



Exploration & Production

GENERAL SPECIFICATION

ROTATING MACHINERY

GS MEC 290

Rotating machines packages

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1. Scope

This specification relates to the packaging of rotating machinery and specifies the minimum design and construction requirements for the equipment that make the package, apart from the main shaft line, which is covered in a separate document.

All deviations from this specification or the documents referred to herein shall be stated in writing. 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 ensuring 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.

2. Reference documents

The reference documents listed below form an integral part of this General Specification. Unless otherwise specified, the applicable version of these documents, including relevant appendices and supplements, is the latest revision published at the EFFECTIVE DATE of the CONTRACT.

Standards

Reference	Title
ASTM F 1941M	Standard Specification For Electrodeposited Coatings on Threaded Fasteners (Metric)
ASTM B 633	Standard Specification For Electrodeposited Coatings of Zinc on Iron and Steel

Professional Documents

Reference	Title
API 671	Special – Purpose Couplings for Refinery Service
API 613	Special Purpose Gear Units for Petroleum, Chemical and Gas Industry Services
API 614	Lubrication, Shaft-Sealing, and Control-Oil Systems and Auxiliaries for Petroleum, Chemical and Gas Industry Services
API 670	Machinery Protection Systems

Regulations

Reference	Title
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
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

Codes

Reference	Title
Not applicable	

Other documents

Reference	Title
Not applicable	

Total General Specifications

Reference	Title
GS COR 350	External protection of offshore and related structures and equipment by painting.
GS COR 351	External protection of structures and equipment by painting. Floating structures.
GS COR 352	Internal protection of equipment by painting
GS COR 354	External protection of onshore structures and equipment by painting.
GS ELE 011	Electrical requirements for packaged units.
GS ELE 079	Electrical apparatus for potentially explosive gas atmospheres.
GS INS 101	Instrumentation engineering, supply and construction general requirements
GS INS 110	Instrumentation for package units
GS MEC 281	Lubrication, shaft sealing and control oil systems for special-purpose applications according to API Standard 614

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

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

Reference	Title
GS PVV 111	Piping design specification
GS PVV 112	Piping material classes
GS PVV 144	Fittings
GS PVV 145	Flanges
GS PVV 175	Internal cleaning of piping and vessels
GS PVV 202	Standard drawings for accessories and equipment of vessels
GS PVV 211	Design and fabrication of pressure vessels according to ASME VIII
GS PVV 402	Standards for exchanger accessories and equipment
GS PVV 411	Shell and tube heat exchangers
GS PVV 412	Plate heat exchangers
GS PVV 415	Design and fabrication of air cooler
GS PVV 611	Welding of pressure containing piping and equipment
GS PVV 612	Piping and equipment subject to severe sour service. Metallurgical and welding requirements
GS PVV 614	Welding of duplex and super-duplex stainless steel
GS PVV 622	Piping and equipment subject to intermediate sour service. Metallurgical and welding requirements
GS SAF 222	Safety rules for machinery and equipment handling hydrocarbon in enclosed area.
GS SAF 312	Guidelines for selecting and installing fire and gas detection systems
GS SAF 331	Carbon dioxide fire extinguishing system
GS STR 103	Design and fabrication of skids and equipment supporting structures.
GS STR 401	Load-out, Sea-fastening, Transportation and installation of Offshore Structures

3. Definitions and abbreviations

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.
SUPPLIER or VENDOR	:	The package Supplier or Vendor.
PACKAGE	:	Prefabricated process or utility self-contained unit, generally able to operate on its own, supplied fully tested and ready for immediate installation.
SPL	:	Spare Parts List

4. General considerations

Environmental conditions for the equipment design are indicated in the Project Job Specification.

4.1 Safety and environment

For Package to be installed in hazardous area:

- Package shall be in accordance with the general specification **GS SAF 222**
- **ATEX European directives 94/9/EC** and **1999/92/EEC** shall be applied.
- For category 3 equipment, certification by Manufacturer is not accepted. A Statement of compliance shall be delivered by a Notified Body.
- Package and all accessories shall bear their own marking, according to the mode of protection used.
- The selection and installation of electrical apparatus shall be in accordance with **GS ELE 079**.
- Unless otherwise specified the gas group shall be IIA and temperature class T3 (200°C).

The Package shall be in accordance with the general specification **GS SAF 222**.

4.2 Name plates Tags & Labels

All major equipment shall be identified by 316L Stainless Steel nameplates attached by 316L Stainless Steel pins or screws. All operating notices, warning notices and nameplates shall be in the English language and as indicated in Job specification.

4.3 Rotation Arrows

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

4.4 Electrolytic Corrosion

Stainless steel shall be positively segregated from carbon steel.

4.5 Painting

Package unit shall be painted according to **GS COR 350**, **GS COR 351**, **GS COR 352** or **GS COR 354** according to site environment.

Stainless steel equipment and rotating machines shall be painted to the SUPPLIER standard (subject to COMPANY approval), taking into account the environment (onshore or offshore).

4.6 Bolting

Bolting shall be as follows:

- For diameter above 24 mm, zinc plated and bi-chromated (Zn12/C/Fe) according to standard **ASTM F 1941M** or **ASTM B 633** and painted, except for machine connecting flanges which will be greased.
- For diameter up to and including 24 mm, bolting shall be of **ASTM A 193 M-96 Gr. B8T** and **ASTM A 194 M-96 Gr. B8 (AISI 321)** Stainless steel as a minimum.

4.7 Miscellaneous

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 electrical generator, electric motors and heaters power cables. Segregation shall be as per **GS INS 110** requirements.
- With flanges for piping, as per **GS PVV 112**.

Interconnecting junction boxes shall be provided with cable gland plates. Cable glands for interconnecting cables shall be provided by the interconnecting cables supplier.

For DC connection (if any), intermediate junction box shall be provided by **VENDOR**, if required to accommodate **COMPANY** interconnecting cables.

All interconnecting piping, including drains, vents, auxiliary fluids connections at skid edge, shall be identified and tagged.

4.8 Vents

Oil vents, piping and associated accessories including demister, flame arrestors, accessible tapping points downstream the demister, shall be designed, made of AISI 316L, provided and installed by **VENDOR**. In the case of gas turbine driver oil vent piping shall be routed into the exhaust of the gas turbine.

Gas vents to atmosphere piping and associated accessories including flame arrestors shall be designed, made of AISI 316L, provided and installed by **VENDOR**. Terminal points shall be located in safe area. Preference for terminal points is given to the air cooler draft area, whenever possible.

4.9 Drains

All drains shall be sized 2" minimum.

Marine vane separator drain shall be routed to plant open drain using a dedicated piping.

Skid drains shall be routed to plant open drain.

Enclosure drains shall be fitted with isolating valve and routed to plant open drain.

Oil tank drains shall be fitted with lockable valve and plug.

5. Package support structure

Skid design shall conform to GS STR 103. However, skid mounting (three points or multi-points) is defined in Project Technical Specification, or subject to mutual agreement between **COMPANY** / **CONTRACTOR** and **VENDOR**.

Anchor bolts, stainless steel shims and jack screws for skid leveling shall be included in the **VENDOR** scope of supply.

Access areas on top of the base frame, shall be covered with non slip decking.

A drip pan with at least one drain point of 2" diameter minimum shall be part of the base frame and routed to the skid edge.

The package skids shall be sufficiently rigid to maintain alignment of the line shaft under all operating condition whether normal, transient and abnormal.

Package lifting accessories, such as lifting beams, slings, etc., shall be included in the VENDOR scope of supply, tested and certified by an approved authority. After test, NDT control shall be performed.

In case of three points skid installation:

5.1 Turbo-compressor (pump)

Two points under the compressor (pump), one point under the gas turbine with stroke limiting device.

5.2 Electric driven compressor (pump)

Two points under the electric motor, one point under the compressor (pump), with stroke limiting device.

5.3 Turbo-generators

Two points under the generator, one point under the compressor, with stroke limiting device.

6. Enclosure (If required)

The enclosure shall comply with **GS SAF 222** requirements.

For offshore and coastal environment, the enclosure shall be made of AISI 316L or 321 stainless steel.

The internal perforated liners shall be made of AISI 316L or 321 stainless steel.

The enclosure shall include side doors and removable panels, to allow equipment removal, if required.

Hinges, rod assemblies and door handles shall be of heavy duty type, made of AISI 316L stainless steel.

Doors shall be fitted with anti-panic handles on the inside.

6.1 Air ventilation air system

The air ventilation system shall comply with **GS SAF 222** requirements.

Damper hinges shall be of heavy duty type and made of AISI 316L Stainless Steel that does not require periodic lubrication.

The air inlet ventilation duct shall be equipped with cleanable, barrier type filters.

6.2 Fire and gas detection systems and fire suppression system

The supply and installation of the Fire and Gas protection systems and fire suppression system shall be included in the VENDOR's scope of supply and shall comply with **GS SAF 222**, **GS SAF 312** and **GS SAF 331** requirements.

7. Instrumentation

Package instrumentation shall comply with **GS INS 110**.

Furthermore, machinery protection and monitoring system shall comply with **API 670** requirements. In particular, Appendix H – typical System arrangement plans shall apply.

SUPPLIER shall provide with its technical proposal a preliminary P&ID.

8. Load Couplings

Couplings shall conform to **API 671**.

For turbo-compressors with output shaft power greater than 10 MW, the power turbine output shaft shall include a torque-meter, with access for torque-meter setting and adjustment. Temperature within the coupling guard shall be limited to 120°C.

In all cases, coupling shall be equipped with rigid spark-proof coupling guard fitted with drain and vent connections, designed to avoid windage effect.

9. Gearbox (if required)

The load gears shall be rated based on recommended AGMA factor and the maximum driver power at minimum site temperature condition.

Gearbox shall be in accordance with **API 613**. Gearbox shall be tested fully in accordance with **API 613**.

Gears shall be hunting type.

Gearbox protection and monitoring system shall comply with **API 670** requirements. In particular, Appendix H – typical System arrangement plans shall apply.

Vibration and temperature monitors shall be either programmed in the package UCP or in a dedicated vibration/temperature monitoring cabinet.

Note: the low and high speed shafts shall be fitted with one key-phaser probe each.

10. Lubrication systems

The lubrication oil systems, shall meet the requirements of **API 614** and **GS MEC 281**.

11. Maintainability

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 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....



For equipment over 25 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 316L stainless steel machined shims
- 3 mm final adjustment shims

These shims are part of the VENDOR scope of supply.

12. Spare parts and special tools

12.1 Commissioning spares

The VENDOR scope of supply shall include sufficient spare parts for commissioning and start-up (including sub-SUPPLIER equipment). A detailed list of commissioning and start-up spare parts shall be provided with SUPPLIER's proposal. Commissioning spare parts shall be shipped together with the main equipment.

12.2 Operational spares

The SUPPLIER's proposal shall include a quotation based on the SPL form for 2 years operational spare parts. CONTRACTOR / COMPANY may place orders for these spare parts based on this quotation.

12.3 Capital / Insurance spares

The SUPPLIER's proposal shall include a quotation based on SPL form for insurance spare parts. CONTRACTOR / COMPANY may place orders for these spare parts based on this quotation.

12.4 Special tools

A detailed list of all special tools required for the installation, commissioning, start-up and maintenance of the equipment shall be included in the SUPPLIER's proposal.

These tools shall:

- Remain the property of COMPANY,
- Include the configuration tools (software and hardware) for UCP maintenance. A field-programming terminal shall be provided,
- Any special lifting facilities.

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.



13. Packing and Preservation

SUPPLIER shall provide a detailed preservation specification for sea transportation and long duration storage (more than 6 months) covering limit flanges, location of desiccants, end-shaft locking and protection, bearings and seals removal, valves position, lube oil system preservation, nitrogen blanketing, etc.....

All flanges and opening shall be sealed with plastic or rubber plugs. Threaded connections shall be capped or plugged for thread protection. Any external components, which may be subject to damage during transit and are not easily protected, shall be removed and packed separately.

Commissioning and two years spare parts, if ordered with main equipment, shall be delivered in separated boxes.