along with the sub plate and the sole plate for the fixing of these tools.

The sub plate shall be directly welded by the Vendor and/or Manufacturer on the main base plate during the construction of the base plate, the sole plate shall be directly welded to the support by Contractor during the construction of the support.

9.2.4 Marking

The minimal requirements for marking shall conform to the [ISO 780](#) code in addition to the specific requirement of the project.

9.2.5 Pumps Specific

The pumps shall be preserved as per clause 9.1.3 and packed as per clause 9.2 during transportation at rest on skid from Vendor facilities to Contractor yard and from Contractor yard to Company site.

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For light pump rotors, the use of own bearing supports during transportation is allowed. However Vendor has to demonstrate that transportation with pump rotor at rest shall not impact the integrity and capability of the pump to recover original performances during commissioning and start-up at site.

For heavy rotors, the bearings shall be removed prior packing and replaced by dummies.

The rotor shall be locked in position for transportation. The locking devices shall be supplied by the Vendor.

The capital spares delivered with the Contract shall be preserved as per clause 9.1.3 and shall be packed inside specific N2 pressurized container design for airways transportation. The container shall be sealed type, re-usable and shall be provided with:

- Internal or external vibrations and shocks absorbers and shock loggers. Drop acceleration limit shall be indicated by the Supplier
- External marking in accordance with [ISO 780](#) and Project Specific requirements,
- External lifting and handling devices and fastening provisions
- Atmospheric seals by means of replaceable gaskets or o-rings (air tight design)
- Internal rotors locking devices
- Internal harness for fastening
- Gauge for internal pressure measurement
- Pressure safety valve (bursting discs are not allowed)
- N2 filling port
- N2 pressure release and N2 container sweeping
- Monitoring device with announcement when reaching the N2 low pressure setting (to be connected to Company and/or Contractor storage monitoring system)
- Moisture indicator
- Internal provision for documentation storage
- Internal provision for desiccant products storage
- External 50 liters N2 filled bottle for emergency refilling
- Name plate
- Notified body certification plate with certification validity time
- External blank marking area and/or location to attached the AWB (Air Way Bill).

The design of the container has to provide capability of vertical storage and anchor points to change position from horizontal to vertical by means of lifting apparatus. The transportation shall always be done in horizontal position.

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9.2.6 Loose shipped items and auxiliaries

The loose shipped items delivered with the Contract (including commissioning and start-up spare parts) shall be preserved as per clause 9.1 and shall be packed inside a VCI plastic bags as per clause 9.2.1 and clause 9.2.2 during transportation from Vendor facilities to Contractor yard and from Contractor yard to Company site, except for structural frames and ducting when part of the scope of supply.

The packing boxes shall be provided with:

- Internal or external vibrations and shocks absorbers
- External lifting and handling devices and fastening provisions
- External marking in accordance with [ISO 780](#) and Project specific requirements
- Internal harness and/or means for fastening
- Moisture indicator
- Internal or external provision for documentation storage
- External blank marking area and/or location to attached the AWB (Air Way Bill).

9.3 Transportation

The Notified body responsible for transportation between Vendor facilities and port of shipment shall perform the assessment of the means, risks and constraints.

It shall be clearly specified in the Vendor proposal the means to be used for transportation, the loading of the equipments and the induce constraints due to sea, road, rails transportation in term of equipment assembly and number of packs.

A preliminary packing list including packing dimensions and weight table shall be attached to the Vendor proposal to give possibility to Company to assess the transportation impacts prior Contract award.

The handling, loading and unloading procedures and the lifting drawings shall be part of the engineering phase and shall be developed by the Vendor.

The spreader bars, the lifting beams and ancillaries (slings, shackles) shall be supplied by Vendor and shall be load tested and certified by third party notified body. The use of synthetic slings is not allowed.

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Appendix 1

Appendix 1 Definitions and abbreviations

AVM	Anti-Vibration Mount
Company	Total E&P or any Total E&P subsidiary
Contractor	Any Company Total E&P has signed a Contract with for the Engineering, Procurement, Construction and Installation of a part of a project
DMF	Dimethyl Fumarate
FO	Field Operations
HMI	Human Machine Interface
ICSS	Integrated Control and safety System
ITP	Inspection test plan
MCC	Motor Control Center
NDT	Non Destructive Test
Package	Prefabricated process or utility self-contained unit, generally able to operate on its own, supplied fully tested and ready for immediate installation
PLC	Programmable Logic Controller
SAT	Site Acceptance Test
SPL	Spare Parts List
Supplier or Vendor	The package Supplier or Vendor
UCP	Unit Control Panel
VCI	Volatile Corrosion Inhibitor
VPI	Vapor Phase Inhibitor
VSIDS	Variable Speed Drive System
VTMS	Vibration & Temperature Monitoring System

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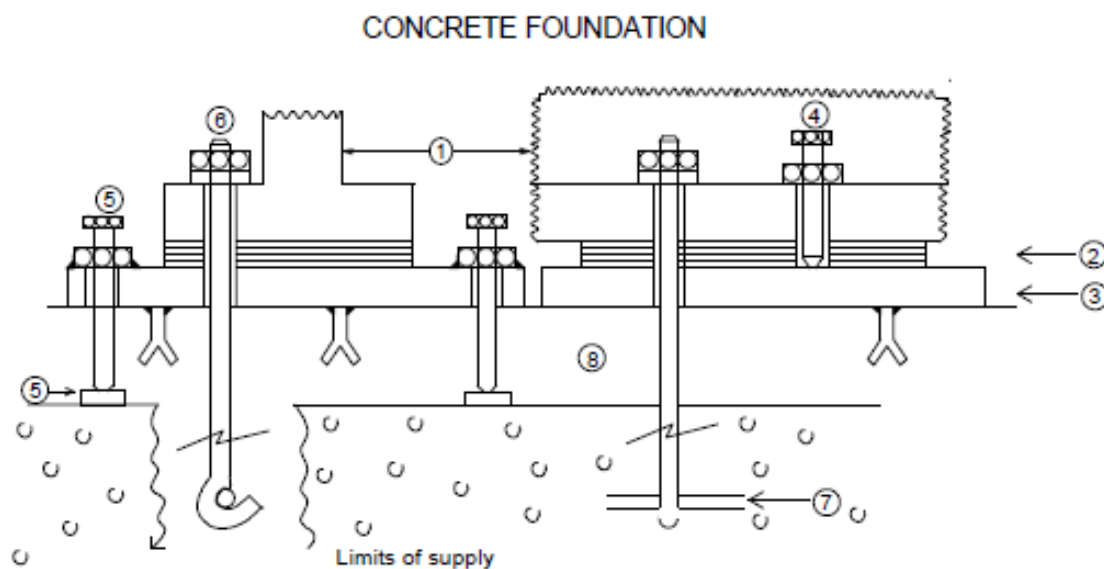
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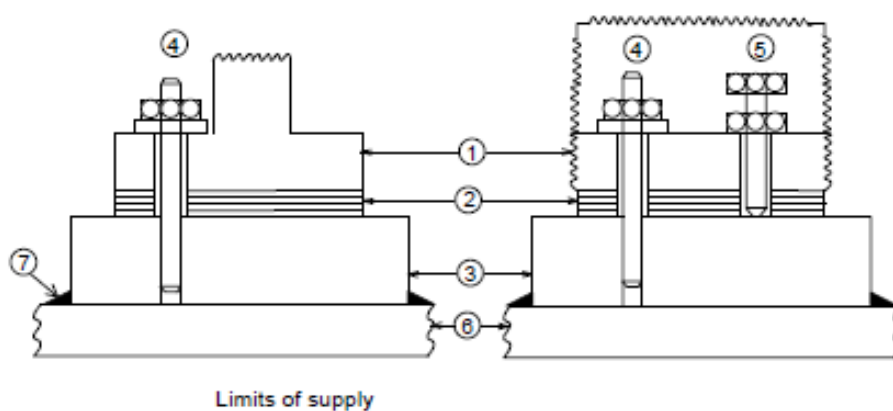
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Appendix 2
Appendix 2 Baseplate installation

SUPPLIER

- ① Base plate
- ② Shims (20 mm min)
- ③ Sole plate (30 mm min)
- ④ Base plate levelling screws
- ⑤ Soleplate levelling screws
- ⑥ Anchor bolts
- ⑦ Anchor bars

CONTRACTOR

- ⑧ Non shrinking epoxy grout

STEEL STRUCTURE FOUNDATION


Limits of supply

SUPPLIER

- ① Baseplate or Gimbals or AVM
- ② Shims (20 mm min)
- ③ Soleplate (50 mm min)
- ④ Anchor bolts
- ⑤ Levelling screws

CONTRACTOR

- ⑥ Deck
- ⑦ Welding

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Appendix 3

Appendix 3 Vendor Document Register (VDR)

The following documents shall be delivered by the Package Vendor. This list is a mandatory base frame but might be extended on a Project basis.

(1) Documents to be supplied with offer.

Item	Designation	(1)
1	GENERAL DOCUMENTS	
1.1	General	
1.1.1	Vendor document register	X
1.1.2	Installation and operating manual index	
1.1.3	Installation and operating manual	
1.1.4	Preservation procedure	
1.1.5	Packing procedure	
1.1.6	Weight data sheets with CoG	X
1.1.7	Special tools list	
1.1.8	Start up and commissioning spare parts list	
1.1.9	Operating spare parts list (with prices)	
1.1.10	Capital spare parts list	
1.1.11	Declaration of conformity for ATEX	
1.1.12	Monthly report	
1.2	Procedures & Reports	
1.2.1	Painting procedure	
1.2.2	Pump performance (API Std 610) test procedure	
1.2.3	Gearbox test procedure (if applicable)	
1.2.4	Lube oil system test procedure (if applicable)	
1.2.5	Mechanical seals test procedure	
1.2.6	Package full load string test procedure	
1.2.7	Package site acceptance test procedure	
1.2.8	Reports for all the above tests ⁽²⁾	
1.3	Manufacturing / Quality / HSE documents	
1.3.1	Quality control plan	
1.3.2	Inspection and test plan	
1.3.3	NDE procedures	
1.3.4	Welding procedures	
1.3.5	Vessel/exchanger code calculation notes	
1.3.6	Material certificates	
1.3.7	All tests and inspections certificates	
1.3.8	QA/ QC (Manufacturing data book) index	

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Item	Designation	(1)
1.3.9	QA/ QC (Manufacturing data book) Dossier	
2	STRUCTURAL	
2.1	Foundation drawing (multipoints, or 3 point) - Plan view	
2.2	Foundation drawing (multipoints, or 3 point) - Elevation view	
2.3	Foundation loadings (static and dynamic loads, permanent and temporary location)	
2.4	Baseplate calculation note including modal analysis and lifting appliance	
2.5	Lifting equipment general arrangement including lifting calculation	
3	MECHANICAL	
3.1	Arrangements	
3.1.1	General arrangement drawing - Plan view	
3.1.2	General arrangement drawing - Elevation view	
3.1.3	General arrangement drawing - Isometric view	
3.1.4	General arrangement drawing including piping (plan, elevation and isometric views)	
3.1.5	Limits of supply table (interface and connection schedule)	
3.1.6	Allowable nozzles loads	
3.1.7	Lube oil console arrangement drawing (if applicable)	
3.1.8	Mechanical Seal System arrangement drawing	
3.2	Data sheets	
3.2.1	Centrifugal pump data sheet (as per data sheets in GS EP MEC 271 appendix)	X
3.2.2	Gearbox data sheet (as per data sheets in GS EP MEC 242 appendix) (if applicable)	X
3.2.3	Couplings (low and high speed) data sheets	
3.2.4	Lube oil system data sheets (as per data sheets in GS EP MEC 281 appendix) (if applicable)	
3.2.5	Mechanical Seal data sheet (as per data sheets in GS EP MEC 270 appendix)	
3.3	P&IDs & Lists	
3.3.1	Lube oil system P&ID (if applicable)	X
3.3.2	Lube oil shaft line P&ID (if applicable)	X
3.3.3	Lube oil purifier P&ID (if applicable)	
3.3.4	Mechanical seal system P&ID	X
3.3.5	Lube oil system P&ID bill of material (if applicable)	
3.3.6	Lube oil shaft line P&ID bill of material (if applicable)	
3.3.7	Mechanical seal system P&ID bill of material	
3.3.8	P&ID symbols table	
3.3.9	Utility list	X
3.3.10	Equipment list	
3.3.11	Lubrication list and schedule	
3.4	Detail drawings	
3.4.1	Pump outline drawing	
3.4.2	Pump cross section drawing	X

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Item	Designation	(1)
3.4.3	Pump sub assemblies drawings (rotor, casing, bearings...)	
3.4.4	Mechanical seal drawing	
3.4.5	Gearbox outline drawing (if applicable)	
3.4.6	Gearbox cross section drawing (if applicable)	
3.4.7	Couplings (low and high speed) drawings	
3.4.8	Nameplate drawings (pump, gearbox...)	
3.5	Calculations & Performances data	
3.5.1	Pump performances curves	X
3.5.2	Pump thrust bearing sizing calculation	
3.5.3	Pump lateral analysis	
3.5.4	Gearbox lateral analysis	
3.5.5	Shaft line torsional analysis	
3.5.6	Package noise data sheet	X
4	ELECTRICAL	
4.1	List of required document as per GS EP ELE 011 , GS EP ELE 111 , GS EP ELE 121 and GS EP ELE 141 . The data sheets will be supplied according to DS EP ELE 111, DS EP ELE 112, DS EP ELE 121 and DS EP ELE 141.	X
4.2	Lube oil heater data sheets	
4.3	Electrical load list	X
5	INSTRUMENTATION	
5.1	General	
5.1.1	Package functional analysis (including pump, motor, VSD... and all auxiliaries)	
5.1.2	Load sharing functional analysis (if applicable)	
5.1.3	Instruments hook ups	
5.1.4	All UCP general arrangements (if applicable)	
5.1.5	VDU displays (HMI video pages) (if applicable)	
5.1.6	PLC software (if applicable)	
5.1.7	Obsolescence dossier	
5.1.8	UCP factory tests procedure (if applicable)	
5.2	Data sheets	
5.2.1	Instruments data sheets	
5.3	P&IDs & Lists	
5.3.1	Vibration and temperature P&ID (if applicable)	X
5.3.2	Instruments list including service, range, trip and alarm levels	
5.3.3	Instruments and electrical cables list	
5.3.4	Modbus list including addressing (if applicable)	
5.3.5	I/O list	
5.3.6	List of software used (if applicable)	

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Item	Designation	(1)
5.4	Diagrams	
5.4.1	Control system architecture (including power supply if applicable)	
5.4.2	Interconnecting diagram (instrumentation and electrical)	X
5.4.3	Earthing diagram	
5.4.4	Logic diagrams	
5.4.5	Cause and effect chart	
5.4.6	Instrument loop diagrams	
5.4.7	UCP terminal strips (if applicable)	
5.4.8	Junction boxes terminal strips	
6	PIPING, VALVES and VESSELS	
6.1	General	
6.1.1	Piping classes	X
6.2	Data sheets	
6.2.1	Minimum flow valve data sheet	X
6.2.2	Oil cooler data sheets (if applicable)	
6.2.3	Lube oil filters data sheets (if applicable)	
6.2.4	PCV data sheet (if applicable)	
6.3	Drawings	
6.3.1	Minimum flow valve drawing	
6.3.2	Oil cooler drawing (general arrangement and internals drawings)	
6.3.3	Lube oil filters drawings (if applicable)	
6.3.4	PCV drawing (if applicable)	
6.4	Calculations & Performances data	
6.4.1	Calculation notes for safety relief valves (if applicable)	

(2) The package string test report shall include pictures of the package (four side views and four isometric views).



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Appendix 4

Appendix 4 Minimum inspection requirements

As a minimum, the following inspections shall be conducted on the package:

- Functional, performance and mechanical running test of all units
- Final inspection
- Final dossier data book review.

Note: This list does not include the inspections to be conducted on each individual component constituting the package.



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Appendix 5

Appendix 5 Deviations to the contractual documents

If deviations are waived during the bid phase, they shall be listed in the following pages in the purchase revision.

The deviation list shall exhibit at least the following:

- Reference of the specification
- Paragraph of the specification
- Description of the deviation
- Reason for deviation
- Vendor proposal
- Company final position.

The deviations that are not accepted by Company shall appear in this list in order to give a complete overview of the technical discussions.

The following list contains pages.

Note: The deviation list might not be attached to this specification but referenced under a project document (as reported below).

Project document reference:

Revision .