G-56SL GUASCOR ENERGY GAS ENGINE
Technical Scope of Supply

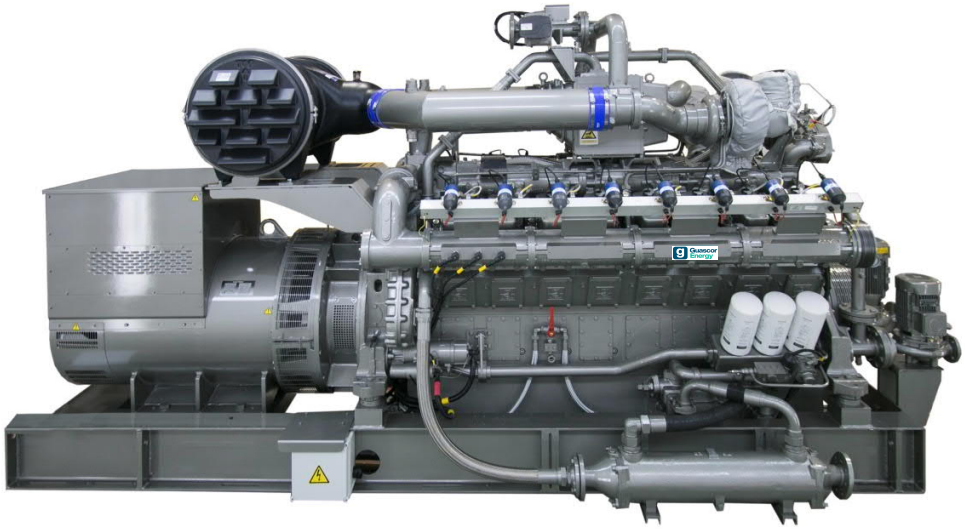

Image non-binding, may not reflect actual engine configuration

- [x] **Natural gas & biogas, 1200 rpm, 60Hz**
- [ ] **Natural gas & biogas, 1500 rpm, 50 Hz**
- [ ] **Natural gas & biogas, 1800 rpm, 60 Hz**

G-56SL engine is a proven and flexible stationary gas engine, key features include:

- Spark-ignited lean-burn engine based on the 4-stroke Otto cycle technology.
- 16 V cylinder design, part of the SL family.
- Wet exhaust manifold with a two exhaust turbocharger configuration.
- Cast iron and four valves per cylinder head design, that offer a robust solution for a high range of gaseous fuels (Natural gas, Biogas, Syngas, APG / Well gases, LPG)
- Crankshaft - press forge hardened and tempered alloy steel for durability.
- Two water circuits with two stage charge cooler to optimize thermal performance.
- Designed for electrical power generation and CHP (combined heat-power) in continuous duty applications.
- On engine digital engine control system– type GCS-E.
- G-SL engines design focus is on ease of maintenance, durability and long lifecycle.

GUASCOR ENERGY can provide scope of supplies to meet customer's demands:

- ✓ Bare engine and accessories.
- ✓ Generator set, peripherals and controls.
- ✓ Containerized solutions for generation and CHP applications.

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General Specifications:

Engine model	**G-56SL**
Rated rpm	1200 / 1500 / 1800
ISO COP, kWb (bhp)	
Cylinder arrangement	V – 16
Displacement,	56.30 L (3,436 cu.in)
Bore x stroke,	160 x 175 mm (6.3 x 6.89 in)
Compression ratio	
Mean piston speed, m/s (in/s)	7 / 8.8 / 10.5 (276 / 346 / 413)
Exhaust manifold type	Wet
Engine noise, LpA,∑ dB(A)	89 / 97 / 95

Sound pressure levels measured at 1m / 3.3 ft of the engine.
For further information see IC-G-D-00-042e

Ambient temperature	0°C to 25°C (32°F to 77 °F)
Altitude	0 - 500 mamsl (1640 FAMSL)

Remark: Higher temperatures and altitudes will require a power derating. For further information IC-G-B-00-001e.

Engine performance data is provided within the Specific Engine Power Rating

Fuel

Fuel type	Natural Gas or Biogas
Engine inlet pressure range	50-275 mbar (0.7 - 4 psi)

Electronic carburation & flow control valve

☐ Cost adder for biogas as fuel: Carburetor, flow control valve size adaptation, etc.

Engine Control System GCS-E



Integrated control system that handles all critical engine control functions in a Plug&Play ECU:

- Speed / load control. Carburation.
- Ignition and timing control; emissions control.
- Autonomous engine protection and control.
- Knocking detection system
- Engine ancillaries control panel (starter, water & oil preheating, pre-lubrication pump, etc.)
- Interface protocols: Modbus TCP/IP, CAN J1939, CANopen

☐ Exhaust temperature sensors by cylinder.

Lubrication System

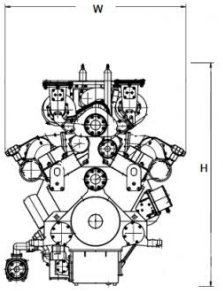
Lube oil pump	Gear mechanical pump
Lube oil capacity	272 L (72 gal)
Filters	3 Full flown type filters

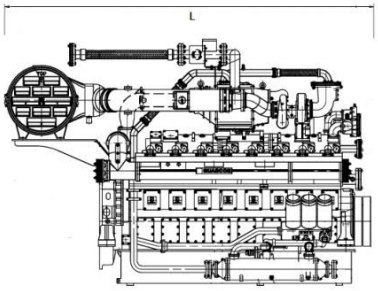
Approx. oil consumption, 0.20 g/kWh (0.00033 lb/bHP.hr)
Oil level maintainer with float and sight glass

☐ Oil crankcase gases recirculation system – Option

Dimensions and Weights:

Engine overall size LxWxH	**3385 x 1669 x 2270 mm**
	133.27 x 65.71 x 89.37 in
Weight, dry,	5800 kg (12787 lb)
Standard color	Grey - RAL 9007





Engine Starting System

Starting system	Electrical starter, 24 Vdc

Cooling System

Cooling system	**2 circuits (HT & LT)**
Oil cooler	In LT (optional in HT circuit)
Intercooler stages	Two stage IC (1st LT & 2nd HT)

Jacket (HT) Water circuit

Outlet Temperature	**90 °C / 194°F**
Capacity,	200 L (52.8 gal)
Flow rate min, m³/hr (gpm)	60 /77/ 80 (264/339/352)
Flow rate max,	90 m³/hr (396 gpm)

Intercooler (LT) Water circuit

Inlet Temperature	**55°C / 131°F or 40°C/104°F**
Capacity	60 L (15.8 gal)
Flow rate min m³/hr, (gpm)	15 / 20 / 25 (66/ 88/110)
Flow rate max,	30 m³/hr (132 gpm)

☐ Cost adder for oil cooler in the HT circuit – Option

☑ Mechanical-driven HT & LT Water Pumps with thermostatic boxes – only advisable for pure generation

Included in scope of supply

- Pre-lube electric oil pump (if a 300l tank is not included).
- Oil & water preheating system.
- Dry type high efficiency air filter.
- Flexible water, gas, oil and exhaust connections
- Basic spare parts & maintenance tool kit for start-up.
- Documentation: Installation, O&M manuals.

SPECIAL ACCESSORIES / COMMENTS:

Guascor Energy, S.A.U.
Barrio Oikia, 44 E-20759 Zumaia, Spain

G-56SL GUASCOR ENERGY GAS ENGINE Technical Scope of Supply

GENSET MODULE ☑

Genset Module

Electrical power,kWe

Voltage, V	☑	☐	☐
	400 / 480	415 / 440	600
Frequency, Hz	**60 / 50 / 60**		

Coupling: Flexible coupling.
Alignment at GE facilities

Bedframe: Welded rigid steel bedframe
Adjustable mounts for engine
Battery rack and wiring to starter
Lifting lugs
Elastic suspensions: 10

Alternator

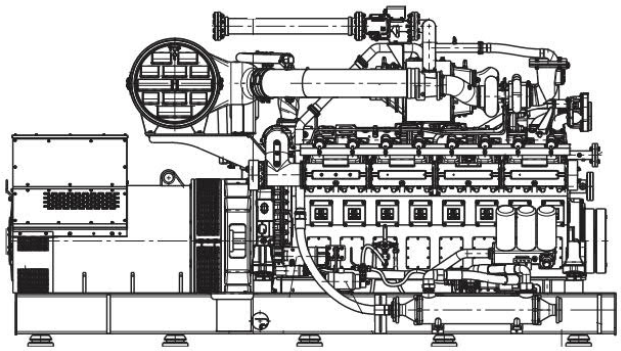
Type:	Synchronous brushless
Duty:	Continuous duty
Isolation/Temperature rise:	Class H / Class F
Protection	IP23
Excitation type:	AREP (PMG as optional)
AVR:	Electronic
Bearings / Poles:	2 / 4
Winding pitch:	2/3 – standard 6-wire winding
Voltage regulation/ accuracy:	± 5 % / ± 0.5 %
Short circuit current withstand:	3 x In for 10Sec
Norms:	IEC 60034, NEMA MG-1-32-33 ISO 8528/3 CSA-22.2-100
Heating resistance:	Included
Protections:	PTC thermistors in the windings

☐ Cost adder alternator with PMG excitation
☑ Cost adder for alternator at 1200rpm – 6 poles
☐ Cost adder - UL 1004 alternator certificate

Dimensions and Weights:

Genset Overall Size LxWxH	**4331 x 1756 x 2287 mm** **170.51 x 69.13 x 90.04 in**
Weight dry,	10000 kg (22046 lb)
Standard color:	Grey - RAL 9007

Remark: These dimensions are valid for 1500 & 1800 rpm models.
For the 1200 rpm model please contact Guascor Energy.



CE Marked

Batteries - Options

☐ Batteries: 2x12Vdc high duty lead acid type, 230 Ah, Supplied loose.

Gas Supply System - Options

☑ **Gas train**, includes:
Manual shut off valve, gas filter, pressure regulator, double solenoid valve, low and high level pressure switches, electronic leak detection, inlet and outlet pressure gauges.

☐ Inlet pressure range 150-500 mbar (2.2-7.25 psi)
☑ Inlet pressure range 1 – 4 bar (14.5-58 psi)
☐ Gas train according NFPA37

☐ **Fuel Blending system,** N.G./ Biogas . See IC-G-D-50-008.
Remark: FB system includes double gas train with progressive valves and double Tecjet on engine. It requires additionally GCS-G control cabinet.

OTHER SPECIAL ACCESSORIES / COMMENTS

G-56SL GUASCOR ENERGY GAS ENGINE Technical Scope of Supply

ACCESSORIES

Lubrication System - Options

- ☐ External lube oil supply tank, 300 liter (79.2 gallons) capacity, including filling/emptying electric oil pump
- ☐ Lube Oil drum (2) – first fill supply

Exhaust System - Options

- ☐ Exhaust Y-Pipe
- ☐ Industrial silencer - 30dB 40 dB cost adder ☐
- ☐ Oxidative catalyzer
  - ☐ High efficiency in NMHC – cost adder
- ☐ Exhaust motorized diverter for CHP
  - ☐ Electrical motors according UL
  - ☐ Cost adder for stainless steel in exhaust line.

Cooling System / CHP Equipment - Options

- ☐ 3-ways thermostatic valves for HT & LT circuits
- ☐ Electric water circuits circulating pumps for HT &LT circuits
- ☐ Dry Air Cooler, dual coil. (LT & HT coils combined in a single frame)
  - ☐ Electrical motors according UL
- ☐ Plate heat exchanger HT circuit – hot water recovery
- ☐ 3-Ways Electrical control valve HT circuit.Acc/thermal diagram
- ☐ Skid mounted with piping for HT & LT
- ☐ Expansion tanks for the HT & LT circuits
  - ☐ Expansion tanks and safety valves under ASME rules
- ☐ Pyrotubular exhaust heat exchanger for hot water recovery. Instrumentation included.Acc/thermal diagram.
- ☐ 3-Ways Electrical control valve process circuit – see thermal diagram (Loose item supply always)

OTHER SPECIAL ACCESSORIES / COMMENTS

G-56SL GUASCOR ENERGY GAS ENGINE Technical Scope of Supply

CONTROLS

GCS-G CONTROL & POWER CABINET

GCS-G Control Cabinet: A multi-function genset and ancillary control system. A PLC based flexible control system configurable to a range of generators in model, frequency (50/60) Hz and voltage. Selectable for island and/or parallel operation, with black start, import/export control, economode options available.

GCS-G Power Cabinet: Switchgear panel rated for generator at 400-600 Volt.

Several GCS-G (up to 6 units) can work together in a group island mode, to share kW/KVAr; control of a master grid switch can also be incorporated.

The GCS-G control system Key features:

- PLC based, with touch HMI interface.
- Flexible configuration options to meet application needs.
- Integration with Guascor Energy switchgear panel. Synchronization and main circuit breaker operation.
- Full integration with engine ECU (GCS-E), for control, monitoring and setup.
- Alternator protections and regulation.
- Gas train control.
- Battery charger.
- Control for ancillary system:
    - Cooling system – pumps.
    - Cooling system – Emergency coolers.
    - Thermal recovery-
    - Ancillary equipment status.

Detailed description according IC-G-D-AM-006e

GCS-P PLANT CABINET & SCADA SYSTEM

GCS-P governs a power plant.

GCS-P is a PLC based hub cabinet that provides a single control and data collection point for the whole power plant.

GCS-P system controls the GCS-G gensets when >6 gensets operate in island mode or a complex installation is required.

The GCS-P governs:

- GCS-G units as the master.
- The operation of the grid switch(s).
- Co-generation machines. (absorption machines, for example)
- Additional special ancillary operations.

GCS-P detailed description according IC-C-D-AI-001e.

Guascor Energy has developed an ad-hoc Scada Application for Guascor Energy Genset Power Plants including the ancillaries (cooling & CHP) and other peripherals.

The SCADA establishes communications with GCS-G and GCS-P PLC's providing a user friendly HMI to interact with the whole plant control systems and allowing the collecting and analyzing of the provide data.

SCADA detailed description according IC-C-D-SC-001e.

Consult Guascor Energy for additional information

GCS-G Supply Options

☐ GCS-G control cabinet

☐ GCS-G power cabinet

☐ GCS-G control & power cabinets (joined)

GCS cabinets according UL508 ☐

Plant Control - Supply Options

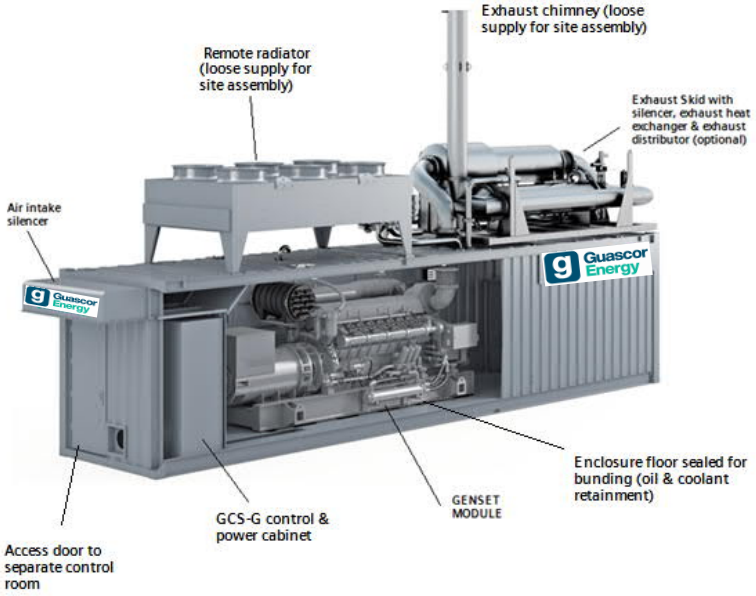
☐ GCS-P Plant cabinet

☐ SCADA System

OTHER SPECIAL EQUIPMENT / COMMENTS

G-56SL GUASCOR ENERGY GAS ENGINE Technical Scope of Supply

CONTAINERIZED UNIT ☐



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CHARACTERISTICS

Core design is a bespoke 40 feet ISO container (HC) directly suitable for freight transport.

Weatherproof for outdoors installation.

Standard average perimeter noise pressure level: 75dB(A) @10m / 33 ft. See IC-G-D-00-406e. Other levels by request.

Enclosure ventilation included, positive pressure axial fans.

Gas leakage and fire detectors included: alarm signaling and safety automatic genset & gas supply shutdown.

Containerized unit is supplied assembled and tested – based on the scope defined in this document. (External equipment will be supplied lose for site assembly)

Optional – an exhaust recovery skid, roof mounted, can be supplied; to include silencer, heat exchanger, bypass valve and thermal insulation.

Standard operation temperature range: 0°C to 35°C (32°F to 95°F)

Freight container certification. Valid for marine transportation.

Extra wide doors on both side of the container to provide for ease of maintenance.

Internal lighting, emergency lighting and available power sockets included.

Equipment on the roof of container is pre-assembled and pre-wired at factory and must be assembled at site

Factory assembly and testing and pre-configured external skids minimize site installation and commissioning works.

Detailed description according IC-G-D-00-391e

OPTIONAL

☐ CE marked container.

☐ Manufacture of container under NFPA70, UL508, NFPA72

☐ Noise pressure level 75dB(A)@1m / 3.3 ft.(@Tamb ≤35°C/95°F)

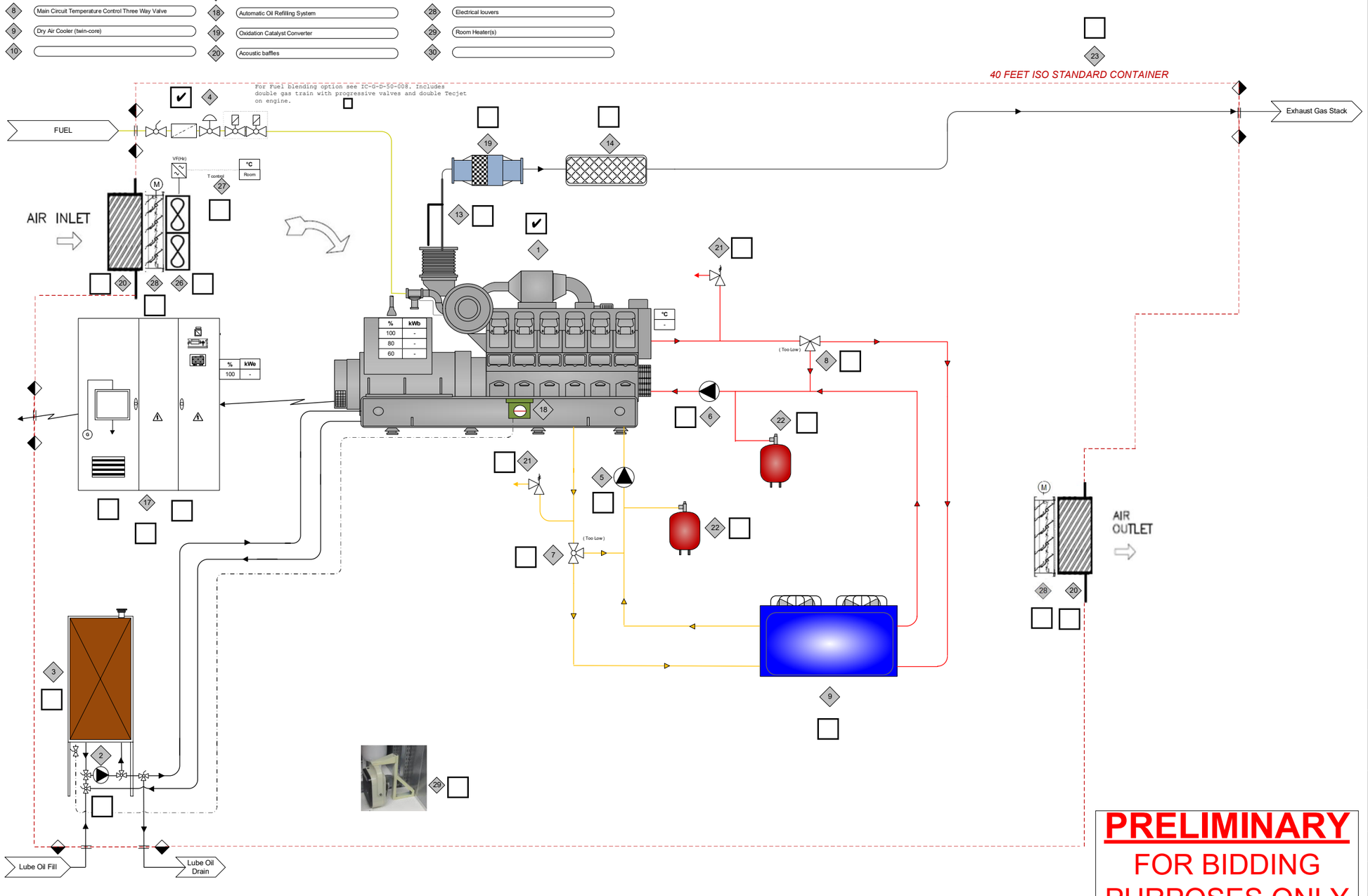
Minimum ambient temperature: ☐ -4°C / 25°F ☐ -16°C /3°F

Maximum ambient temperature: ☐ 45°C / 113°F

OTHER SPECIAL EQUIPMENT / COMMENTS

LEGEND

1	Gas Engine Driven Generator Set	11		21	Relief Valves
2	Lubricating Oil Pump	12		22	Expansion Tank
3	Lubricating Oil Tank	13	Y-Pipe	23	Sound-proofed 40 feet ISO Container
4	Fuel Gas Ramp	14	Exhaust Silencer	24	
5	Auxiliary Circuit Water Pump	15		25	
6	Main Cooling Circuit Water Pump	16		26	Electric driven fans for air recirculation
7	Auxiliary Circuit Temperature Control Three Way Valve	17	Control&Power Electrical Cabinet	27	Variable Frequency drive for room ventilation controlled by Room Temperature
8	Main Circuit Temperature Control Three Way Valve	18	Automatic Oil Refilling System	28	Electrical louvers
9	Dry Air Cooler (twin-core)	19	Oxidation Catalyst Converter	29	Room Heater(s)
10		20	Acoustic baffles	30	



Key

- FUEL GAS
- EXHAUST
- HT JACKET WATER CIRCUIT
- LT AUXILIARY WATER CIRCUIT
- EXTERNAL USES HOT WATER
- LUBRICATING OIL

Notes:

1. INTERFACE CONNECTIONS
   Others — GUASCOR
2. PFD Illustrates one genset CHP System
3. SCOPE OF SUPPLY
   Guascor (only if marked) — Others

Tolerance values as specificied in the engine data sheet according to ISO 3046

Rev.	Initials	Date	Remark
4	IBU	14/2/23	Engine model name change (SGE->G)
3	IBU	30/9/22	Company name change. (Guascor Energy).
2	IBU	13/11/20	Company name change
1	IBU	27/05/20	Louvers, VFD and Room heater(s) added. Other minor changes

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Proposal:

G-56SL GENERATION PROPOSALS

Drawing Title:

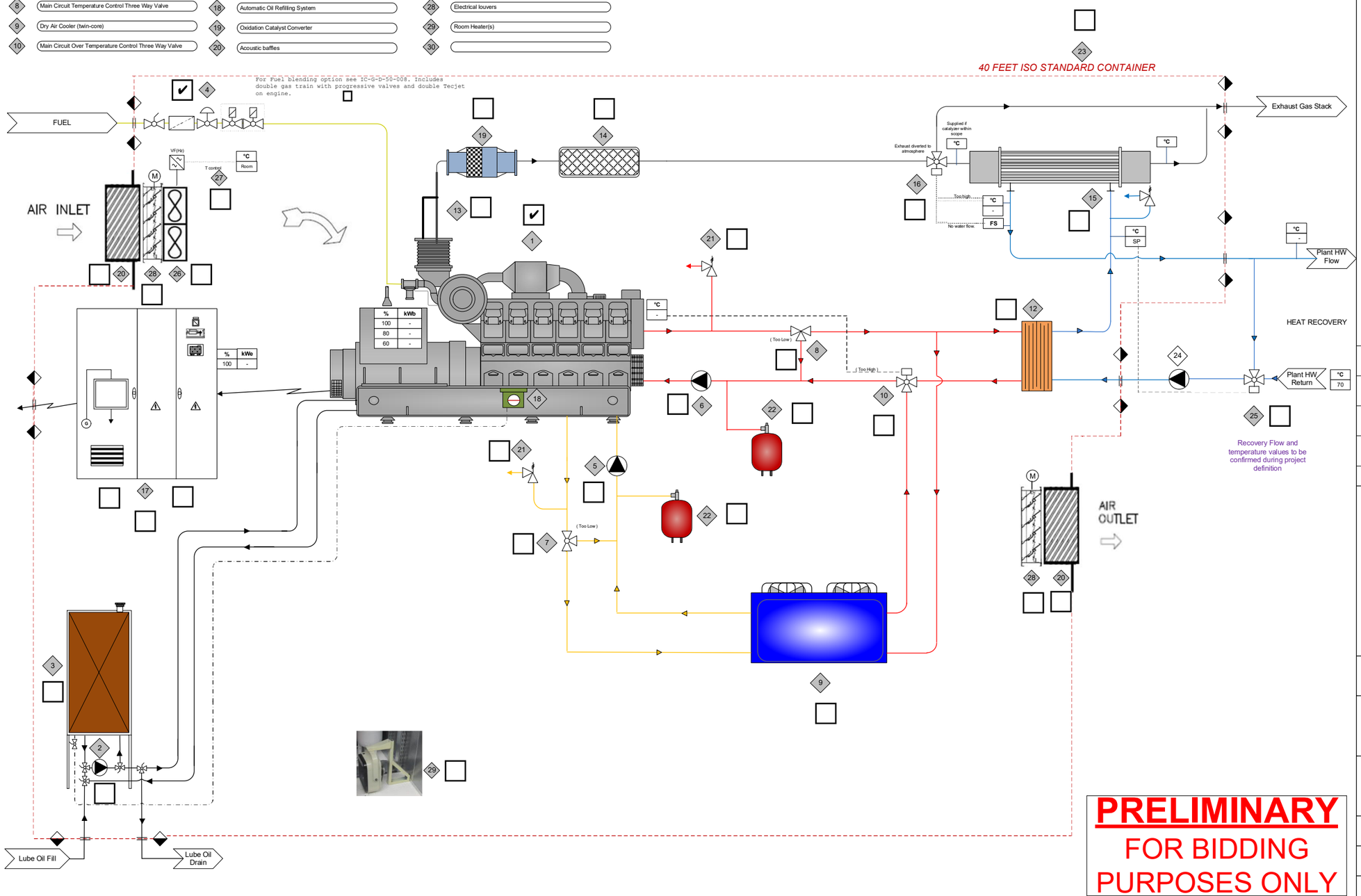
G-56SL GENERATION PROCESS FLOW DIAGRAM (D7 GDC)

Drawn By: I.Bengoetxea	Scale: n/a
Checked By: C.García	Date: 26/04/18
Drawing Number: **G-56SL generation Process flow diagram (D7 GDC)**	Rev: **4**

PRELIMINARY
FOR BIDDING PURPOSES ONLY

LEGEND

1	Gas Engine Driven Generator Set	11		21	Relief Valves
2	Lubricating Oil Pump	12	Main Cooling Circuit Plate Heat Exchanger	22	Expansion Tank
3	Lubricating Oil Tank	13	Y-Pipe	23	Sound-proofed 40 feet ISO Container
4	Fuel Gas Ramp	14	Exhaust Silencer	24	Recovery Circuit Pump
5	Auxiliary Circuit Water Pump	15	Pyrotubular Exhaust Heat Exchanger w/safety valve and associated instrumentation (flow switch, temperature sensors)	25	Recovery Circuit Three Way Valve
6	Main Cooling Circuit Water Pump	16	Exhaust Gas Bypass Three Way Valve	26	Electric driven fans for air recirculation
7	Auxiliary Circuit Temperature Control Three Way Valve	17	Control&Power Electrical Cabinet	27	Variable Frequency drive for room ventilation controlled by Room Temperature
8	Main Circuit Temperature Control Three Way Valve	18	Automatic Oil Refilling System	28	Electrical louvers
9	Dry Air Cooler (twin-core)	19	Oxidation Catalyst Converter	29	Room Heater(s)
10	Main Circuit Over Temperature Control Three Way Valve	20	Acoustic baffles	30	



Recovery Flow and temperature values to be confirmed during project definition

PRELIMINARY
FOR BIDDING PURPOSES ONLY

Key

- FUEL GAS
- EXHAUST
- HT JACKET WATER CIRCUIT
- LT AUXILIARY WATER CIRCUIT
- EXTERNAL USES HOT WATER
- LUBRICATING OIL

Notes:

1. INTERFACE CONNECTIONS
   - Others
   - GUASCOR
2. PFD Illustrates one genset CHP System
3. SCOPE OF SUPPLY
   - Guascor (only if marked)
   - Others

Tolerance values as specificied in the engine data sheet according to ISO 3046

Rev.	Initials	Date	Remark
5	IBU	14/2/23	Engine model name change (SGE->G)
4	IB	30/9/22	Company name change. (Guascor Energy).
3	IB	13/11/20	Company name change. Instrumentation associated with exhaust heat exchanger. POS 25 mixing valve
2	IB	25/05/20	Exhaust heat exchanger in process side. Louvers, VFD and Room heater(s) added.Other minor changes

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Proposal:

G-56SL CHP PROPOSALS

Drawing Title:

G-56SL CHP PROCESS FLOW DIAGRAM (D3 MC EG)

Drawn By:	Scale:
I.Bengoetxea	n/a
Checked By:	Date:
C.García	10/12/18
Drawing Number:	Rev:
G-56SL CHP Process flow diagram (D3 MC EG)	**5**