# G-36SL GUASCOR ENERGY GAS ENGINE
## Technical Scope of Supply



*Image non-binding, may not reflect actual engine configuration*

- ☐ **Natural gas & biogas, 1200 rpm, 60Hz**
- ☐ **Natural gas & biogas, 1500 rpm, 50 Hz**
- ☐ **Natural gas & biogas, 1800 rpm, 60 Hz**

**G-36SL** 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.
- 12 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.

# G-36SL GUASCOR ENERGY GAS ENGINE Technical Scope of Supply

## General Specifications:

| | |
|---|---|
| **Engine model** | **G-36SL** |
| **Rated rpm** | 1200 / 1500 / 1800 |
| **ISO COP, kWb (bhp)** | |
| Cylinder arrangement | V – 12 |
| Displacement, | 35.93 L (2,191 cu.in.) |
| Bore x stroke, | 152 x 165mm (5.98 x 6.5 in) |
| Compression ratio | |
| Mean piston speed, m/s (in/s) | 6.6 / 8.3 / 9.9 (260 / 327/ 390) |
| Exhaust manifold type | Wet (Dry optional) |
| Engine noise, LpA,∑ dB(A) | 87 / 92 / 93 |

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.
- 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.

☐ Knocking Detection System.

☐ Mechanical carburation adjustment,without GCS-E

## Lubrication System

| | |
|---|---|
| Lube oil pump | Gear mechanical pump |
| Lube oil capacity | 174 L (46 gal) |
| Filters | 3 Full flown type filters |

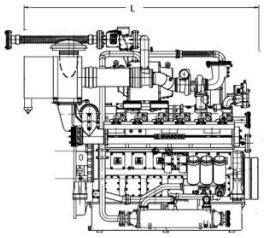
Approx. oil consumption, 0.35 g/kWh (0.00058 lb/bHP.hr)

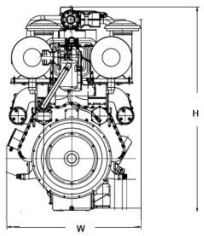
Oil level maintainer with float and sight glass

☐ Oil crankcase gases recirculation system – Option

## Dimensions and Weights:

| | |
|---|---|
| **Engine overall size** LxWxH | **2588 x 1664 x 2258 mm** |
| | **101.89 x 65.51 x 88.9 in** |
| Weight, dry, | 4200 kg (9259 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, | 180 L (47.5 gal) |
| Flow rate min, m³/hr (gpm) | 60/72/82 (264/317/361) |
| Flow rate max, | 90 m³/hr (396 gpm) |

**Intercooler (LT) Water circuit**

| | |
|---|---|
| **Inlet Temperature** | **55°C / 131°F or 40°C/104°F** |
| Capacity | 40 L (10.6 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-36SL 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 Guascor facilities

Bedframe: Welded rigid steel bedframe
Adjustable mounts for engine
Battery rack and wiring to starter
Lifting lugs
Elastic suspensions: 8

### 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: | 1 / 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

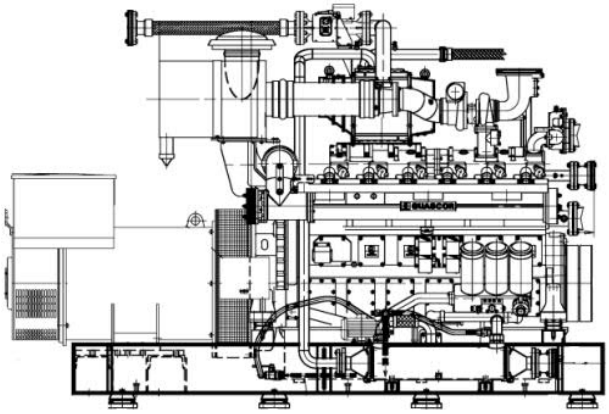
☐ Cost adder for alternator at 1200rpm – 6 poles

☐ Cost adder - UL 1004 alternator certificate

### Dimensions and Weights:

| | |
|---|---|
| Genset Overall Size LxWxH | **3579 x 1736 x 2372 mm** **140.91x68.35x93.39 in** |
| Weight dry, | 7160 kg (15785 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-36SL 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-36SL 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 ☐

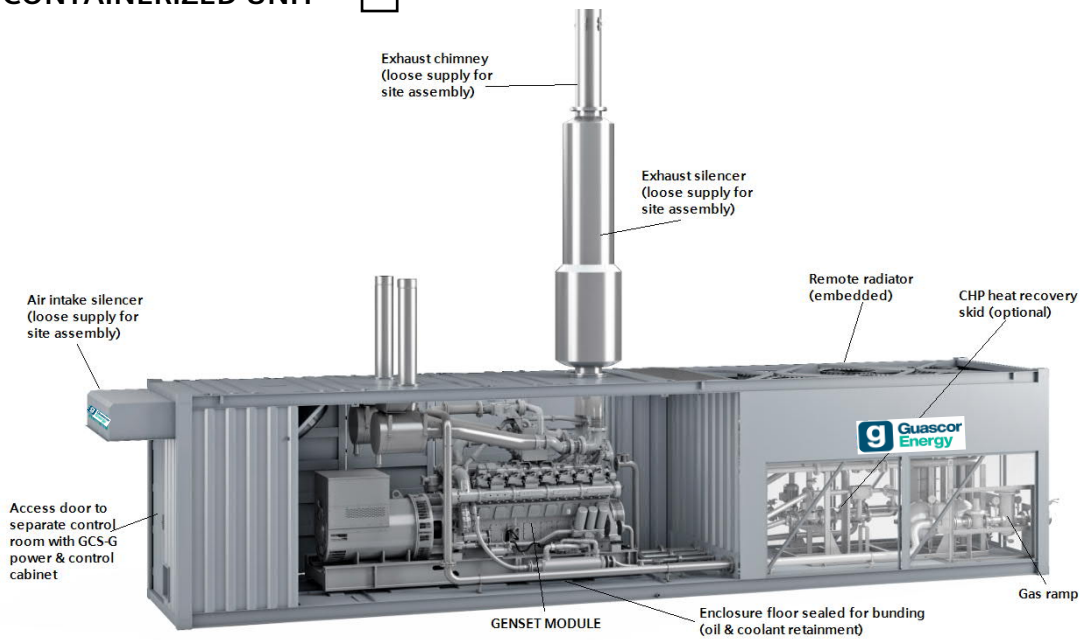
### Plant Control - Supply Options

- ☐ GCS-P Plant cabinet
- ☐ SCADA System

### OTHER SPECIAL EQUIPMENT / COMMENTS

# G-36SL 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)

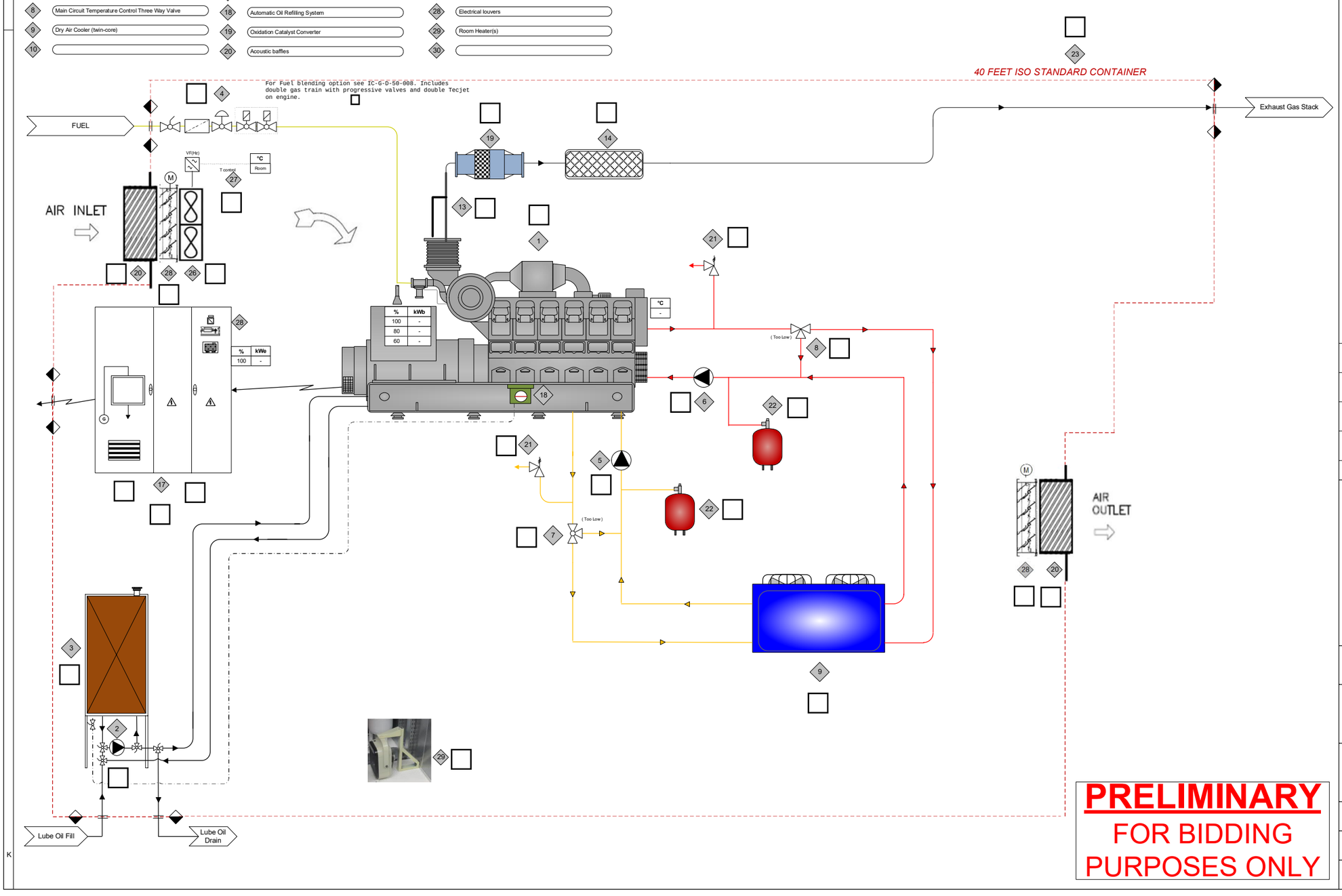
Minimum ambient temperature: ☐ -4°C / 25°F ☐ -16°C /3°F

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

**PRELIMINARY**
FOR BIDDING PURPOSES ONLY

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

| Rev. | Initials | Date | Remark |
|---|---|---|---|
| 4 | IBU | 16/2/23 | Engine name change (SGE->G) |
| 3 | IBU | 30/9/22 | Company name change. (Guascor Energy). |
| 2 | IBU | 13/11/20 | Company name change |
| 1 | IBU | 01/06/20 | Louvers, VFD and Room heater(s) added. Other minor changes |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Proposal:

**G-36SL GENERATION PROPOSALS**

Drawing Title:

**G-36SL GENERATION PROCESS FLOW DIAGRAM (D7 GDC)**

| | |
|---|---|
| Drawn By: I.Bengoetxea | Scale: n/a |
| Checked By: C.García | Date: 26/04/18 |
| Drawing Number: **G-36SL generation process flow diagram (D7 GDC)** | Rev: **4** |

## LEGEND

| | | | | | |
|---|---|---|---|---|---|
| 1 | Gas Engine Driven Generator Set | 11 | | 21 | Relief Valves |
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| 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 |
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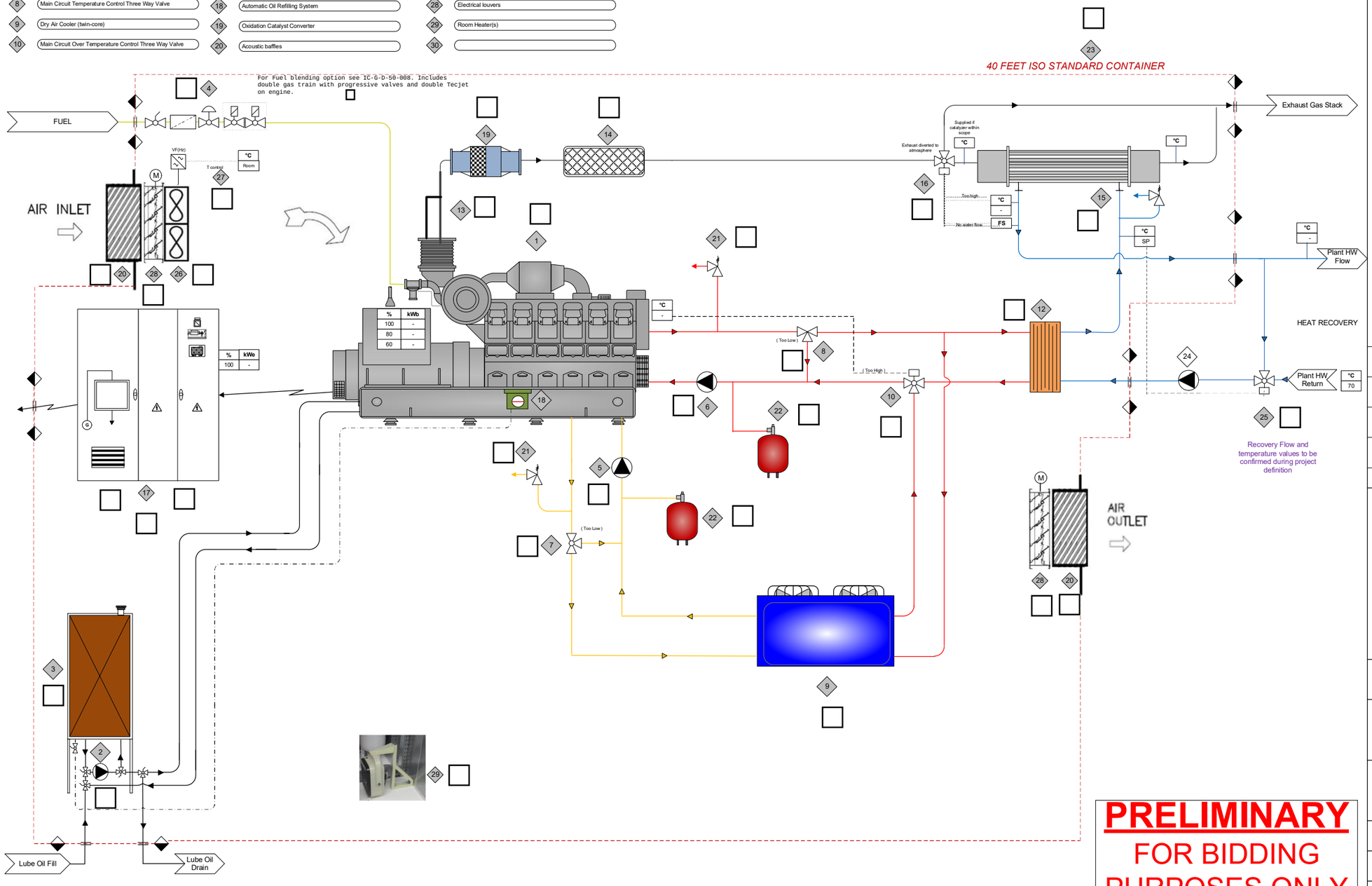


## Key

- FUEL GAS
- EXHAUST
- HT JACKET WATER CIRCUIT
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## Notes:

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

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

| Rev. | Initials | Date | Remark |
|---|---|---|---|
| 5 | IBU | 16/2/23 | Engine name change (SGE->G) |
| 4 | IBU | 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 | 01/06/20 | Exhaust heat exchanger in process side. Louvers, VFD and Room heater(s) added.Other minor changes |


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Proposal:

**G-36SL CHP PROPOSALS**

Drawing Title:

**G-36SL CHP PROCESS FLOW DIAGRAM (D3 MC EG)**

| | |
|---|---|
| Drawn By: I.Bengoetxea | Scale: n/a |
| Checked By: C.García | Date: 10/12/18 |
| Drawing Number: **G-36SL CHP Process flow diagram (D3 MC EG)** | Rev: **5** |

**PRELIMINARY**
FOR BIDDING PURPOSES ONLY