

GENERAL SPECIFICATION

ROTATING MACHINERY

GS EP MEC 032

**Rotating Machine Package Specification
Gas Engine or Electrical Motor driven Reciprocating
Compressor**

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Preamble

1. Scope

1.1 Purpose

This specification defines the minimum design, fabrication, inspection and testing requirements for the supply of the reciprocating compressor 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 reciprocating compressor packages.

1.2 Application

This document applies to the design of reciprocating compressor packages driven by gas engines or electrical motors. It excludes any other type of gas compressor.

1.3 General rules

All deviations from this specification or the documents referred to herein shall be stated in writing in the Appendix 4 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 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.

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 Project Specification shall be attributed a Project reference number with 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 4 of this specification.

This specification will 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 670	Machinery Protection Systems
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 10816-6	Mechanical vibration - Evaluation of machine vibration by measurements on non rotating parts - Part 6: Reciprocating machines with power ratings above 100 kW
ISO 15550	Internal combustion engines - determination and method for the measurement of engine power

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
ISO 780	Packaging. Pictorial marking for handling of goods
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
NFPA 37	Standard for the installation and use of stationary Combustion Engine and Gas Turbines
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
US MIL STD-2073-1 E	Standard Practice for Military Packaging

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 4. 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 170	Materials for Sour Service (Upstream Applications) Specification for design
GS EP COR 350	External protection of offshore and coastal structures and equipment by painting
GS EP COR 352	Internal protection of 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 Topsides applications

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Reference	Title
GS EP ECP 103	Process sizing criteria - paragraph 7 "Vessels sizing criteria"
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
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 261	Packaged Reciprocating Compressors for Oil and Gas Production Services According to ISO 13631
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

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Reference	Title
GS EP PVV 146	Bolting for piping
GS EP PVV 147	Gaskets for piping and vessels
GS EP PVV 211	Design and fabrication of pressure vessels according to ASME VIII
GS EP PVV 411	Shell and tube heat exchangers
GS EP PVV 412	Plate and frame heat exchanger
GS EP PVV 415	Design and fabrication of air cooler
GS EP PVV 611	Welding of pressure containing piping and equipment
GS EP SAF 050	Fire and Gas System and Fire Suppression System for Packaged Rotating Machinery Enclosures
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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In case one of the previous General Specifications is completed with one or more Project specific detailed specification(s), then these detailed specifications (and their respective revision) shall be added to the following list. No amendment will be made to the GS EP MEC specifications since these documents are already amended in the paragraph 4.1 of this specification.

Project Documents (to be completed by Company or Contractor)

	Designation	Rev	Reference
1	Compression PFD (*)		
2	Compression area layout (*)		
3	Project specification for electrical requirements for packaged units (*)		
4	Instrument tagging specification		
5	Instrument list database specification		

Note: All the documents identified by (*) shall be available along with this specification for the issue for inquiry and for purchase.

Project data sheets are listed in paragraph 5.

3. Scope of supply and exclusions

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.

-  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	Compressor including but not limited to:				
1.1.1	Reciprocating compressor	As per data sheet listed in paragraph 5 and GS EP MEC 261 paragraph 6 and GS EP COR 170 for sour application.	X		
1.1.2	Distance pieces	As per data sheet listed in paragraph 5 and GS EP MEC 261 paragraph 6.9.	X		
1.1.3	Nitrogen generator	Membrane type for distance piece purging as per GS EP MEC 261 paragraph 6.9.	Option		
1.1.4	Crankcase lube oil system	As per data sheet listed in paragraph 5 and GS EP MEC 261 paragraph 6.11.	X		
1.1.5	Cylinder lubrication	Cylinder lubrication distribution system including separate oil reservoir as per data sheet listed in paragraph 5 and GS EP MEC 261 paragraphs 6.12.1 and 6.12.2.	X		
1.1.6	Oil coolers	As per data sheet listed in paragraph 5, GS EP PVV 411 , GS EP PVV 412 , or GS EP PVV 415 and GS EP MEC 261 paragraph 9.	X		
1.1.7	Capacity control	As per data sheet listed in paragraph 5 and GS EP MEC 261 paragraph 7.	X		
1.2	Pressure vessels including but not limited to:				
1.2.1	Separators	Inlet, inter-stages and final process gas separators as per data sheet listed in paragraph 5 and GS EP ECP 103 paragraph 7 and GS EP MEC 261 paragraph 10.2.	X		
1.2.2	Pulsation bottles	Suction and discharge pulsation suppression bottles on each stage as per data sheet listed in paragraph 5 and GS EP MEC 261 paragraph 10.3.	X		

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#	Item	Description	Required	Tag	Quantity
1.2.3	On skid gas Coolers (for shell and tube type only)	Inter-stages and final process gas coolers as per data sheet listed in paragraph 5, GS EP PVV 411 and GS EP MEC 261 paragraph 9. 	Off skid 	X	
1.3	Driver including but not limited to:				
1.3.1	Driver	Gas engine or electrical motor as per data sheet listed in paragraph 5. Rating per GS EP MEC 101 . Electrical motor as per GS EP ELE 111 .  Gas engine  Electrical motor	X		
1.3.2	Fuel gas system	As per data sheet listed in paragraph 5 and including fuel gas separator/filter as per GS EP MEC 261 paragraph 8.2.10.	For gas engine		
1.3.3	Starting system	As per data sheet listed in paragraph 5.	For gas engine		
1.3.4	Gas engine enclosure	Including ventilation, gas detection system, fire detection system and extinguishing system as per paragraph 4.2.3 of this specification and as per GS EP SAF 050 .	Option		
1.3.5	Enclosure fire extinguishing system	As per GS EP SAF 050 .  Water mist  CO ₂	Option		
1.3.6	Air intake system	Including filter and ductings as per data sheet listed in paragraph 5 and GS EP MEC 261 paragraph 8.2.4.	For gas engine		
1.3.7	Exhaust system	Including ductings, silencer and expansion bellow as per data sheet listed in paragraph 5 and equipped with emission measurement sampling port as per GS EP MEC 261 paragraph 8.2.7.1.	For gas engine		
1.3.8	Lube oil system	As per data sheet listed in paragraph 5 and including oil level control device as per GS EP MEC 261 paragraph 8.2.9.	For gas engine		
1.3.9	Cooling system	As per data sheet listed in paragraph 5, GS EP PVV 411 , GS EP PVV 412 , or GS EP PVV 415 and GS EP MEC 261 paragraph 9.	For gas engine		
1.4	Power transmission including but not limited to:				
1.4.1	Coupling	As per paragraph 4.2.4 of this specification, data sheet listed in paragraph 5.	X		
1.4.2	Coupling Guard	As per paragraph 4.2.4 of this specification, data sheet listed in paragraph 5.	X		
1.5	Baseplate including but not limited to:				
1.5.1	Common baseplate	Common for all the package except coolers as per paragraph 4.2.2 of this specification and GS EP MEC 261 paragraph 15.	X		
1.6	Piping and valves including but not limited to:				
1.6.1	All on skid piping	As per data sheet listed in paragraph 5 and paragraph 4.2.8.1 of this specification.	X		

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#	Item	Description	Required	Tag	Quantity
1.6.2	Lube oil piping	Stainless steel AISI 316L downstream filter as a minimum as per GS EP MEC 261 paragraph 11.14.2 and paragraph 4.2.8.1 of this specification.	X		
1.6.3	Drain and vent piping	As per GS EP MEC 261 paragraph 11.17 and paragraphs 4.2.8.2 and 4.2.8.3 of this specification.	X		
1.6.4	Automatic, manual and relief valves	As per data sheet listed in paragraph 5, GS EP PVV 142 , and paragraph 4.2.6 of this specification.	X		
1.6.5	Start up screen	Start up strainer as per GS EP MEC 261 paragraph 11.13.	X		
1.6.6	Battery limit flanges	As per GS EP PVV 112 or Project piping classes if available and equipped with blind flanges for transportation.	X		
1.6.7	Heat tracing and insulation	As per GS EP MEC 261 paragraph 11.2.	Option		
1.7	Instrumentation including but not limited to:				
1.7.1	On skid instrumentation	As per data sheet listed in paragraph 5 and paragraph 4.2.6 of this specification.	X		
1.7.2	Gas temperature control	On each compression stage discharge as per GS EP MEC 261 paragraph 6.3.	X		
1.7.3	Oil level control	Low oil level alarm for the engine and the compressor as per GS EP MEC 261 paragraph 14.3.	X		
1.7.4	Terminal junction boxes	Located at skid edge as per GS EP INS 101 and GS EP INS 107 .	X		
1.7.5	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		
1.7.6	Instrumentation cable trays	AISI 316L cable trays with covers between instruments and skid mounted junction boxes/ local panel and empty cable trays for the multi-core cables (supplied and installed by other) between the terminal junction box and skid edge. As per GS EP MEC 261 paragraph 12.6 and GS EP INS 107 .	X		
1.7.7	Instrumentation cables	Between Instruments and skid mounted terminal junction boxes/local panel as per GS EP ELE 161 and GS EP INS 107 .	X		
1.7.8	Local panel	As per data sheet listed in paragraph 5 and GS EP MEC 261 paragraph 13.2.	X		
1.8	Electrical including but not limited to:				
1.8.1	Electrical system	As per data sheet listed in paragraph 5 and paragraph 4.2.7 of this specification.	X		
1.8.2	Electrical cable trays	All necessary cables trays with covers made of AISI 316L between all electrical consumers mounted on skid and the skid edge. As per GS EP MEC 261 paragraph 12.6.	X		

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#	Item	Description	Required	Tag	Quantity
2	OFF SKID EQUIPMENT (shipped loose)				
2.1	Process gas coolers including but not limited to:				
2.1.1	Process gas coolers	Inter-stages and final process gas coolers as per data sheet listed in paragraph 5, GS EP PVV 411 or GS EP PVV 415 and GS EP MEC 261 paragraph 9. Water coolers  Air coolers 	On skid 	X	
2.2	Variable speed drive system including but not limited to:				
2.2.1	HV Variable speed drive	As per data sheet referenced in paragraph 5 of this specification and as per GS EP ELE 121 .	Option		
2.2.2	Power transformer	As per data sheet referenced in paragraph 5 of this specification and as per paragraph 4.17 of GS EP ELE 121 and GS EP ELE 141 .	Option		
2.2.3	Harmonic filter	If required, as per GS EP ELE 121 .	Option		
2.3	Valves, instruments and piping including but not limited to:				
2.3.1	Flame arrestors	As per paragraph 4.2.8.2 of this specification.	X		
2.4	Controls and instrumentation including but not limited to:				
2.4.1	UCP	UCP including PLC for control/safety and a separate one for F&G, panel mounted HMI. As per GS EP INS 110 , data sheet listed in paragraph 5, paragraph 4.2.6 of this specification and GS EP MEC 261 paragraph 13.2. 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		
2.5	Spare parts and special tools including but not limited to:				
2.5.1	Spare parts for commissioning and start up	Detailed scope is given in the paragraph 8.1.1 of this specification.	X		
2.5.2	Capital spare parts	Detailed scope is given in the paragraph 8.1.2 of this specification.	Option		1 set
2.5.3	Special tools	Detailed scope is given in the paragraph 8.2 of this specification.	X		1 set
3	MISCELLANEOUS				
3.1	Base plate anchors and shims	As per paragraph 4.2.2 of this specification and GS EP MEC 261 paragraph 15.	X		
3.2	Off skid equipment anchors and shims	All anchors and shims for all off skid equipment supplied by SUPPLIER.	X		
3.3	Access platform, walkways, ladders and handrails	All devices required for access for operation and maintenance as per GS EP MEC 261 paragraph 15.4 and paragraph 4.2.12 of this specification.	X		
3.4	Skid lifting devices	As per paragraph 4.2.2.3 of this specification and GS EP STR 103 .	X		

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#	Item	Description	Required	Tag	Quantity
3.5	Painting and coating	As per data sheet listed in paragraph 5 and paragraph 4.2.9 of this specification.	X		
3.6	Personal protection and hot surface insulation	As per paragraph 4.2.10.1 of this specification.	X		
3.7	Packing and preservation	As per paragraph 9 of this specification.	X		
3.8	Documentation	Documentation according to Appendix 3 of this specification.	X		
3.9	Earthing	Earthing design and implementation as per GS EP ELE 031 and GS EP INS 107 .	X		
3.10	Maintenance laptop	Including software for UCP configuration.	Option		
3.11	Backup	Complete backup hard disk with application software, PLC program, HMI and any firmware prior to shipment.	X		
3.12	Software	OEM CD/DVD for any software used with full licenses.	X		
3.13	Specific climate considerations	☐ Tropicalization ☐ Winterization ☐ None	X		
4	TESTS				
4.1	Factory tests				
4.1.1	Compressor	Compressor no load mechanical running test, as per manufacturer's standard test procedure.	X		
4.1.2	Driver	☒ Gas engine performance test as per ISO 15550 , test method 1. ☐ Electrical motor test as per GS EP ELE 111	X		
4.1.3	HV variable speed drive	As per paragraph 7 of GS EP ELE 121 .	Option		
4.1.4	Power transformer	As per paragraph 8 of GS EP ELE 141 .	X		
4.1.5	UCP	UCP integration and communication test at sub-Vendor premise. As per paragraph 7 of this specification, and paragraph 7.4 and Appendix 5 of GS EP INS 110 .	X		
4.1.6	Complete unit no load test	As per paragraph 7.2 of this specification.	X		
4.1.7	Complete unit full load test	As per paragraph 7.3 of this specification.	Option		
4.1.8	Noise and vibration tests	As per paragraphs 7 of this specification.	X		
4.2	Site acceptance tests				
4.2.1	Complete unit test	As per paragraph 7.7 of this specification.	X		
4.2.2	Fire suppression system test	As per paragraph 3.5.2 of GS EP SAF 050 .	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:

- Gaskets, counter flanges and bolting for connecting flanges at battery limits of Vendor's supply
- 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 261		
Paragraph	Data Sheets	Project
5.3		Drawings as per Appendix 3 of this specification.
5.4	X	Sound pressure level as per paragraph 4.2.10.2 of this specification.
5.5	X	Area classification as per paragraph 6.1 of this specification.
5.6	X	Site conditions as per paragraph 6.1 of this specification.
6.1.1	X	
6.1.2	X	
6.9.1.1	X	
7.1	X	
7.2	X	
7.3	X	
7.4.2	X	
7.4.3	X	
7.4.4	X	
7.5.2	X	
7.5.3	X	
7.6.3	X	
7.7	X	

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Paragraph	Data Sheets	Project
8.1	X	
8.2.3.2 b)	X	
8.2.3.3 b)	X	
8.2.3.3 c)	X	
8.2.6	X	
8.2.7.1	X	
8.2.7.2	X	
8.2.7.2 a)	X	
8.2.10 e)		Fuel gas heater required: ☐ Yes ☐ No
8.2.11	X	
8.3.1	X	
8.3.2	X	Motor design as per paragraph 4.2.7 of this specification.
8.3.3	X	Power supply as per paragraph 6.2 of this specification.
9.3.5	X	
9.5.4		Air cooler design as per paragraph 4.2.8.1 of this specification and GS EP PVV 415 .
9.6.8	X	
9.6.9		Site conditions as per paragraph 6.1 of this specification.
10.1.1		Pressure vessels design as per paragraph 4.2.8.1 of this specification, GS EP PVV 211 and GS EP PVV 611 .
10.1.5		Piping as per project piping classes if any or per GS EP PVV 112 and paragraph 4.2.8.1 of this specification.
10.2.5	X	
11.1.4	X	Piping scope of supply as per paragraph 3.1 of this specification.
11.8		Piping as per project piping classes if any or per GS EP PVV 112 and 4.2.8.1 of this specification.
11.10	X	
11.15.1	X	
12.2		Power supply as per paragraph 6.2 of this specification.
12.5	X	Site conditions as per paragraph 6.1 of this specification. Electrical equipment design per paragraph 4.2.7 of this specification.
13.1.1	X	Utilities as per paragraph 6.2 of this specification.
13.2.3	X	
13.3.1	X	
13.3.2	X	
13.3.4	X	
13.3.6	X	
14.1	X	

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GS EP MEC 261

Paragraph	Data Sheets	Project
14.3	X	
14.6.3	X	
16.2		Painting as per paragraph 4.2.9 of this specification.
17.2.1	X	
17.4.2		Testing as per paragraph 7 of this specification.
17.4.4	X	
19.3	X	Preservation and packing as per paragraph 9 of this specification.
19.4.1	X	
21.1.3	X	Site conditions as per paragraph 6.1 of this specification.
21.9.3	X	

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 6.1 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.

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.

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The package enclosure will be as follows:

- Classified as safe area (I.E.C. codes) when pressurization and ventilation are in operation with no presence of gas.
- Classified as Zone 1 area (I.E.C. codes) category 2G as per ATEX Directives upon ventilation failure and gas detection.

However, the following equipment and systems shall be certified ATEX **Ex II 2G** and CE marked:

- Unit enclosure ventilation systems
- Fire and gas detection and monitoring systems
- Fire dampers with associated power supply distribution panels
- Fire suppression systems
- Emergency lube oil systems with associated power distribution panels, if any
- Emergency lightings.

4.2.2 Package configuration
4.2.2.1 Number of package base plate supporting points and type

Whatever the type of supporting structure is, package base plate involving reciprocating compressors shall always be designed with multipoint rigid supports and jacking bolts for leveling purpose.

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

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 by Contractor prior to welding the soleplates.

Refer to Appendix 2 for details.

4.2.2.2 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.

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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).

4.2.2.3 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 Enclosure and associated systems

This chapter only applies to machinery enclosures.

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

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

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

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.

4.2.3.1 Air ventilation system

The complete air ventilation system shall be made of AISI 316L stainless steel.

Damper hinges shall be of heavy duty type and made Steel that does not require periodic greasing.

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

Refer to Project documents for General Arrangement layout. Scope of supply for ducting shall be clarified during Bid evaluation.

Fresh air intakes to any machinery enclosure shall be located in a safe area, **at least 2 meters away from a hazardous area**, and should be up the prevailing wind from the rest of the installation.

Machinery enclosure Ventilation air exhaust shall be located 5 meters at least from any machinery combustion air exhaust termination.

Machinery combustion air exhausts shall meet the following criteria:

- Be located 2 meters away from any hazardous area
- Be completely heat insulated with an appropriate thermal insulation in accordance with Hazardous Area classification.

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4.2.3.2 Enclosure

This section is applicable to units composed of gas engines, their auxiliaries (fuel system, cooling system, lube system, start pack, ventilation, etc.) and driven equipment.

In the absence of any particular project specification or local regulation, Company's design shall be based on [NFPA 37](#) and all requirements applicable to Diesel engines for layout, ventilation, prevention of hazards, shutdown, passive protection and active fire-fighting are valid.

For gas engine driven packages to be located in a **Zone 2 hazardous areas**, gas engine shall be installed in an enclosure protected by internal ventilation.

Enclosure internal ventilation shall be designed to:

- Provide temperature control to ensure the intended operation of equipment is achieved
- Control hazardous zones and promote the dilution of flammable gas, vapour and mist leaks.

Enclosure internal ventilation shall be insured by a main ventilation system backed up by a standby ventilation system.

Main ventilation system fan may be either directly driven by the gas engine when gas engine cooling is by radiator or electric driven or hydraulic driven.

Standby ventilation shall be sized to provide adequate ventilation, typically a uniform ventilation rate of at least 12 volumetric air changes per hour with no stagnant areas.

Gas engine shall be equipped with:

- A combustion air shut-off valve with limit switch and manual reset that shall be triggered in case of engine overspeed
- A spark arrester with an ash removal trap.

4.2.3.3 Lighting

The lighting inside enclosed areas, such as package enclosure shall be designed for routine maintenance and inspection. It shall be permanent and supplied from the essential switchboard.

An emergency lighting shall be provided with dedicated battery sets suitable for use in Zone 1 hazardous area to allow for escape.

4.2.3.4 Fire & Gas system and fire suppression system (for gas engine driven packages)

The fire and gas system (FGS) and the fire suppression system (FSS) of the package shall comply with [GS EP SAF 050](#).

4.2.4 Load couplings

Couplings shall conform to [GS EP MEC 240](#).

4.2.5 Installation

The package shall be installed as per [GS EP MEC 292](#) requirements.

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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 environmental 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**.

4.2.6 Instrumentation

The package instrumentation shall comply with **GS EP INS 101**, **GS EP INS 102**, **GS EP INS 107** and **GS EP INS 110** and control valves (including recycle valves) shall comply with **GS EP INS 120**. Actuated on-off valves shall comply with **GS EP PVV 142** and **GS EP INS 137**.

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 **API Std 670** requirements. In particular, Appendix H - typical System arrangement plans shall apply.

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 a sufficient height above the ground (typically 1.6 m) in order to ease maintenance operations and avoid mechanical damage.

4.2.6.1 General

These packages are categorized as "P3 type Package".

4.2.6.2 Package control system configuration

Each package unit shall be supplied with its dedicated UCP including the control and safety PLC, compliant with **GS EP INS 110** and **GS EP INS 135** requirements.

In addition, UCP shall include following systems:

- A separate PLC for F&G functions (if applicable)
- A HMI
- An emergency back-up system
- Redundant incoming power distribution and conversion (two incoming UPS feeders)
- A vibration monitoring system.

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

Signals from any on package skid instrument required by the package control or F&G system, 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

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Contractor specifications. All spare wires shall be earthed through individual terminals, bonding is not permitted.

4.2.6.3 Package control system philosophy

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

- Sequencing (including automatic operation of compressor train suction and discharge valves, blowdown valve, start up bypass valve, ...)
- Process monitoring and control (including all the instrumentation and devices included in the scope of supply)
- Protection
- Monitoring and Display and Maintenance Functions (refer to **GS EP INS 110** relevant paragraphs).

4.2.7 Electrical

The design, manufacture, inspection and testing of electrical equipment provided with the packaged unit shall comply with **GS EP ELE 011** and **GS EP ELE 111**.

4.2.8 Piping, valves and vessels

4.2.8.1 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**.

Piping, tubing and pressure vessels shall be designed, fabricated, tested and installed in accordance with the applicable Project specifications.

However, Manufacturer standard piping specifications are acceptable in the package for all utility lines (oil, water, air, nitrogen) and for fuel gas lines after the Shut-Off Valve. 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.

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.

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Each air-consuming instrument shall be provided with an AISI 316L filter regulator fitted with an AISI 316L pressure gauge and an AISI 316L 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** § U.1 shall be certified by an authorized agency agreed by the Company. ASME stamp is not required.

4.2.8.2 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.

Gas vents to atmosphere shall be provided with flanged flame arrestors with internals made of AISI 316L stainless steel.

4.2.8.3 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.

Drains shall be routed to plant hazardous open drain by Contractor.

4.2.9 Painting

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

4.2.10 Health Safety and Environment

4.2.10.1 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. Compressor cylinders shall not be insulated.

Turbocharger, exhaust manifold and combustion air exhaust ducting located in a restricted area shall be insulated in such a way to limit their skin temperature at 80% of the ignition point temperature, of the hydrocarbon mixture that can be present in the Hazardous area. By default, the surface temperature shall not exceed 200°C (corresponding to ATEX requirement for T3 skin temperature).

4.2.10.2 Noise level

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

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All efforts shall be deployed to limit the average sound pressure level around the compressor 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 reciprocating compressor.

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:

- Reciprocating compressor package
- Driver inlet filter and exhaust
- Lube oil air coolers, if located outside the main package skid
- Oil console(s), if located outside the main package skid.

4.2.11 Miscellaneous

4.2.11.1 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 of AISI 321 Stainless steel as a minimum
- Piping bolting shall be in compliance with **GS EP PVV 112** and **GS EP PVV 146**.

4.2.11.2 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 compressor 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 junction boxes shall be provided with cable gland plates and associated cable glands.

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

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.

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

4.2.11.3 Name plates 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 language and language.

4.2.11.4 Rotation arrows

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

4.2.12 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 316L stainless steel machined shims
- 3 mm AISI 316L stainless steel final adjustment shims.

These shims are part of the Vendor scope of supply.

4.2.13 Inspections

The inspections shall be conducted according to the Project ITP. The weight control shall be performed as per **GS EP STR 001** for offshore packages.



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4.2.14 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 Compressor package

Reference / Revision: /

5.2 Electrical motor

Reference / Revision: /

5.3 Variable speed drive

Reference / Revision: /

5.4 Power transformer

Reference / Revision: /

5.5 Noise

Reference / Revision: /

5.6 Weight

Reference / Revision: /

5.7 Other 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

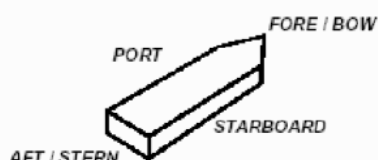
Equivalent static pressure (mbar)

CLASSIFICATION TYPE AREA
OPERATIONAL DESIGN CONDITIONS

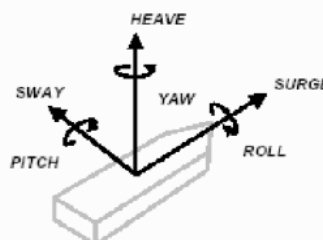
Project Phase:	During towing	On site	On site	
Condition:	Dry	Operating	Damaged	
Longitudinal acceleration (Surge)				m/s ²
Transversal acceleration (Sway)				m/s ²
Vertical acceleration (Heave)				m/s ²
Trim angle (Pitch)				°
List angle (Roll)				°

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



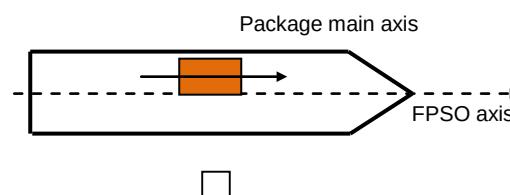
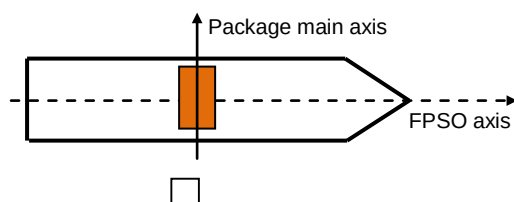
FPSO Orientation



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:

UCP Normal Power Regime:

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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Type	HP	LP	
Max operating temperature			°C
Normal temperature			°C
Max operating pressure			Barg
Normal pressure			Barg

FUEL GAS

Type	Normal	Backup	
Max operating temperature			°C
Normal temperature			°C
Max operating pressure			Barg
Normal pressure			Barg

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7. Tests

The scope of this chapter is to describe the tests to be carried out on the completely assembled compressor package. With the exception of the site acceptance test, these tests shall be conducted before the shipment of the package to the site.

The scope of these tests is to verify the satisfactory performance of the compressor and of the driver, to demonstrate the satisfactory mechanical behavior of the complete compression train under full load conditions and to demonstrate the functionality of the main auxiliary systems of the package.

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

- Pre-test activities
- Compression train no load. This activity shall include the functional test of all the main auxiliary systems of the package and package vibrations measurements according to and if required by **GS EP MEC 300**.
- Optional compression train full load string test in full speed, full power, full pressure and full temperature conditions on the first unit only. This activity shall include the functional test of all the main auxiliary systems of the package and package vibrations measurements according to and if required by **GS EP MEC 300**.
- One fully assembled package shall be weighted before packing and shipment (except particular requirements of Project ITP).

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

- Gas engine (if applicable) fully assembled with all the relevant auxiliaries: enclosure, air inlet duct with filters chamber and silencers, exhaust system with duct and silencers, ventilation system, gas detection and fire suppression systems, starting system, fuel gas system and associated instrumentation
- Electric motor (if applicable) fully assembled with all the relevant auxiliaries including but not limited to pressurization box, cooler, main terminal box
- HV Variable speed drive (if applicable)
- Power transformer (if applicable)
- Compressor(s) fully assembled including all the auxiliary lube oil piping
- Process equipments (gas cooler and separators) and anti pulsation bottles, fully assembled and supported.
- Common base plate fully assembled
- Couplings and torque meter (if applicable)
- Lube oil console including lube oil coolers. Company shall be consulted in case Vendor would intend to conduct the test without the job lube oil coolers
- Lube oil console interconnecting piping
- Driver and compressor control panels (UCP) including fire and gas system if any

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- All the instrumentation
- All the support structures for combustion and ventilation air systems and for exhaust system if any.

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

- Gas analyzer
- 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 compressor package test procedure for Contractor quick reference during the test:

Gas Engine (if any)

Lube oil type			
	Unit	Min	Max
Lube oil pressure	barG		
Lube oil temperature	°C		
Gas engine speed range	rpm		
Gas engine 100% speed	rpm		

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Electric motor (if any)

Lube oil type			
	Unit	Min	Max
Lube oil pressure	barG		
Lube oil temperature	°C		
Electrical motor speed range (if applicable)	rpm		
Electrical motor 100% speed			
		Alarm	Trip
Shaft radial vibration unfiltered peak to peak	µm		
Journal bearings white metal temperature	°C		
Thrust bearings white metal temperature	°C		

Compressor

Lube oil type (crankshaft)			
	Unit	Min	Max
Lube oil pressure	barG		
Lube oil temperature	°C		
100% speed	rpm		
Maximum continuous speed	rpm		
Minimum operating speed	rpm		

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
- Equipment tagging and labeling check

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- Mechanical equipment alignment check
- Leakage tests
- Lube oil systems flushing and cleanliness tests
- Verification of the dynamic stiffness of the test bench as per **GS EP MEC 300**.

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 Compression train no load test

This test shall be carried out to demonstrate the satisfactory mechanical behavior of the complete compression train under no load or part load conditions and to demonstrate the functionality of the main auxiliary systems of the package, including valve sequences.

If more than one identical compressor packages are supplied, this test shall be carried out on all the units (except the first one if optional full load test is performed).

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

- 1 - Cold start up of the unit with minimum lube oil temperature (permissive to start).
- 2 - For variable speed package(s), increase the speed up to compressor(s) minimum operating speed (MOS) and take a complete set of mechanical readings. For fixed speed package, increase the speed up to compressor(s) nominal operating speed (NOS) and take a complete set of mechanical readings, then go to step 4.
- 3 - For variable speed package(s), increase the speed by 10% increments up to compressor(s) maximum continuous speed (MCS) and take a complete set of mechanical readings for each speed increment.
- 4 - After complete temperature stabilization, run the compressor train for 1 hour minimum at MCS (or NOS) and no or part load conditions.
- 5 - Trip, wait 30 minutes, and restart the unit bringing the speed up to MCS (or NOS). The trip may be obtained simulating a train over speed, a lube oil low pressure etc.
- 6 - Run at MCS (or NOS) for minimum 30 minutes. Take a complete set of mechanical readings every 10 minutes.
- 7 - Shut down the unit by a normal stop.

During this test, base plate vibrations shall be measured and recorded according to and if required by **GS EP MEC 300**.

7.3 Compression train full load test

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

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If more than one identical compressor packages are supplied, this test is optionally carried out on the first unit only.

If the option is selected, the full load test procedure will be mutually agreed at bid stage.

During this test, base plate vibrations shall be measured and recorded according to and if required by **GS EP MEC 300**.

Noise measurements shall be performed when unit is at full load, either during the factory full load test if the option is selected, or during the site acceptance test.

Noise measurement shall be performed in accordance with **GS EP MEC 300** for all equipment.

7.4 Electrical

For electrical motor driven packages, 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.

7.5 Post test inspections

After the complete package string test completion, the following shall be inspected:

- On the compressor: bearings
- On the package: oil filters cleanliness.

7.6 Test schedule

The different tests described in the previous paragraphs may be carried out in different days depending on their duration but the compression train full load test shall be the first one.

Nevertheless each test, as specified in the relevant paragraph, shall be carried out with no interruption during the same day.

7.7 Site acceptance test

All packages shall be submitted to site acceptance tests including a performance test done with the field process instrumentation to check that the packages comply with the Exhibit D guarantees.

Supplier 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:

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7.7.1 Pre-test activities

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

- Lube oil circuit flushing
- Alarm and shutdown functional checks
- Calibration of all set points of instruments and controls
- Control loops checks
- Serial links checks
- Vibration tests.

The tests are carried out by the Contractor under the responsibility of the Vendor.

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

7.7.2 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 a 72 continuous running hour with actual process gas in export mode.

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

- Compressor performances evaluation
- Electric motor evaluation if any
- Gas engine performances evaluation if any
- Evaluation of the fuel gas consumption and power delivered by the gas engine if any (and absorbed by the compressor) with the field installed instrumentation and cross checked with the actual performance curves and the power recorded by the torquemeter (if available)
- 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. This run will be done after the compressor thermodynamic performances evaluation
- Noise measurements shall be performed when unit is at full load during the site acceptance test if it had not been realized during the optional factory full load test. Noise measurement shall be performed in accordance with **GS EP MEC 300** for all equipment.
- Verification of the dynamic behavior of the speed/pressure control loop (if any):
 - When process is stable, the gap between measurement and set point is to be within + or - 2% of the set point
 - When a step increase of 10% of measurement occurs, the gap between measurement and set point is to be within + or - 2% after 5 seconds.

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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.

Note: If the process gas is not available at the time of the test, the Company shall be consulted to evaluate how to conduct the test in these particular conditions.

7.7.3 Post-test activities

After the SAT, the following activities shall be performed:

By the Contractor: Removal of the compressor temporary suction strainer.

By the Vendor: Supply of a detailed SAT report including as a minimum the following elements:

- List of the instruments used during the test
- Gas analysis reports
- Test data points log sheets
- Thermodynamic calculations summary for each test data point (including mass and volume flow, head, efficiency, power and associated calculated gas thermodynamic data)
- Summary chart of the package performances converted from the test to the Exhibit D conditions.

7.8 Acceptance criteria

The acceptance criteria shall be those indicated in the Exhibit D of the Contract.

Vibration limits shall be in accordance with following table:

Component	Standard	Classification number	Vibration acceptance criteria
Electrical motor	ISO 10816-6	1	4.46 mm/s (r.m.s.)
Compressor	ISO 10816-6	4	17.8 mm/s (r.m.s.)
Gas engine	ISO 10816-6	To be mutually agreed	
Baseplate	N/A	N/A	7.5 mm/s (r.m.s.)

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

Supplier shall provide the spare part lists on Company SPIR forms, fully filled up. Company will provide electronic format of these SPIR 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.

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

Spare parts shall be separately crated from package loose items.

8.1.1 Commissioning and start up spare parts

Supplier shall include in the scope of supply spare parts for pre-commissioning, commissioning and start up covering the whole scope of supply.

As a minimum the following spare parts shall be included in the Supplier scope of supply:

- Recommended spare parts for driver
- Recommended spare parts for driven equipment
- Recommended spare parts for any auxiliaries of the here above machinery's
- Ten (10) sets of filter cartridges for any filters of any oil systems, part of the scope of supply
- Ten (10) sets of filter cartridges for any filters of the fuel gas system, if any
- For the UCP Control Panel:
 - One (1) power supply card
 - One (1) digital input card
 - One (1) analogue input card
 - One (1) digital output card
 - One (1) analogue output card
 - One (1) communication interface card.
- For the UCP fire and gas system:
 - One (1) FG detector of each type
 - One (1) FG power supply card
 - One (1) FG digital input card

- One (1) FG analogue input card
- One (1) FG digital output card.
- For the UCP machinery vibration system:
 - Five (5) sensors of each type
 - One (1) monitoring power supply card
 - One (1) monitoring card of each type.
- Miscellaneous:
 - Five (5) IS barriers of each type
 - Five (5) relays of each type
 - Two (2) fuses of each type
 - One (1) UCP HMI screen.

8.1.2 Capital spare parts

The following capital spare parts shall be included in the Supplier scope of supply:

- **For reciprocating compressor:**
 - One (1) set of pistons
 - One (1) crankshaft
 - One (1) set of liners, if any
 - One (1) set of piston rods
 - One (1) set of cross head bearings
 - One (1) set of pistons rings
 - One (1) set of seals
 - One (1) set of main bearings.
- **For couplings:**
 - One (1) coupling.
- **For lube oil system:**
 - One (1) set of AC lube oil pump and motor, if any
 - One (1) set of DC lube oil pump and motor, if any.
- **Main electric motor:**
 - One (1) set of sleeve bearings.

8.2 Special tools

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

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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 compressors
 - Removal tool kit for any main load coupling
 - Driven equipment special tools
 - Recharging kit for any blade accumulator
 - For PLC based control systems, a programming console with a personal LAPTOP computer, 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.
 - Calibration kits for each type of fire and gas sensors.
- For site commissioning and start up:
 - Vibration probe calibrations equipment (wobulator)
 - Portable multi channel analyzer
 - Digital voltmeter
 - Proximator
 - Portable particles counter
 - Portable electronic RPM counter
 - Millivolt and milliamp sources
 - DC power supply
 - Variable resistor



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- Pneumatic pressure pump
- Flushing kits for all lube oil systems consisting of:
 - . Portable electric pump unit when the pumps of the systems are not A.C 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-test activities at the Supplier premises as stated in paragraph 7.1 of this specification 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.

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 yards and from Contractor yards to Company sites.

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 equipment 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 equipment 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 outside 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 Operating location.

The short term preservation shall cover a period up to six (6) consecutive months after processing of the preservation. The considered storage shall be outside 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, it 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 (Volatile Corrosion Inhibitor) and VPI (Vapor Phase Inhibitor) 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.

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

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 sealed.

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 Compressor

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, lube system, process equipment and compressor
- Spraying of Tectyl™ or VCI in the air system
- Spraying of Tectyl™ or VCI in the seal gas system
- Insertion of desiccant product inside the reservoir, the compressor, the process equipment and the seal gas system by mean of metallic basket welded to the closing blinds
- Preservation from foreign matters entrance by metallic blinds
- Sealing of openings.

9.1.2 Instrumentation and electrical auxiliaries

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

- Draining
- Drying
- Insertion of soft bags desiccant products in instrument junction boxes and in instrument heads
- Sealing of openings.

9.1.3 Control panels

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

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- 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.

9.1.4 Auxiliaries

The package auxiliaries generally include piping, filters, coolers, heat exchangers, heaters, valves, tanks, ducting, 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](#) standard.

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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.

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.

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 the 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.

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9.2.5 Compressor specific

The compressor shall be preserved as per clause 9.1.1 and packed as per clause 9.2 during transportation from Vendor facilities to Contractor Yard and from Contractor Yard to Company sites.

The capital spare delivered with the Contract shall be preserved as per clause 9.1.1 and shall be packed inside specific N2 pressurized container designed 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 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.

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 sites, except for structural frames and ducting when part of the scope of supply.

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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).

The structural frames and ducting (when part of the scope) shall be packed as follow:

- Transportation steel frame where required including all necessary certified means for handling, lifting, loading, unloading
- Metallic blinds on all openings provided with welded metallic baskets for desiccant bags storage
- External marking in accordance with [ISO 780](#) and Project specific requirements
- 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.

Appendix 1 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
DMF	Dimethyl Fumarate
FO	Field Operations
FSS	Fire Suppression System
HMI	Human Machine Interface
ICSS	Integrated Control and Safety System
ITP	Inspection Test Plan
LOS	Lube Oil System
MCC	Motor Control Center
OEM	Original Equipment Manufacturer
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
NDT	Non Destructive Test
RO	Restriction orifice
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

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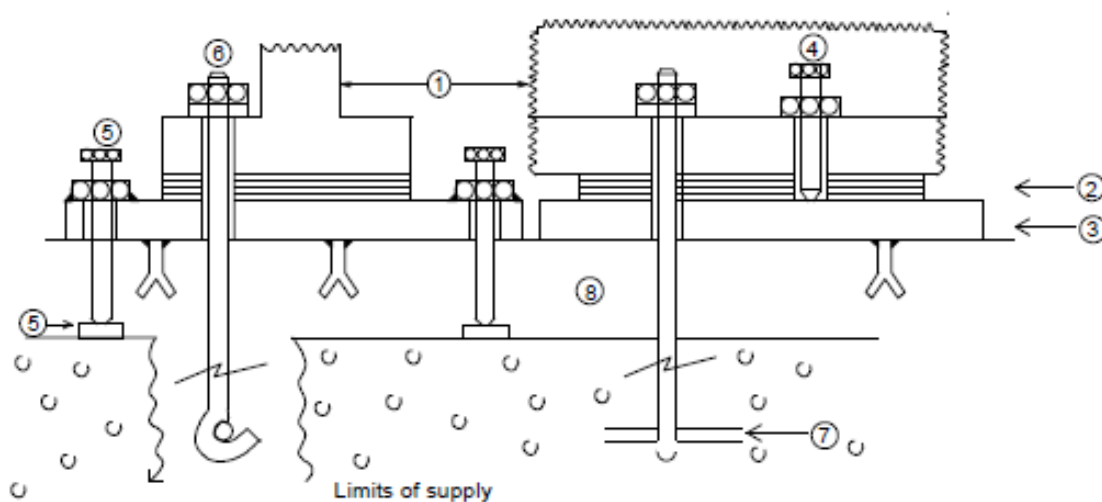
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Appendix 2

Appendix 2 Baseplate installation

CONCRETE FOUNDATION

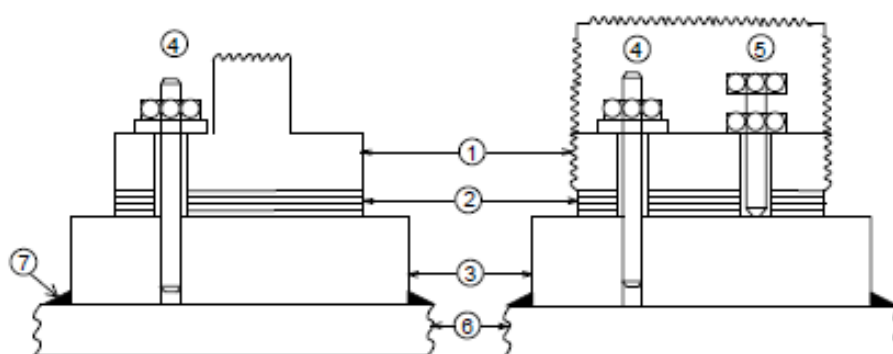

SUPPLIER

- 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

- ⑧ 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	Special tools list	
1.1.6	Start up and commissioning spare parts list	X
1.1.7	Operating spare parts list (with prices)	
1.1.8	Capital spare parts list	
1.1.9	Extinguishing medium calculation notes	
1.1.10	Declaration of conformity for ATEX	
1.1.11	Monthly report	
1.2	Procedures & Reports	
1.2.1	Painting procedure	
1.2.2	Packing procedure	
1.2.3	Weight data sheets with CoG	
1.2.4	Compressor mechanical test procedure	
1.2.5	Electrical motor test procedure	
1.2.6	Gas engine test procedure	
1.2.7	Package full load string test procedure (if applicable)	X
1.2.8	Package no/partial load test procedure	
1.2.9	Package site acceptance test procedure	
1.2.10	Reports for all the above tests (2)	
1.3	Manufacturing / Quality / HSE documents	
1.3.1	Quality control plan	X
1.3.2	Inspection and test plan	X
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	

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Appendix 3

Item	Designation	(1)
1.3.8	QA/ QC (Manufacturing data book) index	
1.3.9	QA/ QC (Manufacturing data book) Dossier	
2	STRUCTURAL	
2.1	Foundation drawing (recommendation) - Plan view	
2.2	Foundation drawing (recommendation) - Elevation view	
2.3	Foundation loadings (static and dynamic loads, permanent and temporary location)	
2.4	Baseplate calculation note including modal analysis and lifting calculation	
2.5	Lifting equipment general arrangement	
3	MECHANICAL	
3.1	Arrangements	
3.1.1	General arrangement drawing - Plan view	X
3.1.2	General arrangement drawing - Elevation view	X
3.1.3	General arrangement drawing - Isometric view	X
3.1.4	General arrangement drawing including piping (plan, elevation and isometric views)	
3.1.5	Limits of supply table (interface and connection schedule)	X
3.1.6	Allowable nozzles loads	
3.1.7	Fire fighting skid general arrangement	X
3.2	Data sheets	
3.2.1	Package reciprocating compressor data sheet	X
3.3	P&IDs & Lists	
3.3.1	Gas compressor and gas bypass simplified P&ID	X
3.3.2	Seal and vent P&ID	X
3.3.3	Lube oil system P&ID for compressor and engine	X
3.3.4	Fire and gas systems P&ID	X
3.3.5	Fuel gas system P&ID	X
3.3.6	Gas engine air combustion system P&ID	X
3.3.7	Gas engine enclosure P&ID	X
3.3.8	P&ID symbols table	
3.3.9	Utility list	X
3.3.10	Equipment list	X
3.3.11	Lubrication list and schedule	
3.4	Detail drawings	
3.4.1	Compressor outline drawing	
3.4.2	Compressor cross section drawing	
3.4.3	Compressor sub assemblies drawings	
3.4.4	Gas engine outline drawing	
3.4.5	Gas engine cross section drawing	
3.4.6	Gas engine air inlet general arrangement	

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Item	Designation	(1)
3.4.7	Gas engine exhaust system general arrangement	
3.4.8	Gas engine enclosure general arrangement	
3.4.9	Couplings and pumps outline drawings	
3.4.10	Coupling and pumps cross sectional drawings	
3.4.11	Nameplate drawings (compressor and driver)	
3.5	Calculations & Performances data	
3.5.1	Reciprocating compressor performance data	X
3.5.2	Gas engine performances data and curves	X
3.5.3	Process calculations (balance)	X
3.5.4	Package noise data	X
3.5.5	Skid and deck dynamic analysis	
3.5.6	Unbalance forces calculation	X
3.5.7	Torsional analysis (including coupling selection)	
3.5.8	Pulsation control study / acoustical report	
4	ELECTRICAL	
4.1	List of required documents 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 the templates included in the General Specifications).	X
4.2	Fuel gas heater data sheets if any	
4.3	Lube oil heater data sheets if any	
4.4	Electrical load list	X
5	INSTRUMENTATION	
5.1	General	
5.1.1	Package functional analysis (including compressor, driver, fire and gas system and all auxiliaries)	
5.1.2	Instruments hook ups	
5.1.3	All UCP general arrangements	X
5.1.4	VDU displays (HMI video pages)	
5.1.5	PLC software	
5.1.6	UCP factory tests procedure	
5.1.7	Obsolescence dossier	
5.2	Data sheets	
5.2.1	Instruments data sheets	
5.3	P&IDs & Lists	
5.3.1	Vibration and temperature P&ID	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	
5.3.5	I/O list	
5.3.6	List of software used	

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Item	Designation	(1)
5.4	Drawings	
5.4.1	Instrument location layout	
5.5	Diagrams	
5.5.1	Control system architecture (including power supply)	
5.5.2	Interconnecting diagram (instrumentation and electrical)	
5.5.3	Earthing diagram	
5.5.4	Logic diagrams	
5.5.5	Cause and effect chart	
5.5.6	Instrument loop diagrams	
5.5.7	UCP terminal strips	
5.5.8	Junction boxes terminal strips	
6	PIPING, VALVES and VESSELS	
6.1	General	
6.1.1	Piping classes	X
6.1.2	Piping layout	
6.1.3	Isometric drawings	
6.1.4	Tie in points list and location	
6.1.5	Piping list	
6.1.6	List of PSV	
6.1.7	List of pressure vessels (including heat exchangers)	
6.2	Data sheets	
6.2.1	Valves data sheet	
6.2.2	Gas Coolers data sheets	
6.2.3	Oil heat exchanger data sheet	
6.2.4	Pulsation bottles data sheets	
6.2.5	Scrubbers data sheet	
6.2.6	Lube oil filters data sheets	
6.3	Drawings	
6.3.1	Gas bypass drawing	
6.3.2	Coolers drawing (general arrangement and internals drawings)	
6.3.3	Scrubbers drawing (general arrangement and internals drawings)	
6.3.4	Pulsation bottles drawing (general arrangement and internals drawings)	
6.3.5	Oil coolers, filters and tank drawings	
6.4	Calculations & Performances data	
6.4.1	Calculation notes for safety relief valves	
6.4.2	Pressure vessels calculation notes as per required construction code and/or notified body	

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



Appendix 4 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

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Date:**Appendix 5****Appendix 5 Minimum inspection requirements**

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

- Compressor performance test
- Electrical motor or gas engine test
- Functional, performance and mechanical running test of the compressor package
- 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.