

GENERAL SPECIFICATION

ROTATING MACHINERY

GS EP MEC 032

Rotating Machine Package Specification Gas Engine or Electrical Motor driven Reciprocating Compressor
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General Specification		GS EP MEC 032
Rotating Machine Package Specification Gas Engine or Electrical Motor driven Reciprocating Compressor		
Rev.: 02	Effective date: 10/2012	Page: 2 of 58

Project Specification n°	Revision: Date:
--------------------------	--------------------

Contents

Preamble	4
1. Scope	5
1.1 Purpose	5
1.2 Application	5
1.3 General rules	5
2. Reference documents.....	6
3. Scope of supply and exclusions.....	11
3.1 Scope of supply	11
3.2 Exclusions.....	16
4. Basis of design.....	17
4.1 Particular specification for rotating equipment.....	17
4.2 Particular specification for rotating equipment - Packaging	19
5. Data Sheets.....	29
5.1 Compressor package	29
5.2 Electrical motor	29
5.3 Variable speed drive	29
5.4 Power transformer	29
5.5 Noise	29
5.6 Weight	29
5.7 Other data sheets templates	29
6. Site conditions and utilities.....	30
6.1 Site conditions.....	30
6.2 Utilities	32
7. Tests.....	34
7.1 Pre-test activities.....	36
7.2 Compression train no load test.....	37
7.3 Compression train full load test	37

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

Rev.: 02

Effective date: 10/2012

Page: 3 of 58

Project Specification n°

Revision:
Date:

7.4	Electrical	38
7.5	Post test inspections	38
7.6	Test schedule	38
7.7	Site acceptance test.....	38
7.8	Acceptance criteria	40
8.	Spare parts and special tools	41
8.1	Spare parts	41
8.2	Special tools	42
9.	Preparation for shipment.....	45
9.1	Preservation.....	45
9.2	Packing.....	47
9.3	Transportation.....	50
Appendix 1	Definitions and abbreviations.....	51
Appendix 2	Baseplate installation	52
Appendix 3	Vendor Document Register (VDR)	53
Appendix 4	Deviations to the contractual documents	57
Appendix 5	Minimum inspection requirements	58

**General Specification****GS EP MEC 032**

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

Rev.: 02

Effective date: 10/2012

Page: 4 of 58

Project Specification n°

Revision:
Date:

Preamble

**Documents**

Document Sharing Hub

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".

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

Rev.: 02

Effective date: 10/2012

Page: 6 of 58

Project Specification n°

Revision:
Date:

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

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

Rev.: 02

Effective date: 10/2012

Page: 7 of 58

Project Specification n°

Revision:
Date:

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

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

Rev.: 02

Effective date: 10/2012

Page: 8 of 58

Project Specification n°

Revision:
Date:

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

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

Rev.: 02

Effective date: 10/2012

Page: 9 of 58

Project Specification n°

Revision:
Date:

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

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		

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

Rev.: 02

Effective date: 10/2012

Page: 12 of 58

Project Specification n°

Revision:
Date:

#	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		

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

Rev.: 02

Effective date: 10/2012

Page: 13 of 58

Project Specification n°

Revision:
Date:

#	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		

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

Rev.: 02

Effective date: 10/2012

Page: 14 of 58

Project Specification n°

Revision:
Date:

#	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		

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

Rev.: 02

Effective date: 10/2012

Page: 15 of 58

Project Specification n°

Revision:
Date:

#	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.

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

Rev.: 02

Effective date: 10/2012

Page: 16 of 58

Project Specification n°

Revision:
Date:

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.

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

Rev.: 02

Effective date: 10/2012

Page: 17 of 58

Project Specification n°

Revision:
Date:

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	

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

Rev.: 02

Effective date: 10/2012

Page: 18 of 58

Project Specification n°

Revision:
Date:

GS EP MEC 261

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	