NATURAL GAS GENSET

based on *mtu* 16V4000L64FNER
for continuous application
2028kWe 400V 50Hz 1500 RPM NOX500)

A Rolls-Royce solution

General Description

- *mtu* gas genset powered by *mtu* gas engine 16V4000L64FNER
- containerized design with ISO 40' High Cube Container
- cooling system for engine and mixture cooling circuit (heat recovery as optional for CHP applications)
- generator output field including customer`s connection
- MCS (Module Control System) for containerized system control, regulating, diagnosis and protection

Features of Container

- full transportability of the system (Rail, Road, Sea)
- Lloyd`s CSC-certified (Convention Safety Container) for trouble-free conventional transport (Rail, Road, Sea) and stackable storage of the modules
- Plug & Play solution for the ease of "On site" installation and operation
- versatile use of the gensets (different operating conditions)
- weather-proof
- minimum external dimensions, ISO 40' HQ container
- proven tested design (extensive testing before launch as standard products)
- combinable optional packages to suit various demands
- environment friendly provision (e.g. low noise level, container floor sealed against leaking oil and water, optional catalytic converter and CHP unit)

Acoustic

Sound pressure level	95dB(A)
Tolerance	+2dB(A)
Distance from genset	1 m
Reference height above ground	1.5 m
Optional Sound pressure level	65 / 75dB(A)

Design Conditions

Ambient Temp.	0˚C~40˚C
Ambient Temp.	60%
Altitude	100m

Applicable Standard

Low voltage Directive 2006/95/EG

EMV Directive 2004/108/EG

Lloyds CSC Certified

Corners of container (ISO1161)

Protective coating (CSN EN12944)

Safety instruction according to international standard (ISO3864 / ANSI Z535)

Conformite Europeenne (2006/42/EC, 2014/35/EU, 97/23/EC)

Color Scheme

Engien, generator	RAL7001
Frame	RAL5002
Control cabinet	RAL7035
External surface of container (if option is selected, customer shall advise the color code)	RAL9003

Technical Specification

Engine

Engine Model	16V4000L64FNER
Number of cylinders / configuration	16V
Engine speed	1500 r/min
Bore	170 mm
Stroke	210 mm
Displacement	76.3 l
Mean Piston Speed	10.5 m/s
Compression Ratio	12.5
BMEP At Nominal Engine Speed Min-1	21.8 bar
Lube Oil Consumption	0.35 dm^3/h

Internal Consumption

Internal consumption for the radiator	10.68 kWe
Internal consumption for HT&LT Pump	20.7 kWe
Internal consumption of ventilation fans	6.2 kWe
Battery charger	4 kWe
Coolant heater	9 kWe
Anti-condensation heater	1.2 kWe

Engine Coolant

Coolant Temp.(in/out)	78/92 ˚C
Coolant flow rate	74.7 m^3/h
Max. operation pressure	6 bar
Pressure drop, design	2.88 / 44.7 bar / m^3/h

Mixture Cooler 2nd Stage, External

Coolant Temp.(in/out), design	58 / 60.2 ˚C
Coolant volumetric flow, design, Constant	34.3 m^3/h
Pressure drop, design	0.48 / 50.6 bar / m^3/h
Max. operation pressure before mixture cooler	6 bar

Exhaust Gas Emissions

NOx, stated as NO2 (dry, 5% O2)	< 500 mg/m3 i.N.
CO (dry, 5% O2)	< 1000 mg/m3 i.N.
HCHO (dry, 5% O2)	< 102 mg/m3 i.N.

Reference Fuel

Natural gas	CH4>95 Vol.%
Minimum methane number	80 MN
Range of heating value: design / operation range	10-10.5 / 8.0 - 11.0kWh/m^3 i.N
Nominal size / gas pressure min. - max	155-250 mbar -mbar

Exhaust System

Exhaust gas temp. (after turbocharger)	424 ˚C
Exhaust gas volume flow, wet	8274 m^3l.N./h
Exhaust gas volume flow, dry	7409 m^3l.N./h
Exhaust gas mass flow, wet	10522 kg/h
Exhaust Back Pressure min. – max	30-60 mbar

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Liquid capacity

Lube oil engine	330 Liter
Coolant for engine	270 Liter
Intercooler coolant capacity	25 Liter

Alternator

Rating power (temp. rise class F)	2800 kVA
Insulation class / temp. rise class	H / F
Winding pitch	2/3
Protection	IP23
Max. allowable pf. Inductive (overexcited) / capacities (under excited)	0.8 / 1.0
Voltage tolerance / frequency tolerance	±5/±5

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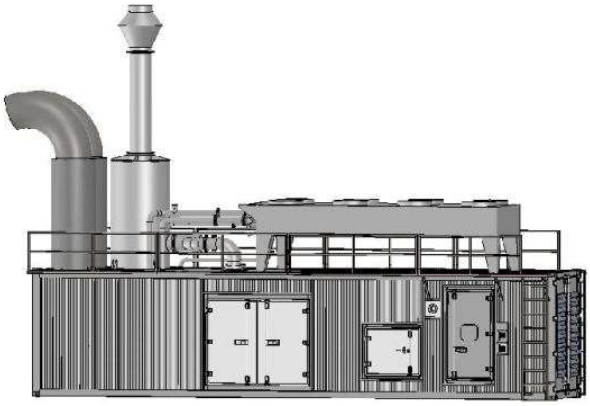


Cooling System

Rated radiator temperature	40 ˚C
Antifreeze cooling medium	35 %

Standard features:

- radiator for engine cooling water circuit and gas mixture cooling circuit
- radiator exhaust air via roof
- stainless steel piping
- temperature control via mixing valve in gas mixture cooling and engine cooling water circuits
- integrated control, safety and shut-off devices in the cooling water circuits
- closed cooling system
- intake and exhaust air with protective grid
- intake and exhaust air with sound attenuated louvers
- exhaust air at the front part of container
- intake and exhaust air with weatherproof grid
- conveyance of the required air volume by means of axial fans

Optional Items:

- air intake with sand filter and protective grid
- air intake with filter mats
- engine cooling water heat recovery

Protective Equipment (Standard Features)

- Fire alarm system (horn + light)
- Gas alarm system (horn + light)
- Leakage monitor for “oil sump”
- Optical alarm for “bus bar under voltage”
- Safety instruction according to international standard (ISO3864 / ANSI Z535)
- Fire extinguishers (hand held type) at the access doors
- EMERGENCY-STOP button at the access doors (outside)
- Complete generator output field installed on the container wall
- Access from outside at one side of the container through lockable access doors

Optional Items:

- Work platform

Generator Output Field (Standard Features)

- isolating switch for power supply of auxiliary drives
- 3P Isolating switch for generator voltage
- 3P Isolating switch for bus bar voltage
- connecting of customer power cable

Lighting

Standard features:

- Complete lighting consisting of 230 V 50 Hz
- Emergency lights
- Lighting for emergency exit in accordance with EU 89/654/EWG

Optional Item:

- Option DC 24V lighting

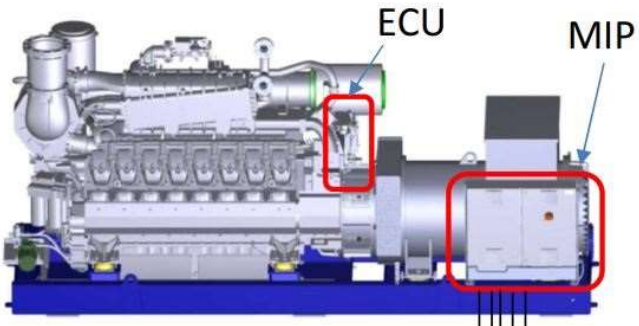
Gravity-operated lube oil system (Top Up System), Optional

- Extra lube oil tank
- Controlled via MCS
- Automatic refilling system
- High/Low level monitor
- Minimum volume monitor for lube oil tank
- Lubricating oil pump for draining the oil sump (including two solenoid valves)

MIP & MCS GAS GENSET CONTROL SYSTEM

Mounted directly on the base frame of all *mtu* systems, the *mtu* Interface Panel (MIP) manages engine and generator operation. It also controls paralleling and synchronizing with other sources of electricity, such as the utility or other generator sets, and provides remote access and software interfacing capabilities.

- Genset Control PLC
- interface to engine control unit (ECU)
- interface to alternator
- bus interface to external (Modbus)
- on-base components cabled to MIP



MCS (Module Control System)

Highly customizable solution – the Module Control System (MCS) – seamlessly links with the MIP engine and generator set controls by cable, making all vital data and functions accessible to the operator from one convenient location.

- Operator interface
- DC power supply
- Data Logging capability
- Remote connections to *mtu* available
- Control of off base components

The MIP/MCS consolidates the following controls and functions:

Generator Set Controls

- Starter Battery Charger
- Gas train control
- Engine oil system (refilling)
- I/O`s (Inputs/Outputs), auxiliary drives
- Parallel/Island operation
- Load sharing
- PLC (Programmable Logic Controller)
- AVR (Automatic Voltage Regulator)
- Energy-Measure-Module - controls

Engine Control Unit (ECU)

- Gas supply (mixture/lambda)
- Throttle / speed control
- Ignition control
- Turbo bypass
- Knocking detection / control
- Engine sensors / monitoring
- Emission sensor (NOx)
- Start / stop procedure

Accessory Controls

- Alarm system
- Data logging
- Visualization (webserver)
- MCS interfaces (Ethernet)
- Customer interfaces (ex. Modbus)
- HMI touchscreen
- Remote monitoring and diagnostic

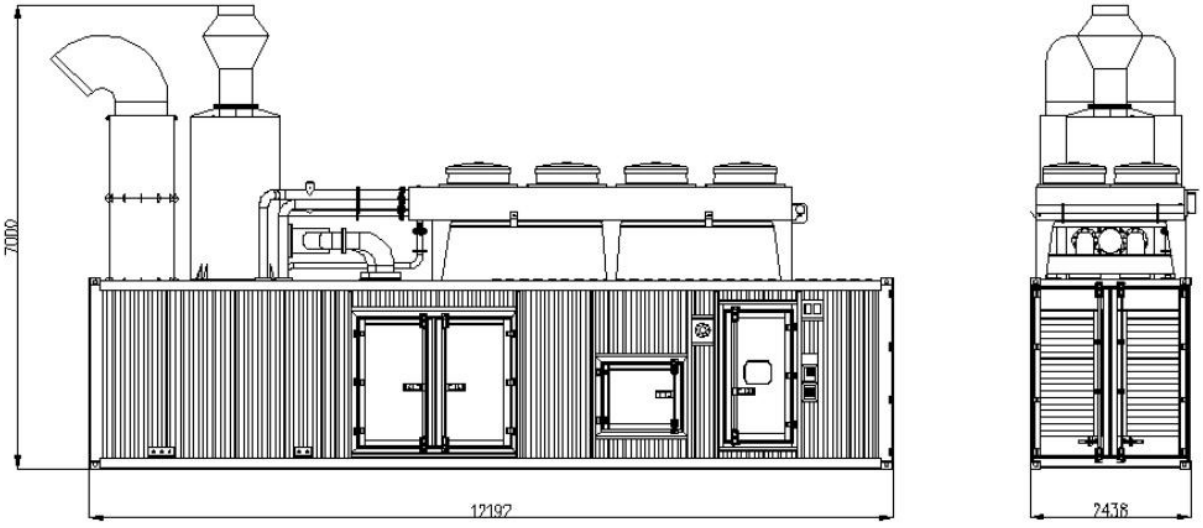
Rated Power

Energy balance	%	100	75	50
Electrical Power	kW	2028	1521	1014
Energy input	kW	4672	3560	2473
Thermal output total	kW	1122	823	563
Thermal output engine (block, lube oil)	kW	1122	823	563
Thermal output mixture cooler 2nd stage	kW	81	46	22
Exhaust heat (120˚C)	kW	980	814	610
Engine power ISO 3046-1	kW	2080	1560	1045
Generator efficiency at power factor = 1	%	97.5	97.5	97.0
Electrical efficiency	%	43.4	42.7	41.0
Total efficiency	%	88.4	88.7	88.4

Примітки:

1) Genset can operate at max. 1000m altitude and max. 40˚C intake air temperature; else power derating
2) Prime power operation will be designed specific to the project
3) Generator gross power at nominal voltage, power factor = 1 and nominal frequency
4) According to ISO 3046 (+5% tolerance), using reference fuel used at nominal voltage, power factor = 1 and nominal frequency
5) Emission values during grid parallel operation
6) Thermal output at layout temperature; tolerance +/- 8%
7) Optional voltages: 690V/6300V/10500/11000V
8) Optional Nox value: 250 mg/m³ i.N.
9) Optional Ambient Temp: 25˚C/40˚C
10) Optional, Containerized solutions: ISO 20'HQ container or customized size
11) Optional Minimum methane number: 60MN~80MN
12) Optional CHP applications for suppling hot water or steam
13) Optional Engine model: 16V4000L64

Dimensions and Weight (Typical Design)



Dry Weight (kg)	Dimensions (L*W*H) mm
31700	12192*2438*7000