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**GEA Code of Ethics**

The Customer shall adhere to

- GEA Group "Global Business Conduct Policy" containing the Code of Ethics as well as the GEA Group Anti-Corruption Guideline (together hereinafter the "Code") approved by the Executive Board of GEA Group Aktiengesellschaft in the current version as available on [www.geagroup.com](http://www.geagroup.com).  
The Policy is available also on simple request to GEA Group AG, Chief Compliance Officer, Dorstener Straße 484, D-44809 Bochum, Germany, and applicable to all GEA Group companies;
- the Management & Control Model ex L. 231/2005 as adopted by Industrie Technofrigo Dell'Orto S.p.A. available on the Internet site [www.technofrigo.it](http://www.technofrigo.it).

## 2 LIMITS OF SUPPLY

### 2.1 Foundations

Machines & equipment : concrete base

### 2.2 Piping

Safety valves/vent outlets	: flange at skid edge
Drains	: flange at skid edge
Gas suction piping	: flange at skid edge
Gas discharge piping	: flange at skid edge
Cooling water inlet piping	: flange at skid edge
Cooling water outlet piping	: flange at skid edge
Compressed air	: flange at skid edge
Nitrogen purge	: flanges on different sections of piping

### 2.3 Electrical

Control panel	: panel terminal box
Low voltage panel	: panel terminal box
Low voltage electric utilities	: terminal box each component
Medium voltage electric motors	: motor terminal box

### 3 SCOPE OF SUPPLY

The supply is composed by:

- two inlet KO drums;
- two screw compressors with electric motor;
- two oil circuits, each inclusive of:
  - one main oil pump,
  - two oil filters,
  - one oil cooler with thermostatic valve;
- two gas coolers on the discharge;
- two oil recovery systems, each inclusive of:
  - one primary oil separator,
  - one final oil separator,
- two acoustic enclosures with gas detection;
- two base frames;
- two control panels with PLC for safe area;
- two low voltage panels for safe area;
- Piping for internal skid connections, valves and controls;
- On skid cabling;
- Standard testing and quality control plan;
- Standard packing;
- Engineering and manuals,
- commissioning spares.

Loose delivery for parts that need to be dismantled for transport purposes.

## 4 EXCLUSIONS

- Inlet Emergency Shut Off Valve;
- Off-skid piping;
- Off-skid control/power cables;
- Thermal insulation/heat tracing for piping;
- Drain piping from the skid edge to sewing system;
- Water cooler, water pump;
- SCADA/supervision system/master PLC;
- MV motor control centre;
- MV cabling;
- Fire detection and firefighting;
- Preparation of the area, all civil and structural works, concrete works and building works;
- Documentation requested by local laws to be presented to local authorities
- Hoisting equipment for unloading, positioning and assembling operations;
- Scaffolds;
- Storage and surveillance of the goods at site yard;
- Supply of water, electric power, gas and fuels for the whole period of the installation;
- Lubricating oil and coolants (first filling);
- Earthing plant;
- Protection from lightning;
- Spare parts and special tools;
- Seaworth packing;
- Import and local duties;
- Freight;
- Installation;
- Training on site;
- Commissioning;
- Performance testing, test run on site;
- Anything else not clearly mentioned in this offer.

## 5 PACKAGE COMPONENTS VENDOR LIST

Item	Origin	Item	Origin	Item	Origin	Item	Origin
<i>Compressor</i>		<i>MV Electric Motors</i>		<i>LV Electric Motors</i>		<i>Oil pumps</i>	
Grasso	Germany	ABB	Italy	ABB	Finland	Viking	USA
Howden	UK	Schorch	Germany	Cemp	Italy	Cucchi	Italy
Mayekawa	Japan	Ansaldo	Italy	Euromotori	Italy	Rotan	Denmark
		Weg	Brazil	Marelli	Italy	Kral	Germany
		GE	Brazil	Schorch	Germany	Seim	Italy
		Elin	Austria	Fimet	Italy		
		Siemens	Germany	Weg	Brazil		
<i>KO drum, Oil Separators</i>		<i>Vessels</i>		<i>Air coolers</i>		<i>Compressor coupling</i>	
Forain	Italy	Comet	Italy	Uniterm	Italy	Vulkan	Italy
Micronsep	Italy	Secat	Italy	DECA	Italy	Autoflex	Italy
Fiorentini	Italy	Fintec	Italy	GEA	Italy		
Valvitalia	Italy	Biesse	Italy	Astra	Italy		
TPI	Italy	EM Polar		Chart	USA		
BEA	Italy	Techsol	Italy	ACE	USA		
Stiti	Italy	Beta Caldaie	Italy	Air-X	USA		
Techsol	Italy			LU-VE	Italy		
Dollinger	Ireland			Thermokey	Italy		
<i>Plate Heat Exchangers</i>		<i>Shell&amp;Tube Heat Exchangers</i>		<i>Ball valves</i>		<i>Butterfly valves</i>	
SWEP	Sweden	Comet	Italy	Alfa Valvole	Italy	Tyco	Italy
GEA	Italy	HsCoolers	Germany	Adler	Italy	Gibson	Italy
Alfa Laval	Italy	HPH	Italy	Tyco	Italy	Ebro	Italy
		R&B	Italy	ABV	Italy	Az Armaturen	
		Spirax Sarco	Italy	Nigrema	Italy		
		Flovex	Italy	Az Armaturen			
		Funke	Germany				
<i>Check valves</i>		<i>Safety valves</i>		<i>Gas control valves</i>			
Flowserve	Italy	TAI	Italy	Emerson	Italy		
Gibson	Italy	Carraro	Italy	Dresser	Italy		
Industrial Forniture	Italy	Technical	Italy	Samson	Italy		
		Parcol	Italy	Tartarini	Italy		
				Fiorentini	Italy		
				Hoffman	Italy		
				Parcol	Italy		
				RMG	Germany		
<i>Transmitters</i>		<i>Level gauges</i>		<i>Pressure gauges</i>		<i>Temperature gauges</i>	
Emerson	Italy	Bonetti	Italy	Wika	Italy	Wika	Italy
Yokogawa	Japan	Klinger	Italy	Nuova Fima	Italy	Nuova Fima	Italy
ABB	Italy						
Eurotec	Italy						
Foxboro	USA						
<i>Automatic Switches</i>		<i>Auxiliary Transformers, AC/DC Feeders</i>		<i>Operator panels</i>		<i>PLC</i>	
ABB		Legrand		Siemens		Siemens	
Siemens		Cabur		GE		GE	
Merlin Gerin		Phoenix		ESA			
		Siemens		HAKKO			
				TLine			
				UniOp			

<i>Auxiliary Relays, Contactors</i>		<i>Electric/Control Panel Carpentry</i>		<i>Soft starters</i>		<i>Intrinsic Safety Barriers</i>	
ABB		Hager Lume		ABB		Pepperl+Fuchs	
Siemens		Rittal		Siemens		GM International	
Omron		Tecnoquadri		Ansaldo		MTL	
Telemecanique		ABB		Telemecanique			
Klockner		Siemens		Lovato			
Moeller		Imequadri					
Phoenix		Duestelle					
Weidmuller		Apierre					
Finder		Iceet					
		Skema					
<i>TA/TV Transformers And Measuring Instruments</i>		<i>Controllers</i>		<i>Junction Boxes</i>		<i>Signal Converters</i>	
IME		Ero Electronic		Cortem		IME	
FRER		Gefran		Weidmuller		GM International	
Siemens		ASCON		Nuova ASP		Datexel	
ABB				BARTEC		Weidmuller	
				Stahl		Phoenix	
				AdViganò		MTL	
						Pepperl+Fuchs	
<i>Inverters</i>		<i>Cables</i>		<i>Pushbuttons, Lamps, Signallers</i>		<i>Protection Relays</i>	
ABB		Generalcavi		Cema		Thytronic	
Siemens		Aristoncavi		Breter		Dossena	
Ansaldo		Nova Cavi		Telemecanique		Lovato	
		Tratos		GE		Siemens	
		Sitekno Cables		Siemens		Pilz	
		General Cavi		Bartec		Phoenix	
				Stahl			
<i>Fuses</i>		<i>Terminals</i>		<i>Cable Glands</i>			
Siemens		Phoenix		RCN	Italy		
Weber		Weidmuller		Nuova ASP	Italy		
Omega		Wago		Cortem	Italy		
Legrand				AdViganò	Italy		
ABB				Bartec	Germany		



## 6 COMPRESSOR PACKAGE SPECIFICATION

### 6.1 Compressor configuration and service

<i>Number of gas turbines</i>	two
<i>Gas turbine manufacturer / model</i>	GE 7FA
<i>Number and redundancy of fuel gas compressors (100% = flow rate of one gas turbine)</i>	2 x 100%

### 6.2 Environmental conditions

Installation site	Venezuela
Min/max ambient temperature	min 22.5°C / max 32°C
Environment	Industrial
Relative humidity	Max 96%
Elevation	40 m asl
Max wind velocity	No info
Snow	No info
Seismic	No info

### 6.3 Hazardous Areas Classification, Installation

<i>Item</i>	<i>Area classification</i>	<i>Installation</i>
<i>Gas compressor skid</i>	Hazardous area Zone 2	Outdoor
<i>Control panel</i>	Safe area	Indoor
<i>Low voltage panel</i>	Safe area	Indoor

## 6.4 Gas composition

CALIDAD ACTUAL			
Calidad de Gas Sistema Anaco-Puerto La Cruz			
Componente/Parámetro	COVENIN 3568-2:2000	OPERACIÓN NORMAL CSJ	PARADA TREN CSJ
Nitrógeno (% molar)	$\leq 1,00$	0,232	0,147
CO <sub>2</sub> (% molar)	$\leq 8,50$	7,111	7,828
Metano (% molar)	$\geq 80,00$	84,491	81,790
Etano (% molar)	$\leq 12,00$	7,856	6,420
Propano (% molar)	$\leq 3,00$	0,300	1,985
I-Butano (% molar)		0,010	0,580
N-Butano (% molar)		0,000	0,480
I-Pentano (% molar)		0,000	0,220
N-Pentano (% molar)		0,000	0,170
Hexanos (% molar)		0,000	0,175
Heptanos (% molar)		0,000	0,125
Octanos (% molar)		0,000	0,070
Nonanos (% molar)		0,000	0,005
Decanos (% molar)		0,000	0,005
Undecanos + (% molar)		0,000	0,000
H <sub>2</sub> S (ppmv)	$\leq 12,00$	10,0	10,0
H <sub>2</sub> O (lb/MMPCE)	$\leq 7,00$	1,0	6,0
C <sub>4</sub> + (% molar)	$\leq 1,50$	0,01	1,83
C <sub>5</sub> + (% molar)	$\leq 0,25^1$	0,00	0,77

No solid particles have been considered.

## 6.5 Applicable standards

The following codes and standards (latest revision) have been referenced for the design of the supply:

ANSI	American National Standards Institute
IEC	International Electrotechnical Commission
CENELEC	Europäisches Komitee für Elektrotechnische Normung
ASME	American Society of Mechanical Engineers (no stamp)

## 6.6 List of specifications received and analysed

Venezuela - Inquiry Gas Compressor Rev.00  
Natural Gas Composition

## 6.7 KO drum

Skid-mounted knock-out vessel installed upstream the compressors, as a safety precaution to avoid liquid “slugs” to enter the compressor.

<i>Gas flow rate</i>	11.2 kg/s = 40,320 kg/h
<i>Operating pressure</i>	17 bara
<i>Operating temperature</i>	15°C ... 40°C
<i>Material</i>	Body in carbon steel
	Demister in stainless steel
<i>Flanges</i>	ANSI 150 RF
<i>Corrosion allowance</i>	1.6 mm
<i>Separation efficiency</i>	99% for particles with size $\geq 10$ micron
<i>Accessories</i>	Automatic drain valve
<i>Instrumentation</i>	Level transmitter
	Pressure transmitter
	Level gauge
	Pressure gauge

## 6.8 Screw Compressor

Screw compressor with fixed internal volume ratio, sleeve bearings, optimised rotor profile ensuring high volumetric efficiency. Male rotor drive avoids additional transmission forces, and guarantees long bearing life, low noise emission and low vibration level. Wear free profile for constant performance characteristic during lifetime.

The rotors are made of forged tool steel (C45, carbon steel with 0.42%...0.50% content of carbon, comparable with SA-29). They are designed according to low energy consumption criteria (patented profile with optimized main dimensions). The primary rotor is driven by the motor, whereas the secondary rotor is directly driven by the primary rotor by means of a thin oil film. Drive shaft is a straight shaft design. Shaft seal material: combination of different materials (grey cast iron alloy, antimony bound hard carbon).

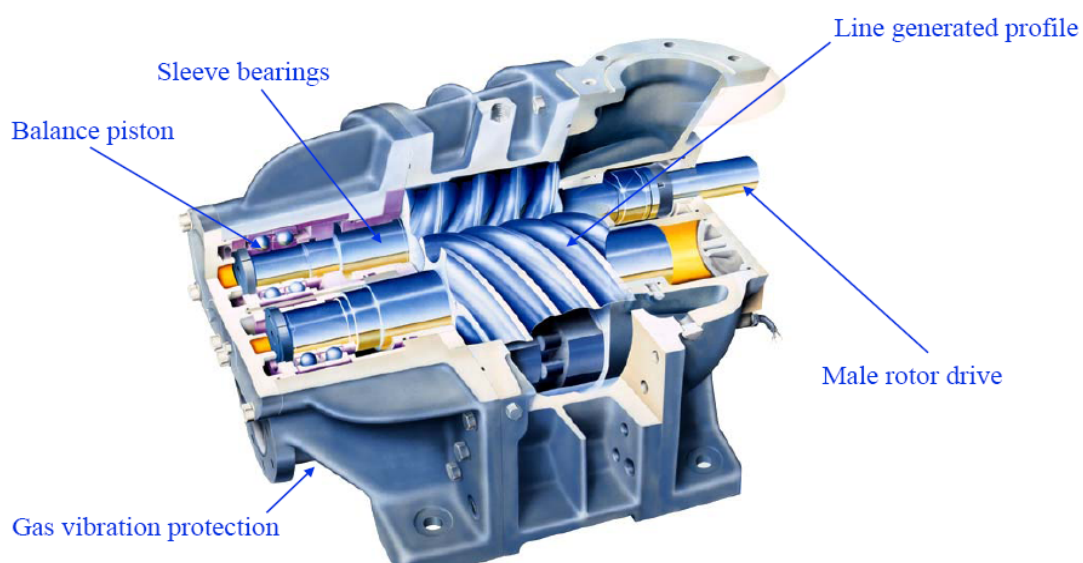
The casings are made of nodular cast iron.

Low wear sleeve type bearings carry the radial loads of the rotor shafts on a thin oil film without contact, whereas the angle-contact ball bearings take the axial load.

The standard driven main shaft is sealed by means of a ring bearing oil seal with a rotating ring and a fixed ring (impregnated carbon/steel). The seal is designed to accept load variations while containing oil pressure. Thin oil film between the rings results in a long service life.

Balanced rotors, balance quality 2.5 acc. to DIN ISO 1940.

High performance shaft seal, HNBR quality O-rings, gas pulsation protection for high pressure ratios.



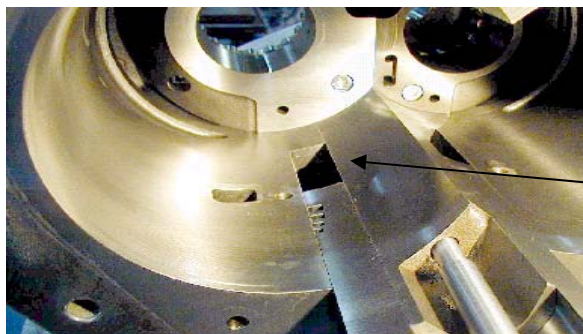
The gas compressor shall be capable of delivering compressed natural gas at the demand flow rate of the gas turbine, which will vary from time to time according to turbine operating conditions.

It is assumed that the pressure at the inlet of the package is stable at the value stated by the Customer.

<i>Package Inlet Pressure(at terminal point on skid)</i>	17 bara
<i>Inlet Temperature</i>	15°C ... 40°C
<i>Delivery pressure (at terminal point on skid)</i>	30 bara
<i>Delivery Temperature (upstream gas cooler)</i>	90 °C
<i>Required design capacity</i>	11.2 kg/s = 40,320 kg/h
<i>Compressor type</i>	Oil injected screw compressor
<i>Compressor Model</i>	TE1500S
<i>Compressor stages</i>	one
<i>Running speed</i>	3590 rpm
<i>Oil supply temperature</i>	70 °C
<i>Oil flow rate</i>	421 l/min
<i>Oil cooler capacity</i>	422 kW
<i>Capacity control</i>	Recirculation bypass
	Internal slide valve

The margin on the maximum rotation speed and the absence of vibrations lead to reliability and major overhaul intervals comparable to the turbine ones.

## Slide valve control



Moved by the lube oil pressure, allows to bypass a part of the gas at the suction, thus limiting the compressed gas flow rate. This automatic capacity control allows to continuously change the gas flow rate, based on the discharge pressure that decreases when the turbine calls for more gas.

By-pass

The control loop is implemented in the PLC, based on the gas discharge pressure value received by the pressure transmitter. This by-pass, which is internal to the compressor, allows a continuous capacity control from 10% to 100%.

## 6.9 MAIN ELECTRIC MOTOR

Squirrel cage, induction motor, manufactured in accordance with European Standards.

<i>Type</i>	Three phase asincronous
<i>Power</i>	1500 kW
<i>No. of poles</i>	2
<i>Voltage</i>	4160 V
<i>Phase</i>	3 ph
<i>Frequency</i>	60 Hz
<i>Running speed</i>	3590 rpm
<i>Insulation class</i>	F
<i>Temperature class</i>	B
<i>Mechanical protection</i>	IP55
<i>Execution</i>	Eexd or Eexe
<i>Starting</i>	DOL
<i>Mounting</i>	B3
<i>Cooling</i>	Air
<i>Service factor</i>	1
<i>Duty</i>	S1
<i>Accessories</i>	anticondensation heater
	windings RTD, 2 per phase
	bearings RTD, 1 per bearing



## 6.9.1 COUPLING

Flexible coupling, including non-sparking coupling guard.

## 6.10 OIL SEPARATORS

Two oil separators shall be supplied:

- Primary oil separator;
- Secondary oil separator.

Primary oil separator	Gas flow rate	11.2 kg/s = 40,320 kg/h	
	Operating pressure	30 bara	
	Operating temperature	90°C	
	Material	Body in carbon steel	
		Inertial separator in carbon steel	
		Coalescing cartridges in polymeric fibres	
	Flanges	ANSI 300 RF	
	Arrangement	Horizontal or vertical, with integrated oil reservoir	
	Oil carryover	< 20 ppm	
	Accessories	Manual depressurisation valve	
		Automatic depressurisation valve	
		Pressure safety valve	
		Oil electric heater (Eexd, 2 kW)	
	Instrumentation	Level gauge	
Secondary oil separator	Gas flow rate	11.2 kg/s = 40,320 kg/h	
	Operating pressure	30 bara	
	Operating temperature	80°C	
	Material	Body in carbon steel	
		Coalescing cartridges in polymeric fibres	
	Flanges	ANSI 300 RF	
	Arrangement	vertical	
	Separation efficiency	99% for particles with size ≥ 1 micron	
	Accessories	Automatic drain valve	
	Instrumentation	Level switch	

## 6.11 LUBRICATION CIRCUIT

### 6.11.1 Oil cooler

Oil to water/glycol compact plate heat exchanger (plates in stainless steel, brazing material pure copper) or shell & tube type (tube, tubesheets and shell in carbon steel), with three-way self operated oil temperature control valve in carbon steel.

<i>Heat capacity</i>	422 kW
<i>Water inlet temperature</i>	25 °C
<i>Water outlet temperature</i>	35 °C
<i>Oil inlet temperature</i>	90 °C
<i>Oil outlet temperature</i>	70 °C
<i>Oversizing</i>	5% on surface

### 6.11.2 Oil pump

Gear or screw oil pump, cast iron casing, carbon steel rotor.

Eex-d electric motor, 400V/3ph/60Hz, IP55, coupling and no-sparking coupling guard.

Lube oil filters in carbon steel with replaceable cartridges (150 micron/15 micron).

## 6.12 GAS CIRCUIT

### 6.12.1 Piping, valves, fittings

The following valves and accessories to be provided for each compressor:

- One suction strainer manufactured in carbon steel, with access to service the stainless steel strainer element (80 micron);
- One check valve suction side;
- One check valve discharge side;
- One manual isolating valve suction side;
- One manual isolating valve discharge side;
- One manual vent valve suction side;
- One automatic vent valve discharge side (primary oil separator);
- One set of carbon steel pipework, including pressure reducing valve station to provide the ability to by-pass 100 % of the compressor flow for rapid discharge pressure control.

### 6.12.1.1 ON/OFF Gas Valves specification

<i>Suction isolating valve</i>	
<i>type</i>	Ball, full bore
<i>operator</i>	Manual gear
<i>connections</i>	flanged
<i>size</i>	10"
<i>rating</i>	ANSI150
<i>Body material</i>	Carbon steel ASTM A105
<i>Ball material</i>	Carbon steel ASTM A105
<i>Trim material</i>	Stainless steel F316
<i>Accessories</i>	Slow fill manual ball valve, 1" ANSI150

<i>Discharge isolating valve</i>	
<i>type</i>	Ball, full bore
<i>operator</i>	Manual gear
<i>connections</i>	flanged
<i>size</i>	8"
<i>rating</i>	ANSI300
<i>Body material</i>	Carbon steel ASTM A105
<i>Ball material</i>	Carbon steel ASTM A105
<i>Trim material</i>	Stainless steel F316

<i>Suction vent valve</i>	
<i>type</i>	Ball, full bore
<i>operator</i>	Manual gear
<i>connections</i>	flanged
<i>size</i>	2"
<i>rating</i>	ANSI150
<i>Body material</i>	Carbon steel ASTM A105
<i>Ball material</i>	Carbon steel ASTM A105
<i>Trim material</i>	Stainless steel F316

<i>Discharge vent valve</i>	
<i>type</i>	Ball, full bore
<i>operator</i>	Pneumatic
<i>connections</i>	flanged
<i>size</i>	1"
<i>rating</i>	ANSI300
<i>Body material</i>	Carbon steel ASTM A105
<i>Ball material</i>	Carbon steel ASTM A105
<i>Trim material</i>	Stainless steel F316
<i>Accessories</i>	On-off limit switches



### 6.12.1.2 Regulating Gas Valves specification

<i>Recycle control valve</i>	
<i>type</i>	Globe valve
<i>operator</i>	Pneumatic
<i>conenctions</i>	flanged
<i>size</i>	6" (expected)
<i>rating</i>	ANSI300
<i>Body material</i>	Carbon steel ASTM A105
<i>Internals material</i>	Stainless steel F316
<i>Accessories</i>	Analogic position transmitter 4..20 mA

### 6.12.2 Gas cooler

Water-cooled gas cooler, compact plate heat exchanger, plates in stainless steel, brazing material pure copper or shell&tube type (tube, tubesheets and shell in carbon steel), complete with carbon steel gas temperature control valve.

<i>Heat capacity</i>	272 kW
<i>Water inlet temperature</i>	25 °C
<i>Water outlet temperature</i>	35 °C
<i>Gas inlet temperature</i>	90 °C
<i>Gas outlet temperature</i>	70 °C
<i>Oversizing</i>	5% on surface

## 6.13 Piping material

<b>Process Gas</b>	<i>Schedule</i>	40
	<i>Material</i>	ASTM A 106 Grade B carbon steel
	<i>Connections</i>	flanged
	<i>RX</i>	10%
	<i>Pickling</i>	None
<b>Lube Oil</b>	<i>Schedule</i>	40
	<i>Material</i>	ASTM A 106 Grade B carbon steel
	<i>Connections</i>	Flanged
	<i>RX</i>	per code
	<i>Pickling</i>	None
<b>Cooling water</b>	<i>Schedule</i>	40
	<i>Material</i>	ASTM A 106 Grade B carbon steel
	<i>Connections</i>	Threaded NPT
	<i>RX</i>	None
	<i>Pickling</i>	None
<b>Instrument Air</b>	<i>Type</i>	tubing
	<i>Material</i>	Stainless steel AISI316
	<i>Connections</i>	threaded NPT
	<i>RX</i>	None
	<i>Pickling</i>	None

## 6.14 ACOUSTIC ENCLOSURE

### 6.14.1 SOUND-PROOFING

Sound-proof enclosure for the entire gas compressor package for the reduction of the noise to 85 dB(A). The residual guaranteed average sound pressure level shall be measured at 1.5 m from the ground and 1 m from skid edge, at normal running conditions at full load, with no altering outside background noise and reflecting walls.

The enclosure shall be a modular construction utilising a minimum number of standard panels.

Inside the enclosure fixing points for gas detectors and light fittings are foreseen. Light fittings are suitable for hazardous area and provide an adequate level of illumination for all maintenance activities.

The enclosure shall be intended for outdoor operation and designed and manufactured to be weather tight under all operating conditions, including the depression caused by the ventilation system and all environmental conditions.

Suitable ventilation supplies cooling of the equipment and dilution of any gas concentration in compliance with the relevant Health and safety directives for gas fuel applications.

The air flow shall not be treated, as the design ambient conditions do not require any filtration system.

Silencers shall be installed at the enclosure air inlet/outlet, with protection against rain, complete with carbon steel boxes with lifting lugs. The silencers shall be installed directly on the enclosure, in order to obtain the best acoustic performance.

## 6.14.2 GAS LEAKS DETECTION

Gas detector with sensing element assembled into an explosion-proof enclosure.

Set at 30% LEL, directly connected to the control panel. The flammable gases concentration transmitter sensor (4-20mA) is based on the catalytic technology. Measurement range from 0 to 100% LEL.

When the alarm thresholds are reached, based on lower flammability level, a signal is sent by the gas detector to create an alarm signal and to shut off the gas supply system and all the electrical equipment.

## 6.15 INSTRUMENTATION

Transmitters with hazardous area electrical certification Eex-d / Eex-i.

4 to 20mA output signal, HART communication, SMART flexible configuration facilities, local LCD indicator.

Pressure measurements with 3-way manifold and 1/2" carbon steel ball isolating valves.

Base accuracy : minimum  $\pm 0.15\%$ .

*Main instruments installed on the compression package*

Description	Indication	Alarm	Trip
Suction gas pressure	X	X	
Discharge gas pressure	X	X	X
Suction gas temperature	X	X	
Discharge gas temperature	X	X	X
Oil pressure at the compressor inlet	X	X	X
Oil filter differential pressure	X	X	
Oil temperature upstream oil cooler	X		
Oil temperature downstream oil cooler	X	X	X
Primary oil separator level	X		
Secondary oil separator level	X	X	
KO drum level	X	X	X
Water inlet temperature	X	X	
Water outlet temperature	X		
Water circuit pressure	X	X	

## **6.16 CONTROL SYSTEM**

### ***6.16.1 CONTROL PANEL***

Control panel to be installed in safe area, free standing, in the Customer's control room.

PLC (Siemens S7-300 process controller with OP177B operator panel or equivalent) with single CPU, single power supply, single I/O cards.

Operator panel with graphic monochrome displays (used in text mode) for day-to-day operation fitted in the front, for the visualisation of process data, configurable parameters, utilities status and alarm listing.

In addition to the hardware, the software in English language (with annotations) is supplied.

Programming software-firmware licence is not included.

Ethernet or Modbus interface towards Customer's SCADA.

#### **6.16.1.1 Functions**

- Constant Discharge Pressure Control
- Control of inlet and discharge block valves, (open/close).
- Initialization data
- Operating data
- First out annunciation

### ***6.16.2 LOW VOLTAGE PANEL***

Low voltage panel (non-withdrawable units), carbon steel construction, to be installed in safe area, free standing, in the Customer's control room. Access from the front, standard 2b construction, Icc = 25 kA.

### ***6.16.3 ELECTRICAL PLANT***

On-skid instrument cables, 1.5 mm<sup>2</sup> section, armoured for digital signals and shielded+armoured for analogue signals. Cable trays in galvanised carbon steel with cover.

Local on-skid junction boxes, in polyester (GRP), Eexd-e construction, mounted on carpentry structure, as control interface towards control panel.

Control JBs are separate for signals of different function and type. Cable glands are excluded.

Electrical utilities to be connected by the Customer directly on the equipment junction box. Cable glands are excluded.

On-skid earthing plant, gas detection plant with separate junction boxes.

Acoustic enclosure illumination plant with Eexd lights.

## 6.17 PAINTING

<i>PHASE</i>	<i>TYPE or PRODUCT</i>	<i>CYCLE 1</i>	<i>CYCLE 2</i>
Preparation	Sand Blasting	2 1/2 SA	Std Mfr
Primer	Inorganic Zinc	75 µm	Std Mfr
1st Layer	Epoxyvinil	125 µm	Std Mfr
2nd Layer	Aliphatic Polyurethane	50 µm	Std Mfr

<i>VESSELS, HEAT EXCHANGERS, PIPING &amp; OTHER</i>	<i>PAINTING DATA</i>		
	<i>CYCLE</i>	<i>COLOUR</i>	<i>RAL</i>
<i>Electric motors</i>	2	std. Mfr.	std. Mfr.
<i>Compressors/pumps</i>	1	dark grey	7012
<i>Vessels</i>	1	dark grey	7012
<i>Heat exchangers</i>	1	dark grey	7012
<i>Piping</i>	1	dark grey	7012
<i>Steel structure</i>	1	dark grey	7012
<i>Manual valves</i>	1	dark grey	7012
<i>Actuated valves</i>	1	dark grey	7012
<i>instrumentation</i>	2	std. Mfr.	std. Mfr.

## 6.18 BASE FRAME

Manufactured in carbon steel, preassembled in our factory, complete with lifting lugs.  
Shims, plates, nuts and anchor bolts for the equipment included in our scope of supply.

## 7 PRELIMINARY CONSUMPTIONS

<i>Item</i>	<i>Requirement for one compressor running</i>	<i>Consumption</i>
Instrument air	Dry and clean (dew point -40°C), at 7 barg pressure and 20°C temperature.	18 Nm3/h
Cooling water	Non-corrosive cooling water at 25°C-35°C and 4 barg.	60 m3/h

## 8 QUALITY ASSURANCE PLAN (MAIN TESTS)

<i>Screw compressor</i>	Materials Test Certificates Hydrostatic and leak test certificate Mechanical test run
<i>Main electric motor</i>	Visual and dimensional inspection Routine test on prototype Type test – on 1 <sup>st</sup> unit only Nameplate Check
<i>Oil pump</i>	Hydrostatic test
<i>Oil separators</i>	WPS, WPAR, RX as per code Materials certificates Hydraulic or pneumatic test
<i>Control panel</i>	Dielectric test / Insulation Simulation test (functional test) Wiring check
<i>Low Voltage panel</i>	Dielectric test / Insulation Power supply distribution check Wiring check Check I/O signals Power output test
<i>Assembled package</i>	Leak test (0,5 bar) Pneumatic test (Ps*1,1) Visual and dimensional check Nameplate check (package and vessels) Painting check
<i>Piping</i>	Materials certificates Radiographic controls (RX 10%) on process gas Dye Penetrant Test on Welds not X-rayed

Standard tests are unwitnessed.

Certificates required by codes and standards as per paragraph 6.5 are included.

Detailed Quality Control Plan available upon request.

## 9 ENGINEERING

A complete set of documentation in English language (one paper copy and one on CD-ROM) will be prepared during the engineering phase and sent to the Customer in preliminary version for comments and approval.

The documents will then be revised in as-built version. The issued documents – in UNI standard - shall be the following:

XXXX = GEA contract number

<u>GEA doc. code</u>	<u>Description</u>
XXXXE01	<i>Electrical utilities list</i> Tabella utenze elettriche
XXXXE02	<i>Control Panel wiring diagrams</i> Schemi elettrici quadro di controllo
XXXXE03	<i>Low voltage panel drawings</i> Schemi elettrici quadro di potenza
XXXXE04	<i>Bill material - electrical components</i> Bill material componenti elettrici
XXXXE05	<i>I/O list</i> Lista I/O
XXXXM01	<i>Bill material – mechanical components</i> Bill material componenti meccanici
XXXXM02	<i>Compression package layout</i> Layout package di compressione
XXXXM03	<i>Utilities list (compressed air, cooling water...)</i> Lista utenze (aria compressa, acqua di raffreddamento...)
XXXXQ01	<i>Quality Control plan</i> Piano controllo qualità
XXXXC01	<i>Foundations (load and fixing details)</i> Input opere civili
XXXXT01	<i>Overall fabrication programme</i> Piano di fabbricazione
XXXXO01	<i>Operating and maintenance manuals<sup>1</sup></i> Manuale operativo e di manutenzione
XXXXF01	<i>P&amp;I Drawings</i> Schemi P&ID
XXXXS01	<i>Control philosophy</i> Relazione di funzionamento
XXXXS02	<i>Paint specification</i> Specifica verniciatura
XXXXS03	<i>Lista lubrificanti</i> Lubricants list

<sup>1</sup> including:

- The gas compressor package manuals;
- The manuals of the equipments installed on the package provided by the manufacturers.

## 10 PRELIMINARY DIMENSIONS AND WEIGHT OF THE SUPPLY

Empty weights, no packing.

	<i>Length mm</i>	<i>Width mm</i>	<i>Height mm</i>	<i>Weight kg</i>
Compressor skid	11,000	3,000	3,000	31,000



## 11 MAIN DEVIATIONS/COMMENTS TO CUSTOMER SPECIFICATION

<i>Item</i>	<i>Doc no.</i>	<i>Paragrap h</i>	<i>Requirement</i>	<i>Comment or deviation</i>
1	Venezuela - Inquiry Gas Compressor Rev.00	1.1.2, page 3	Gas Filter - Separator Unit 2 x 100% (maximum total plant consumption = 100%) - duty filter - separator units including drains, vents, shut off valves and safety equipment	Based on inlet gas composition, we included a suction scrubber for liquid droplets. This will be installed on the skid, with no dedicated isolation valves. Pls let us know is any power content is foreseen in the gas.
2	Venezuela - Inquiry Gas Compressor Rev.00	1.1.3, page 3	Vibration monitoring system	Signals will be sent to PLC. No Bently Nevada 3500 monitoring system.
3	Venezuela - Inquiry Gas Compressor Rev.00	1.2, page 4	Erection supervision - Commissioning supervision - Execution of performance tests - Training of customer Operation & Maintenance teams - Operation & Maintenance supervision and assistance during the first year of operation	Excluded from base price. Will be quoted at daily rate.
5	Venezuela - Inquiry Gas Compressor Rev.00	2, page 5	INTERFACES AND DELIVERY LIMITS ... at building wall	At skid edge. We don't know at the moment the building dimensions.