Technical Description

Cogeneration Unit-Container

JMC 420 GS-B.L

no special Grid Code

Zorg Biogas

Electrical output	1501	kW el.
Thermal output	1490	kW

Emission values

NOx < 500 mg/Nm³ (5% O2)

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0.01 Technical Data (container)

			100%	75%	50%
Power input	[2]	kW	3.538	2.726	1.914
Gas volume	*)	Nm³/h	786	606	425
Mechanical output	[1]	kW	1.540	1.155	770
Electrical output	[4]	kW el.	1.501	1.125	747
Recoverable thermal output					
~ Intercooler 1st stage	[9]	kW	293	166	31
~ Lube oil		kW	211	188	165
~ Jacket water		kW	407	339	284
~ Exhaust gas cooled to 180 °C		kW	579	484	370
Total recoverable thermal output	[5]	kW	1.490	1.177	850
Total output generated		kW total	2.991	2.302	1.597
Heat to be dissipated					
~ Intercooler 2nd stage		kW	83	62	40
~ Lube oil		kW	~	~	~
~ Surface heat	ca. [7]	kW	127	~	~
Spec. fuel consumption of engine electric	[2]	kWh/kWel.h	2,36	2,42	2,56
Spec. fuel consumption of engine	[2]	kWh/kWh	2,30	2,36	2,49
Lube oil consumption	ca. [3]	kg/h	0,31	~	~
Electrical efficiency			42,4%	41,3%	39,0%
Thermal efficiency			42,1%	43,2%	44,4%
Total efficiency	[6]		84,5%	84,5%	83,5%
Hot water circuit:					
Forward temperature		°C	90,0	85,8	81,4
Return temperature		°C	70,0	70,0	70,0
Hot water flow rate		m³/h	64,0	64,0	64,0
Fuel gas LHV		kWh/Nm³	4,5		

*) approximate value for pipework dimensioning
[ ] Explanations: see 0.10 - Technical parameters

All heat data is based on standard conditions according to attachment 0.10. Deviations from the standard conditions can result in a change of values within the heat balance, and must be taken into consideration in the layout of the cooling circuit/equipment (intercooler; emergency cooling; ...). In the specifications in addition to the general tolerance of ±8 % on the thermal output a further reserve of +5 % is recommended for the dimensioning of the cooling requirements.

Main dimensions and weights (container)

Length	mm	~ 12.200
Width	mm	~ 3.000
Height	mm	~ 2.600
Weight empty	kg	~ 37.600
Weight filled	kg	~ 39.500

Connections

Hot water inlet and outlet [A/B]	DN/PN	100/10
Exhaust gas outlet [C]	DN/PN	300/10
Fuel gas connection (container) [D]	mm	150/16
Fresh oil connection	G	28x2"
Waste oil connection	G	28x2"
Cable outlet	mm	800x400
Condensate drain	mm	18

Output / fuel consumption

ISO standard fuel stop power ICFN	kW	1.540
Mean effe. press. at stand. power and nom. speed	bar	20,17
Fuel gas type		Biogas
Based on methane number | Min. methane number	MZ	135 | 117 d)
Compression ratio	Epsilon	12,5
Min./Max. fuel gas pressure at inlet to gas train	mbar	120 - 200 c)
Max. rate of gas pressure fluctuation	mbar/sec	10
Maximum Intercooler 2nd stage inlet water temperature	°C	55
Spec. fuel consumption of engine	kWh/kWh	2,30
Specific lube oil consumption	g/kWh	0,20
Max. Oil temperature	°C	85
Jacket-water temperature max.	°C	95
Filling capacity lube oil (refill)	lit	~ 437

c) Lower gas pressures upon inquiry
d) based on methane number calculation software AVL 3.2

0.02 Technical data of engine

Manufacturer		GE Jenbacher
Engine type		J 420 GS-B25
Working principle		4-Stroke
Configuration		V 70°
No. of cylinders		20
Bore	mm	145
Stroke	mm	185
Piston displacement	lit	61,10
Nominal speed	rpm	1.500
Mean piston speed	m/s	9,25
Length	mm	3.750
Width	mm	1.580
Height	mm	2.033
Weight dry	kg	7.200
Weight filled	kg	7.900
Moment of inertia	kgm²	11,64
Direction of rotation (from flywheel view)		left
Radio interference level to VDE 0875		N
Starter motor output	kW	13
Starter motor voltage	V	24

Thermal energy balance

Power input	kW	3.538
Intercooler	kW	376
Lube oil	kW	211
Jacket water	kW	407
Exhaust gas cooled to 180 °C	kW	579
Exhaust gas cooled to 100 °C	kW	770
Surface heat	kW	73

Exhaust gas data

Exhaust gas temperature at full load [8]	°C	415
Exhaust gas temperature at bmep= 15,1 [bar]	°C	~ 436
Exhaust gas temperature at bmep= 10,1 [bar]	°C	~ 463
Exhaust gas mass flow rate, wet	kg/h	7.943
Exhaust gas mass flow rate, dry	kg/h	7.391
Exhaust gas volume, wet	Nm³/h	6.204
Exhaust gas volume, dry	Nm³/h	5.517
Max.admissible exhaust back pressure after engine	mbar	60

Combustion air data

Combustion air mass flow rate	kg/h	7.334
Combustion air volume	Nm³/h	5.675
Max. admissible pressure drop at air-intake filter	mbar	10

Sound pressure level

Aggregate a)		dB(A) re 20µPa	97
31,5	Hz	dB	79
63	Hz	dB	87
125	Hz	dB	98
250	Hz	dB	95
500	Hz	dB	91
1000	Hz	dB	86
2000	Hz	dB	88
4000	Hz	dB	92
8000	Hz	dB	89
Exhaust gas b)		dB(A) re 20µPa	115
31,5	Hz	dB	95
63	Hz	dB	117
125	Hz	dB	115
250	Hz	dB	113
500	Hz	dB	108
1000	Hz	dB	105
2000	Hz	dB	108
4000	Hz	dB	109
8000	Hz	dB	107

Sound power level

Aggregate	dB(A) re 1pW	117
Measurement surface	m²	110
Exhaust gas	dB(A) re 1pW	123
Measurement surface	m²	6,28

a) average sound pressure level on measurement surface in a distance of 1m (converted to free field) according to DIN 45635, precision class 3.
b) average sound pressure level on measurement surface in a distance of 1m according to DIN 45635, precision class 2.
The spectra are valid for aggregates up to bmep=20 bar. (for higher bmep add safety margin of 1dB to all values per increase of 1 bar pressure).
Engine tolerance ± 3 dB

0.03 Technical data of generator

Manufacturer		Leroy-Somer e)
Type		LSA 52.3 L9 e)
Type rating	kVA	1.870
Driving power	kW	1.540
Ratings at p.f. = 1,0	kW	1.501
Ratings at p.f. = 0,8	kW	1.486
Rated output at p.f. = 0,8	kVA	1.857
Rated reactive power at p.f. = 0,8	kVar	1.114
Rated current at p.f. = 0,8	A	2.680
Frequency	Hz	50
Voltage	V	400
Speed	rpm	1.500
Permissible overspeed	rpm	1.800
Power factor (lagging - leading)		0,8 - 1,0
Efficiency at p.f. = 1,0		97,5%
Efficiency at p.f. = 0,8		96,5%
Moment of inertia	kgm²	48,30
Mass	kg	4.489
Radio interference level to EN 55011 Class A (EN 61000-6-4)		N
Ik'' Initial symmetrical short-circuit current	kA	26,51
Is Peak current	kA	67,48
Insulation class		H
Temperature (rise at driving power)		F
Maximum ambient temperature	°C	40

Reactance and time constants (saturated) at rated output

xd direct axis synchronous reactance	p.u.	2,01
xd' direct axis transient reactance	p.u.	0,20
xd'' direct axis sub transient reactance	p.u.	0,10
x2 negative sequence reactance	p.u.	0,11
Td'' sub transient reactance time constant	ms	22
Ta Time constant direct-current	ms	28
Tdo' open circuit field time constant	s	2,99

e) GE Jenbacher reserves the right to change the generator supplier and the generator type. The contractual data of the generator may thereby change slightly. The contractual produced electrical power will not change.

0.04 Technical data of heat recovery

General data - Hot water circuit

Total recoverable thermal output	kW	1.490
Return temperature	°C	70,0
Forward temperature	°C	90,0
Hot water flow rate	m³/h	64,0
Nominal pressure of hot water	PN	10
min. operating pressure	bar	3,5
max. operating pressure	bar	9,0
Pressure drop hot water circuit	bar	0,40
Maximum Variation in return temperature	°C	+0/-5
Max. rate of return temperature fluctuation	°C/min	10

General data - Cooling water circuit

Heat to be dissipated	kW	83
Return temperature	°C	55
Cooling water flow rate	m³/h	20
Nominal pressure of cooling water	PN	10
min. operating pressure	bar	0,5
max. operating pressure	bar	5,0
Loss of nominal pressure of cooling water	bar	~
Maximum Variation in return temperature	°C	+0/-5
Max. rate of return temperature fluctuation	°C/min	10

Exhaust gas heat exchanger

Type	shell-and-tube

PRIMARY:

Exhaust gas pressure drop approx	bar	0,02
Exhaust gas connection	DN/PN	300/10

SECONDARY:

Pressure drop hot water circuit	bar	0,20
Hot water connection	DN/PN	100/10

The final pressure drop will be given after final order clarification and must be taken from the P&ID order documentation.

connection variant 1Kc

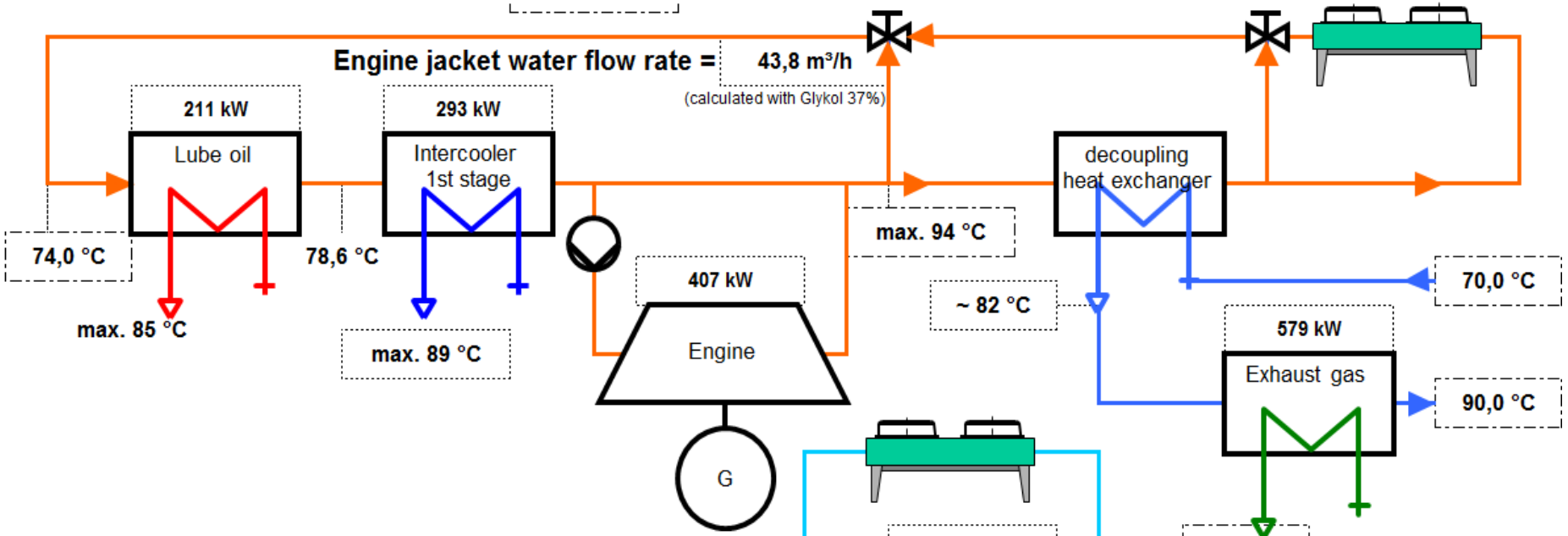
Teofipol 3 **J 420 GS-B25**

Hot water circuit

Recoverable thermal output = **1.490 kW**

(±8 % tolerance +5 % reserve for cooling requirements)

Hot water flow rate = **64,0 m³/h**



Low temperature circuit (calculated with Glykol 37%)

Heat to be dissipated = **83 kW**

(±8 % tolerance +5 % reserve for cooling requirements)

Cooling water flow rate = **20,0 m³/h**

0.10 Technical parameters

All data in the technical specification are based on engine full load (unless stated otherwise) at specified temperatures and the methane number and subject to technical development and modifications.

All pressure indications are to be measured and read with pressure gauges (psi.g.).

(1) At nominal speed and standard reference conditions ICFN according to DIN-ISO 3046 and DIN 6271, respectively
(2) According to DIN-ISO 3046 and DIN 6271, respectively, with a tolerance of +5 %.
Efficiency performance is based on a new unit (immediately upon commissioning).Effects of degradation during normal operation can be mitigated through regular service and maintenance work; reference value --> 65%CH4
(3) Average value between oil change intervals according to maintenance schedule, without oil change amount
(4) At p. f. = 1.0 according to VDE 0530 REM / IEC 34.1 with relative tolerances
(5) Total output with a tolerance of ±8 %
(6) According to above parameters (1) through (5)
(7) Only valid for engine and generator; module and peripheral equipment not considered (at p. f. = 0,8)
(8) Exhaust temperature with a tolerance of ±8 %
(9) Intercooler heat on:
*** standard conditions (Vxx)** - If the turbocharger design is done for air intake temperature > 30°C w/o de-rating, the intercooler heat of the 1st stage need to be increased by 2%/°C starting from 25°C. Deviations between 25 – 30°C will be covered with the standard tolerance.
*** Hot Country application (Vxxx)** - If the turbocharger design is done for air intake temperature > 40°C w/o de-rating, the intercooler heat of the 1st stage need to be increased by 2%/°C starting from 35°C. Deviations between 35 – 40°C will be covered with the standard tolerance.

Radio interference level
The ignition system of the gas engines complies the radio interference levels of CISPR 12 and EN 55011 class B, (30-75 MHz, 75-400 MHz, 400-1000 MHz) and (30-230 MHz, 230-1000 MHz), respectively.

Definition of output
- ISO-ICFN continuous rated power:
  Net break power that the engine manufacturer declares an engine is capable of delivering continuously, at stated speed, between the normal maintenance intervals and overhauls as required by the manufacturer. Power determined under the operating conditions of the manufacturer's test bench and adjusted to the standard reference conditions.
- Standard reference conditions:

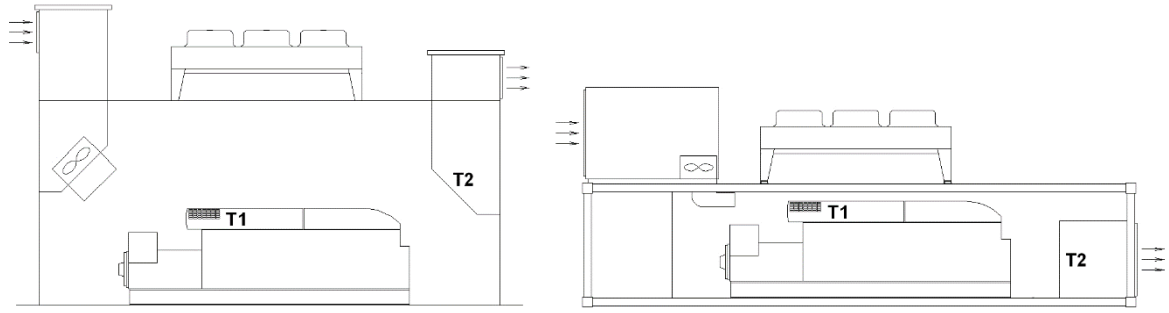
Barometric pressure:	1000 mbar (14.5 psi) or 100 m (328 ft) above sea level
Air temperature:	25°C (77°F) or 298 K
Relative humidity:	30 %

- Volume values at standard conditions (fuel gas, combustion air, exhaust gas)

Pressure:	1013 mbar (14.7 psi)
Temperature:	0°C (32°F) or 273 K

Output adjustment for turbo charged engines

Standard rating of the engines is for an installation at an altitude ≤ **500 m** and an air intake temperature ≤ **30 °C** (T1)
Maximum room temperature: **50°C** (T2) -> engine stop



If the actual methane number is lower than the specified, the knock control responds. First the ignition timing is changed at full rated power. Secondly the rated power is reduced. These functions are carried out by the engine management system.
Exceedance of the voltage and frequency limits for generators according to IEC 60034-1 Zone A will lead to a derate in output.

Parameters for the operation of GE Jenbacher gas engines
The genset fulfils the limits for mechanical vibrations according to ISO 8528-9.
The following "Technical Instruction of GE JENBACHER" forms an integral part of a contract and must be strictly observed: **TA 1000-0004, TA 1100 0110, TA 1100-0111**, and **TA 1100-0112.**
Transport by rail should be avoided. See **TA 1000-0046** for further details

Failure to adhere to the requirements of the above mentioned TA documents can lead to engine damage and may result in loss of warranty coverage.

Parameters for the operation of control unit and the electrical equipment
Relative humidity 50% by maximum temperature of 40°C.
Altitude up to 2000m above the sea level.

Parameters for using a gas compressor
The gas quantity indicated under the technical data refers to standard conditions with the given calorific value. The actual volume flow (under operating conditions) has to be considered for dimensioning the gas compressor and each gas feeding component – it will be affected by:

- Actual gas temperature (limiting temperature according to TI 1000-0300)
- Gas humidity (limiting value according to TI 1000-0300)
- Gas Pressure
- Calorific value variations (can be equated with methane (CH4) variations in the case of biogas)
- The gas compressor is designed for a max. relative under pressure of 15 mbar(g) (0.22 psi) and a inlet temperature of 40°C (104°F) , if within scope of supply GE Jenbacher

1.00 Scope of supply - module

Design:
The module is built as a compact package. Engine and generator are connected through a coupling and are mounted to the base frame. To provide the best possible isolation from the transmission of vibrations the engine is mounted to the frame by means of anti-vibrational mounts. The remaining vibrations are eliminated by mounting the module on isolating pads (e.g. Sylomer). This, in principle, allows the module to be placed directly on any floor capable of carrying the static load. No special foundation is required. Prevention of sound conducted through solids has to be provided locally.

1.01 Spark ignited gas engine

Four-stroke, air/gas mixture turbocharged, aftercooled, with high performance ignition system and electronically controlled air/gas mixture system.
The engine is equipped with the most advanced

LEANOX® LEAN-BURN COMBUSTION SYSTEM

developed by GE JENBACHER.

1.01.01 Engine design

Engine block
Single-piece crankcase and cylinder block made of special casting; crank case covers for engine inspection, welded steel oil pan.

Crankshaft and main bearings
Drop-forged, precision ground, surface hardened, statically and dynamically balanced; main bearings (upper bearing shell: 3-material bearing / lower bearing shell: sputter bearing) arranged between crank pins, drilled oil passages for forced-feed lubrication of connecting rods.

Vibration damper
Maintenance free viscous damper

Flywheel
With ring gear for starter motor

Pistons
Single-piece, made of light metal alloy, with piston ring carrier and oil passages for cooling; piston rings made of high quality material, main combustion chamber specially designed for lean burn operation.

Connecting rods
Drop-forged, heat-treated, big end diagonally split and toothed. Big end bearings (upper bearing shell: sputter bearing / lower bearing shell: sputter bearing) and connecting rod bushing for piston pin.

Cylinder liner

Chromium alloy gray cast iron, wet, individually replaceable.

Cylinder head
Specially designed and developed for GE JENBACHER-lean burn engines with optimised fuel consumption and emissions; water cooled, made of special casting, individually replaceable; Valve seats, valve guides and spark plug sleeves individually replaceable; exhaust and inlet valves made of high quality material.

Crankcase breather
Connected to combustion air intake system.

Valve train
Camshaft, with replaceable bushings, driven by crankshaft through intermediate gears, valve lubrication by splash oil through rocker arms.

Combustion air/fuel gas system
Motorized carburetor for automatic adjustment according to fuel gas characteristic. Exhaust driven turbocharger, mixture manifold with bellows, water-cooled intercooler, throttle valve and distribution manifolds to cylinders.

Ignition system
Most advanced, fully electronic high performance ignition system, external ignition control.
MORIS: Automatically, cylinder selective registration and control of the current needed ignition voltage.

Lubricating system
Gear-type lube oil pump to supply all moving parts with filtered lube oil, pressure control valve, pressure relief valve and full-flow filter cartridges. Cooling of the lube oil is arranged by a heat exchanger.

Engine cooling system
Jacket water pump complete with distribution pipework and manifolds.

Exhaust system
Turbocharger and exhaust manifold

Exhaust gas temperature measuring
Thermocouple for each cylinder

Electric actuator
For electronic speed and output control

Electronic speed monitoring for speed and output control
By magnetic inductive pick up over ring gear on flywheel

Starter motor
Engine mounted electric starter motor

1.01.02 Additional equipment for the engine (spares for commissioning)

The initial set of equipment with the essential spare parts for operation after commissioning is included in the scope of supply.

1.01.03 Engine accessories

Insulation of exhaust manifold:
Insulation of exhaust manifold is easily installed and removed

Sensors at the engine:
- Jacket water temperature sensor
- Jacket water pressure sensor
- Lube oil temperature sensor
- Lube oil pressure sensor
- Mixture temperature sensor
- Charge pressure sensor
- Minimum and maximum lube oil level switch
- Exhaust gas thermocouple for each cylinder
- Knock sensors
- Gas mixer / gas dosing valve position reporting.

Actuator at the engine:
- Actuator - throttle valve
- Bypass-valve for turbocharger
- Control of the gas mixer / gas dosing valve

1.01.04 Standard tools (per installation)

The tools required for carrying out the most important maintenance work are included in the scope of supply and delivered in a toolbox.

1.02 Generator-low voltage

The 2 bearing generator consists of the main generator (built as rotating field machine), the exciter machine (built as rotating armature machine) and the digital excitation system.
The digital regulator is powered by an auxiliary winding at the main stator or a PMG system

Main components
- Enclosure of welded steel construction
- Stator core consist of thin insulated electrical sheet metal with integrated cooling channels.
- Stator winding with 2/3 Pitch
- Rotor consists of shaft with shrunken laminated poles, Exciter rotor, PMG (depending on Type) and fan.
- Damper cage
- Excitation unit with rotating rectifier diodes and overvoltage protection
- Dynamically balanced as per ISO 1940, Balance quality G2,5

- Drive end bracket with re greaseable antifriction bearing
- Non-drive end bracket with re grease antifriction bearing
- Cooling IC01 - open ventilated, air entry at non-drive end , air outlet at the drive end side
- Main terminal box includes main terminals for power cables
- Regulator terminal box with auxiliary terminals for thermistor connection and regulator.
- Anti-condensation heater
- 3 PT100 for winding temperature monitoring+3 PT100 Spare
- 2 PT100 for bearing temperature monitoring

Option:
Current transformer for protection and measuring in the star point
xx/1A, 10P10 15VA , xx/1A, 1FS5, 15VA

Electrical data and features

- Standards: IEC 60034, EN 60034, VDE 0530, ISO 8528-3, ISO 8528-9
- Voltage adjustment range: +/- 10 % of rated voltage (continuous)
- Frequency: -6/+4% of rated frequency
- Overload capacity: 10% for one hour within 6 hours, 50% for 30 seconds
- Asymmetric load : max. 8% I2 continuous, in case of fault I2 x t=20
- Altitude: < 1000m
- Max permitted generator intake air temperature: 5°C - 40°C
- Max. relative air humidity: 90%
- Voltage curve THD Ph-Ph: <3,5% at idle operation and <5% at full load operation with linear symmetrical load
- Generator suitable for parallel operating with the grid and other generators
- Sustained short circuit current at 3-pole terminal short circuit: minimum 3 times rated current for 5 seconds.
- Over speed test with 1.2 times of rated speed for 2 minutes according to IEC 60034

Digital Excitation system ABB Unitrol 1010 mounted within the AVR Terminal box with following features:

- Compact and robust Digital Excitation system for Continuous output current up to 10 A (20A Overload current 10s)
- Fast AVR response combined with high excitation voltage improves the transient stability during LVRT events.
- The system has free configurable measurement and analog or digital I/Os. The configuration is done via the local human machine interface or CMT1000
- Power Terminals
  3 phase excitation power input from PMG or auxiliary windings
  Auxiliary power input 24VDC
- Excitation output
- Measurement terminals: 3 phase machine voltage, 1 phase network voltage, 1 phase machine current
- Analog I/Os: 2 outputs / 3 inputs (configurable), +10 V / -10 V
- Digital I/O: 4 inputs only (configurable), 8 inputs / outputs (configurable)
- Serial fieldbus: RS485 for Modbus RTU or VDC (Reactive power load sharing for up to 31 GEJ engines in island operation), CAN-Bus for dual channel communication

- Regulator Control modes: Bump less transfer between all modes
  Automatic Voltage Regulator (AVR) accuracy 0,1% at 25°C ambient temperature
  Field Current Regulator (FCR)
  Power Factor Regulator (PF)
  Reactive Power Regulator (VAR)
- Limiters: Keeping synchronous machines in a safe and stable operation area
  Excitation current limiter (UEL min / OEL max)
  PQ minimum limiter
  Machine current limiter
  V / Hz limiter
  Machine voltage limiter
- Voltage matching during synchronization
- Rotating diode monitoring
- Dual channel / monitoring: Enables the dual channel operation based on self diagnostics and setpoint follow up over CAN communication.. As Option available
- Power System Stabilizer (PSS) is available as option. Compliant with the standard IEEE 421.5-2005 2A / 2B, the PSS improves the stability of the generator over the highest possible operation range.
- Computer representation for power system stability studies: ABB 3BHS354059 E01
- Certifications: CE, cUL certification according UL 508c (compliant with CSA), DNV Class B,

- **Commissioning and maintenance Tool CMT1000** (for trained commissioning/ maintenance personal)
- With this tool the technician can setup all parameters and tune the PID to guarantee stable operation. The CMT1000 software allows an extensive supervision of the system, which helps the user to identify and locate problems during commissioning on site. The CMT1000 is connected to the target over USB or Ethernet port, where Ethernet connection allows remote access over 100 m.
- Main window
  - Indication of access mode and device information.
  - Change of parameter is only possible in CONTROL access mode.
  - LED symbol indicates that all parameter are stored on none volatile memory.
- Setpoint adjust window
  - Overview of all control modes, generator status, active limiters status and alarms.
  - Adjust set point and apply steps for tuning of the PID.
- Oscilloscope
- 4 signals can be selected out of 20 recorded channels. The time resolution is 50ms.Save files to your PC for further investigation.
- Measurement
  - All measurements on one screen.

Routine Test

Following routine tests will be carried out by the generator manufacturer

- Measuring of the DC-resistance of stator and rotor windings
- Check of the function of the fitted components (e.g. RTDs, space heater etc.)
- Insulation resistance of the following components
  Stator winding, rotor winding
  Stator winding RTDs
  Bearing RTDs
  Space heater
- No Load saturation characteristic (remanent voltage)

- Stator voltage unbalance
- Direction of rotation, phase sequence
- High voltage test of the stator windings (2 x Unom. + 1000 V) and the rotor windings (min. 1500 V)

1.03 Module accessories

Base frame
Welded structural steel to accommodate engine, generator and heat exchangers.

Flexible coupling
With torque limiter to couple engine with generator. The coupling isolates the major subharmonics of engine firing impulses from the generator.

Bell housing
To connect engine with generator housing. With two ventilation and control windows.

Anti-vibration mounts
Arranged between engine/generator assembly and base frame. Isolating pads (SYLOMER) for placement between base frame and foundation, delivered loose.

Exhaust gas connection
Connection of exhaust gas turbocharger; including flexible connection to compensate for expansions and vibrations.

Combustion air filter
Dry type air filter with replaceable filter cartridges, including flexible connection to carburetor and service indicator.

Interface panel
Totally enclosed sheet steel cubicle with front door, wired to terminals, ready to operate. Cable entry at bottom.

Painting: RAL 7035

Protection: IP 54 external, IP 20 internal (protection against direct contact with live parts)

Design according to IEC 439-1 (EN 60 439-1/1990) and DIN VDE 0660 part 500, respectively.
Ambient temperature: 5 - 40 °C (41 - 104 °F),Relative humidity:70 %

Dimensions:
- Height: 1000 mm (39 in)
- Width: 800 mm (32 in), **[-> at type 4 1000 mm (39 in)]**
- Depth: 300 mm (12 in)

Power supply from the starter battery charger.

Power distribution to the engine mounted auxiliaries (power input from the supplier of the auxiliaries power supply):
3 x 380/220 V, 50 Hz, 16 A

Essential components installed in interface panel:
- Terminal strip
- Decentralised input and output cards, connected by a data bus interface to the central engine control of the module control panel.
- Speed monitoring
- Relays, contacts, fuses, engine contact switch to control valves and auxiliaries
- Measuring transducer for excitation voltage

1.03.01 Engine jacket water system

Engine jacket water system
Closed cooling circuit, consisting of:
- Expansion tank
- Filling device (check and pressure reducing valves, pressure gauge)
- Safety valve(s)
- Thermostatic valve
- Required pipework on module
- Vents and drains
- Electrical jacket water pump, including check valve
- Jacket water preheat device

1.03.02 Automatic lube oil replenishing system incl. extension tank

Automatic lube oil replenishing system:
Includes float valve in lube oil feed line, including inspection glass. Electric monitoring system will be provided for engine shut-down at lube oil levels "MINIMUM" and "MAXIMUM". Solenoid valve in oil feed line is only activated during engine operation. Manual override of the solenoid valve, for filling procedure during oil changes is included.

Oil drain
By set mounted cock

Oil sump extension tank 300 l
To increase the time between oil changes

Pre-lubrication- and aftercooling oil pump:
Mounted on the module base frame; it is used for pre-lubrication and aftercooling of the turbochargers.
Period of operation: Pre-lubrication: 1 minute
Aftercooling: 15 minutes from engine stop
Consisting of:
- 1 piece oil pump 1500 W, 24 V
- All necessary vents
- Necessary pipework

1.04 Heat recovery

Engine-mounted intercooler and lube oil heat exchanger, jacket water heat exchanger mounted to the engine res. to the module base frame, complete with interconnecting pipe work.
The exhaust gas heat exchanger is mounted to the heat recovery module.
The insulation of heat exchangers and pipe work is not included in GE Jenbacher scope of supply.

Heat exchanger - air/fuel mixture to warm water (intercooler)
The engine-mounted intercooler is of two stage design. The first stage is integrated with the warm water circuit. The second stage requires low temperature water.

Heat exchanger - lube oil to warm water
Heat recovery via a mounted heat exchanger which is integrated in the warm water circuit.

Heat exchanger - engine jacket water to warm water
The plate-type heat exchanger is mounted to the module base frame, complete with interconnecting pipework, for recovery of engine jacket water.
Heat exchanger - exhaust gas to warm water
Single duct, tube-type heat exchanger, provided as a component of the heat recovery system

Consisting of:
- Inlet chamber, with flushing connection for cleaning
- Tube type heat exchanger
- Outlet chamber with condensate drain and flushing connection for cleaning
- Thermocouple for monitoring of exhaust gas outlet temperature

1.05.01 Gas train <500mbar

Consisting of:
- Shut off valve
- Gas filter, filter fineness <3 µm
- Pressure gauge with push button valve
- Gas admission pressure regulator
- Solenoid valves
- Leakage detector
- Gas pressure switch (min.)
- TEC JET (has to be implemented horizontal)

The gas train complies with DIN - DVGW regulations.

1.07 Painting

- Quality: Oil resistant prime layer
  Synthetic resin varnish finishing coat

- Colour:

Engine:	RAL 6018 (green)
Base frame:	RAL 6018 (green)
Generator:	RAL 6018 (green)
Module interface panel:	RAL 7035 (light grey)
Control panel:	RAL 7035 (light grey)

1.11 Engine generator control panel per module- Dia.ne XT4 incl. Single synchronization of the generator breaker

Dimensions:

- Height: 2200 mm (including 200 mm (8 in) pedestal *)
- Width: 800 -1200mm*)
- Depth: 600 mm *)

Protection class:

- external IP42
- Internal IP 20 (protection again direct contact with live parts)

*) Control panels will be dimensioned on a project specific basis. Actual dimensions will be provided in the preliminary documentation for the project.

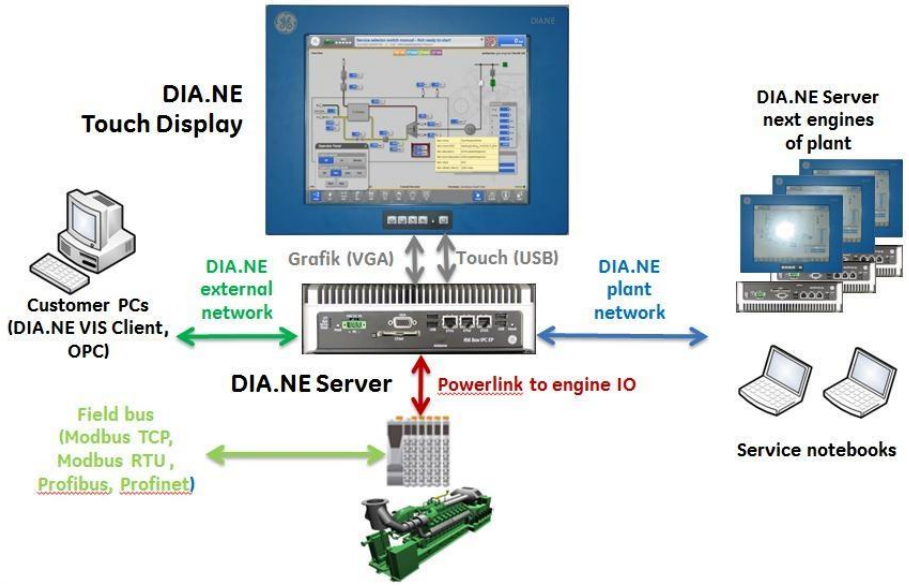
Control supply voltage from starter and control panel batteries: 24V DC

Auxiliaries power supply: (from provider of the auxiliary supply)
3 x **380**/**220** V, **50** Hz

Consisting of:
Motor - Management - System DIA.NE

Setup:

- a) Touch display visualization
- b) Central engine and unit control



Touch Display Screen:

15“ Industrial color graphic display with resistive touch.

Interfaces:

- 24V voltage supply
- VGA display connection
- USB interface for resistive touch

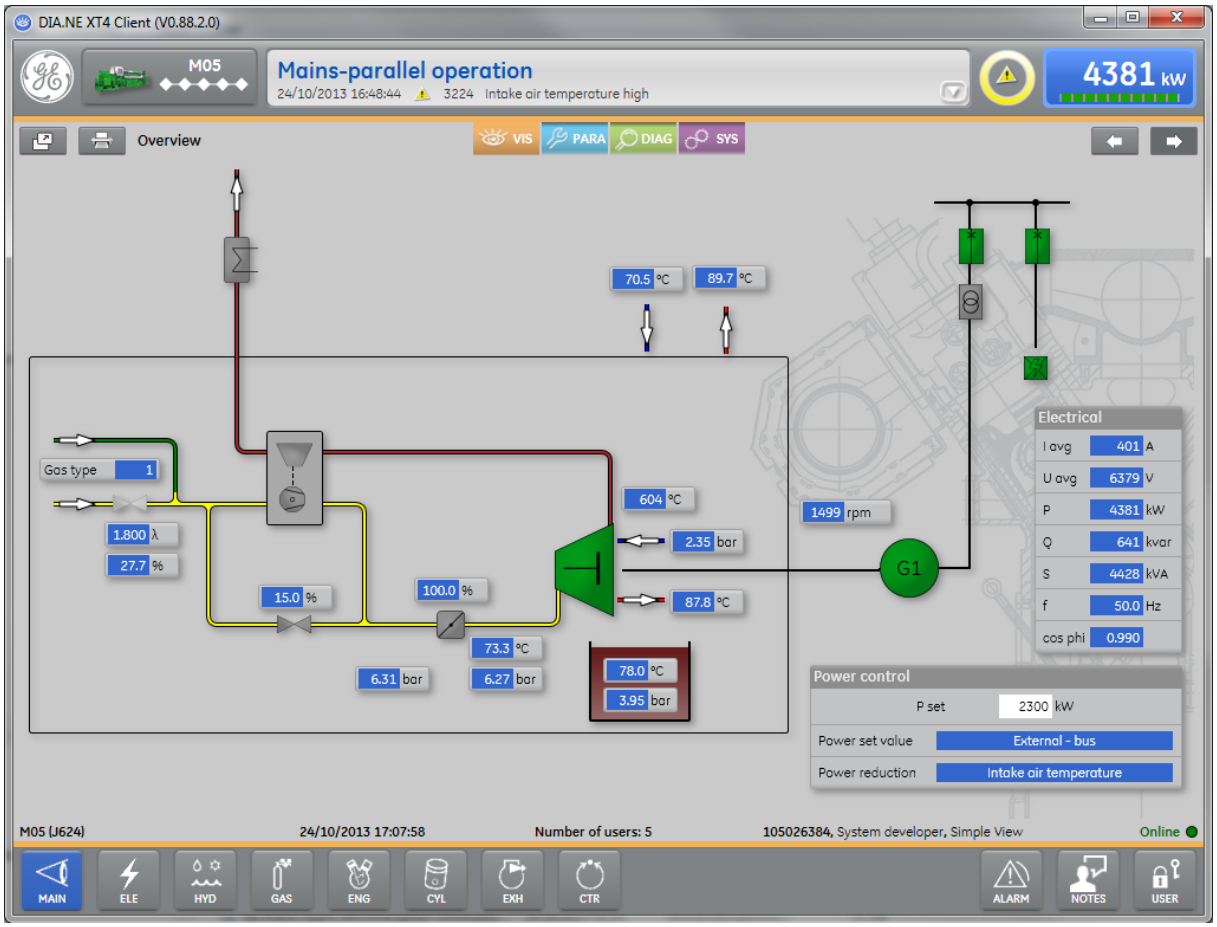
Protection class of DIA.NE XT panel front: IP 65
Dimensions: W x H x D = approx. 410x310x80mm

The screen shows a clear and functional summary of the measurement values and simultaneously shows a graphical summary.

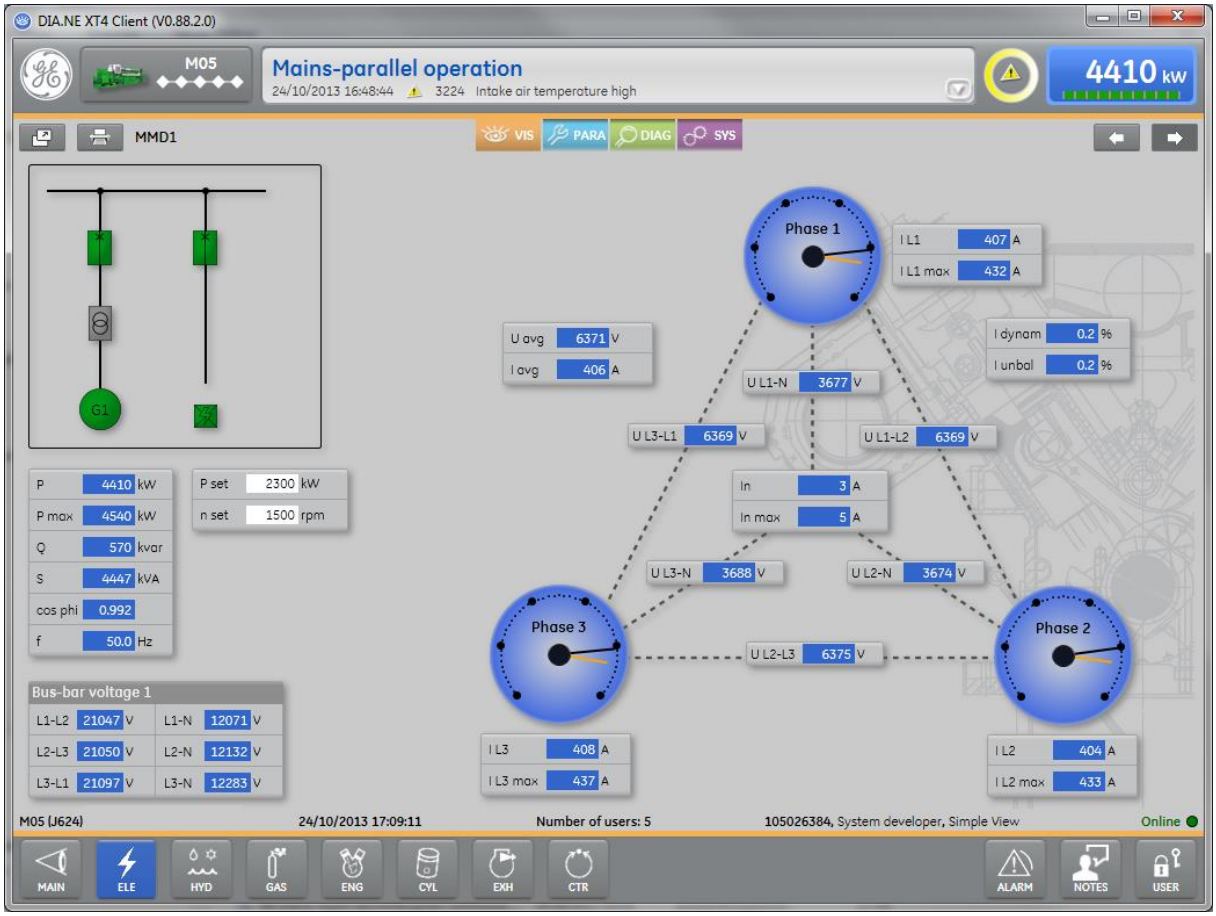
Operation is via the screen buttons on the touch screen
Numeric entries (set point values, parameters…) are entered on the touch numeric pad or via a scroll bar. Determination of the operation mode and the method of synchronization via a permanently displayed button panel on the touch screen.

Main screens (examples):

Main: Display of the overview, auxiliaries status, engine start and operating data.

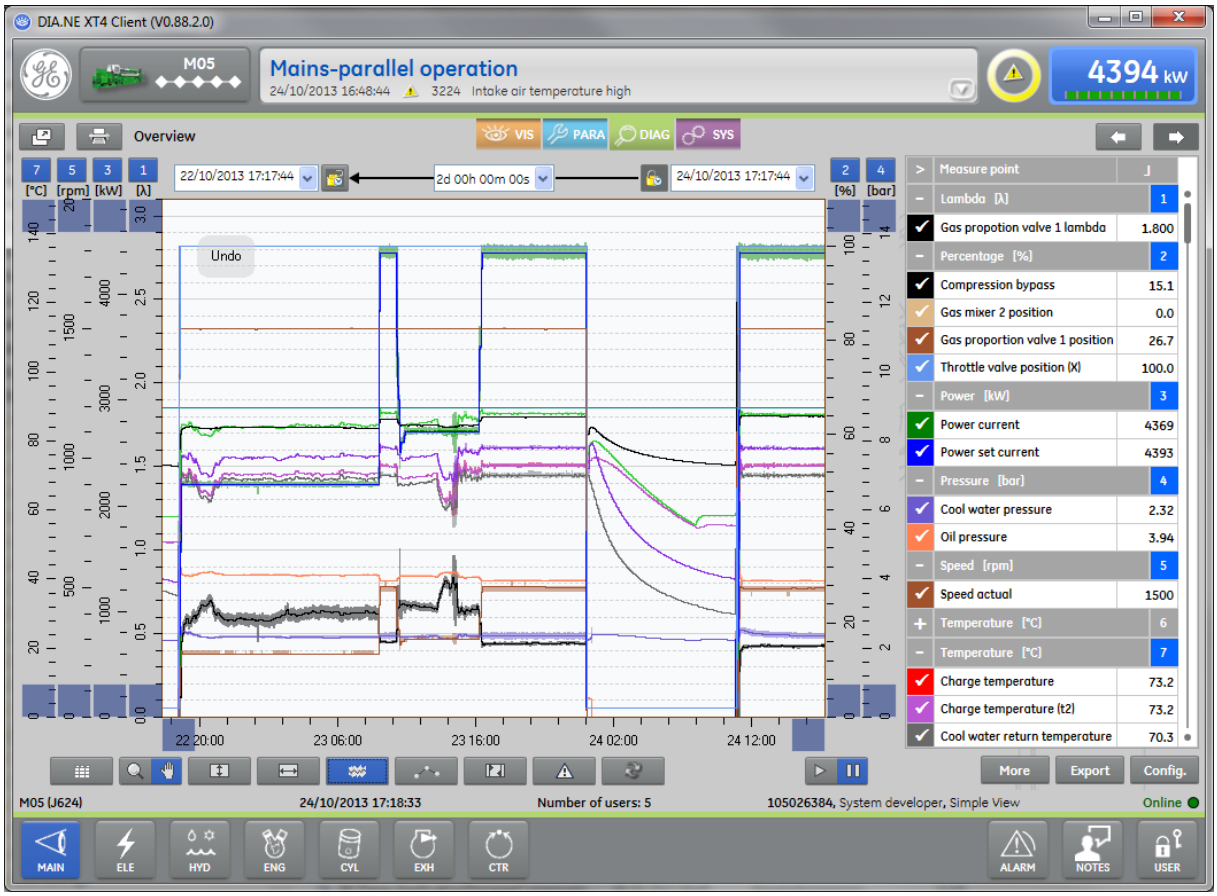


ELE: Display of the generator connection with electrical measurement values and synchronization status



OPTION: Generator winding and bearing temperature

Trending
Trend with 100ms resolution



Measurement values:

- 510 data points are stored
- Measurement interval = 100ms
- Raw data availability with 100ms resolution: 24 hours + max. 5.000.000 changes in value at shut down (60 mins per shut down)
- Compression level 1: min, max, and average values with 1000ms resolution: 3 days
- Compression level 2: min, max, and average values with 30s resolution: 32 days
- Compression level 3: min, max, and average values with 10min resolution: 10 years

Messages:
10.000.000 message events

Actions (operator control actions):
1.000.000 Actions

System messages:
100.000 system messages

Central engine and module control:

An industrial PC- based modular industrial control system for module and engine sequencing control (start preparation, start, stop, aftercooling and control of auxiliaries) as well as all control functions.

Interfaces:

- Ethernet (twisted pair) for remote monitoring access
- Ethernet (twisted pair) for connection between engines
- Ethernet (twisted pair) for the Powerlink connection to the control input and output modules.
- USB interface for software updates

Control functions:

- Speed control in idle and in island mode
- Power output control in grid parallel operation, or according to an internal or external set point value on a case by case basis
- LEANOX control system which controls boost pressure according to the power at the generator terminals, and controls the mixture temperature according to the engine driven air-gas mixer
- Knocking control: in the event of knocking detection, ignition timing adjustment, power reduction and mixture temperature reduction (if this feature is installed)
- Load sharing between engines in island mode operation (option)
- Linear power reduction in the event of excessive mixture temperature and misfiring
- Linear power reduction according to CH4 signal (if available)
- Linear power reduction according to gas pressure (option)
- Linear power reduction according to air intake temperature (option)

Multi-transducer to record the following alternator electrical values:

- Phase current (with slave pointer))
- Neutral conductor current
- Voltages Ph/Ph and Ph/N
- Active power (with slave pointer)
- Reactive power
- Apparent power
- Power factor
- Frequency
- Active and reactive energy counter

Additional 0 (4) - 20 mA interface for active power as well as a pulse signal for active energy

The following alternator monitoring functions are integrated in the multi-measuring device:

- Overload/short-circuit [51], [50]
- Over voltage [59]
- Under voltage [27]
- Asymmetric voltage [64], [59N]
- Unbalance current [46]
- Excitation failure [40]
- Over frequency [81>]
- Under frequency [81<]

Lockable operation modes selectable via touch screen:

- "OFF" operation is not possible, running units will shut down immediately;
- "MANUAL" manual operation (start, stop) possible, unit is not available for fully automatic operation.
- "AUTOMATIC" fully automatic operation according to external demand signal:

Demand modes selectable via touch screen:

- external demand off („OFF“)
- external demand on („REMOTE“)
- overide external demand („ON“)

Malfunction Notice list:

Shut down functions e.g.:

- Low lube oil pressure
- Low lube oil level
- High lube oil level
- High lube oil temperature
- Low jacket water pressure
- High jacket water pressure
- High jacket water temperature
- Overspeed
- Emergency stop/safety loop
- Gas train failure
- Start failure
- Stop failure
- Engine start blocked
- Engine operation blocked
- Misfiring
- High mixture temperature
- Measuring signal failure
- Overload/output signal failure
- Generator overload/short circuit
- Generator over/undervoltage
- Generator over/underfrequency
- Generator asymmetric voltage
- Generator unbalanced load

- Generator reverse power
- High generator winding temperature
- Synchronizing failure
- Cylinder selective Knocking failure

Warning functions e.g.:
- Cooling water temperature min.
- Cooling water pressure min.
- Generator winding temperature max.

Remote signals:
(volt free contacts)

1NO = 1 normally open
1NC = 1 normally closed
1COC = 1 change over contact

• Ready for automatic start (to Master control)	1NO
• Operation (engine running)	1NO
• Demand auxiliaries	1NO
• Collective signal "shut down"	1NC
• Collective signal "warning"	1NC

External (by others) provided command/status signals:

• Engine demand (from Master control)	1S
• Auxiliaries demanded and released	1S

Single synchronizing Automatic

For automatic synchronizing of the module with the generator circuit breaker to the grid by PLC-technology, integrated within the module control panel.

Consisting of:
- Hardware extension of the programmable control for fully automatic synchronization selection and synchronization of the module and for monitoring of the generator circuit breaker closed signal.
- Lockable synchronization selection via touch screen with the following selection modes:
  - "MANUAL" Manual initiation of synchronization via touch screen button followed by fully automatic synchronization of the module
  - "AUTOMATIC" Automatic module synchronization, after synchronizing release from the module control
  - "OFF" Selection and synchronization disabled
    Control of the generator circuit breaker according to the synchronization mode selected via touch screen.
  - "Generator circuit breaker CLOSED/ Select" Touch-button on DIA.NE XT
  - "Generator circuit breaker OPEN" Touch-button on DIA.NE XT

Status signals:

Generator circuit breaker closed
Generator circuit breaker open

Remote signals:
(volt free contacts)
Generator circuit breaker closed 1 NO

The following reference and status signals must be provided by the switchgear supplier:

- Generator circuit breaker CLOSED 1 NO
- Generator circuit breaker OPEN 1 NO
- Generator circuit breaker READY TO CLOSE 1 NO
- Mains circuit breaker CLOSED 1 NO
- Mains circuit breaker OPEN 1 NO

Mains voltage 3 x **380**/**220**V or 3x 110V/v3 other measurement voltages available on request
Bus bar voltage 3 x **380**/**220** V or 3x 110V/v3 – other measurement voltages available on request
Generator voltage 3 x **400 V** or 3x 110V/v3 – other measurement voltages available on request

Voltage transformer in the star point with minimum 50VA and Class 0,5

The following volt free interface-signals will be provided by GE Jenbacher to be incorporated in switchgear:

- CLOSING/OPENING command for generator circuit breaker (permanent contact) 1 NO + 1 NC
- Signal for circuit breaker undervoltage trip 1 NO

Maximum distance between module control panel and engine/interface panel:	30m
Maximum distance between module control panel and power panel:	50m
Maximum distance between module control panel and master control panel:	50m
Maximum distance between alternator and generator circuit breaker:	30m

1.11.06 Remote Data-Transfer with DIA.NE XT4

General
DIA.NE XT4 offers remote connection with Ethernet.

Applications:

1.) DIA.NE XT4 HMI
DIA.NE XT4 HMI is the human-machine-interface of DIA.NE XT4 engine control and visualization system for GE Jenbacher gas engines.
The system offers extensive facilities for commissioning, monitoring, servicing and analysis of the site.
By installation of the DIA.NE XT4 HMI client program it can be used to establish connection to site, if connected to a network and access rights are provided.

The system runs on Microsoft Windows Operating systems (Windows XP, Windows 7, Windows 8)

Function
Functions of the visualization system at the engine control panel can be used remotely. These are among others control and monitoring, trend indications, alarm management, parameter management, and access to long term data recording. By providing access to multiple systems, also with multiple clients in parallel, additional useful functions are available like multi-user system, remote control, print and export functions and data backup.DIA.NE XT4 is available in several languages.

Option - Remote demand/blocking

If the service selectors switch at the module control panel is in pos."Automatic" and the demand-selector switch in pos."Remote", it is possible to enable (demanded) or disable (demand off) the module with a control button at the DIA.NE XT4 HMI
Note:
With this option it makes no sense to have an additional clients demand (via hardware or data bus) or a self-guided operation (via GE Jenbacher master control, grid import /export etc.).

Option - Remote - reset (see TA-No. 1100-0111 chapter 1.7 an d1.9)

Scope of supply
- Software package DIA.NE XT4 HMI Client Setup (Download)
- Number of DIA.NE XT4 HMI - Client user license (Simultaneous right to access of one user to the engine control)

Nr. of license	Access
1	1 Users can be logged in at the same time with a PC (Workplace, control room or at home).
2 - “n“ (Optional)	2- “n” Users can be logged in at the same time with a PC (Workplace, control room or at home). If 2- “n” users are locally connected at Computers from office or control room, then it is not possible to log in from home.

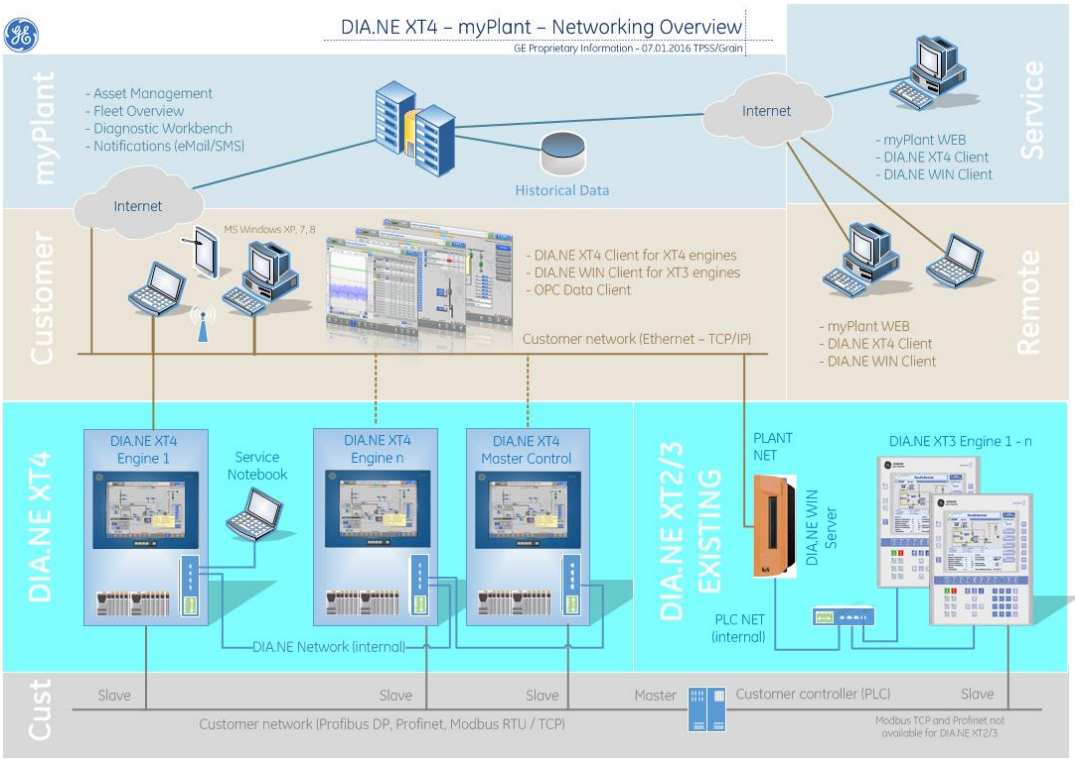
Caution! This option includes the DIA.NE XT4 HMI client application and its license only – NO secured, encrypted connection will be provided by GE Jenbacher! A secured, encrypted connection – which is mandatory – has to be provided by the customer (via LAN connection or customer-side VPN), or can be realized by using option myPlant™.

Customer requirements
- Broad band network connection via Ethernet(100/1000BASE-TX) at RJ45 Connector (ETH3) at DIA.NE XT4 server inside module control panel
- Standard PC with keyboard, mouse or touch and monitor (min. resolution 1024*768)
- Operating system Windows XP, Windows 7, Windows 8
- DirectX 9.0 c compatible or newer 3D display adapter with 64 MB or higher memory

2.) myPlant™

3.) Network overview

For information only!



1.20.03 Starting system

Starter battery:
4 piece 12 V Pb battery, 160/200 Ah (according to DIN 72311), complete with cover plate, terminals and acid tester.

Battery voltage monitoring:
Monitoring by an under voltage relay.

Battery charging equipment:
Capable for charging the starter battery with I/U characteristic and for the supply of all connected D.C. consumers.
Charging device is mounted inside of the module interface panel or module control panel.

- **General data:**
  - Power supply **3 x 320 - 550 V, 47 - 63 Hz**
  - max. power consumption 1060 W
  - Nominal D.C. voltage 24 V(+/-1%)
  - Voltage setting range 24V to 28,8V (adjustable)
  - Nominal current (max.) 40 A
  - Dimensions 240 x 125 x 125 mm
  - Degree of protection IP20 to IEC 529
  - Operating temperature 0 °C - 60 °C
  - Protection class 1
  - Humidity class 3K3, no condensation.
  - Natural air convection
  - Standards EN60950,EN50178
    UL/cUL (UL508/CSA 22.2)

Signalling:

Green Led:	Output voltage > 20,5V
Yellow Led:	Overload, Output Voltage < 20,5V
Red Led:	shutdown

Control accumulator:
- Pb battery 24 VDC/18 Ah

1.20.05 Electric jacket water preheating

Installed in the jacket water cooling circuit, consisting of:
- Heating elements
- Water circulating pump

The jacket water temperature of a stopped engine is maintained between 56°C (133 °F) and 60°C (140°F), to allow for immediate loading after engine start.

1.20.08 Flexible connections

Following flexible connections per module are included in the GE Jenbacher -scope of supply:

No. Connection	Unit	Dimension	Material
2 Warm water in-/outlet	**DN/PN**	**100/10**	Stainless steel
1 Exhaust gas outlet	**DN/PN**	**300/10**	Stainless steel
1 Fuel gas inlet	**DN/PN**	**125/10**	Stainless steel
2 Intercooler in-/outlet	**DN/PN**	**65/10**	Stainless steel
2 Lube oil connection	**mm**	**28**	Hose

Sealings and flanges for all flexible connections are included.

1.20.10 Exhaust gas bypass

The exhaust gas bypass consists of two flaps (electrically driven), to close the inlet and outlet openings at the exhaust gas heat exchanger, and open the exhaust gas bypass duct. The exhaust gas bypass is activated as soon as the exhaust gas heat cannot be fully used.

Scope of supply:
- 2 exhaust flaps, **DN/PN 300/10**
- Electrical motor drive 3 x 380/**220** V, **50** Hz
- Necessary flanges, seals, fixings
- Flap valve control ON/OFF

1.20.25 Warm water monitoring

The monitoring device is included in the warm water circuit. The components are delivered loose.

Consisting of:

• 1 Flow control	Shut down signal: minimum flow
• 1 Pressure switch	Shut down signal: maximum pressure
• 1 Temperature switch	Shut down signal: maximum temperature
• 1 Pressure relief valve	

1.20.27 Return temperature control

Control of the return temperature ensures a constant warm water temperature at the inlet of the module. This is made possible by mixing warm water from the outlet flow into the return flow.

Consisting of:
- 1 x 3-way valve with electrical regulating control (delivered loose)
- 1 PT 100 (mounted on the engine or delivered loose)
- 1 PID-regulation (installed in the control panel)

2.00 Electrical Equipment

Totally enclosed floor mounted sheet steel cubicle with front door wired to terminals. Ready to operate, with cable entry at bottom. Naturally ventilated.

Protection:	IP 42 external	
	IP 20 internal (protection against direct contact with live parts)	

Design according to EN 61439-2 / IEC 61439-2 and ISO 8528-4.
Ambient temperature 5 - 40 °C (41 - 104 °F), 70 % Relative humidity

Standard painting:	Panel:	RAL 7035
	Pedestal:	RAL 7020

2.02 Grid monitoring device

Standard without static Grid Code - 50Hz alternator

Function:
For immediate disconnection of the generator from the grid in case of grid failures.

Consisting of:
- High/low voltage monitoring
- High/low frequency monitoring
- Specially adjustable independent time for voltage and frequency monitoring
- Vector jump monitoring or df/dt monitoring for immediate disconnection of the generator from the grid for example at short interruptions
- Indication of all reference dimensions for normal operation and at the case of disturbance over LCD and LED
- Adjusting authority through password protection against adjusting of strangers

Scope of supply:
Digital grid protection relay with storage of defect data, indication of reference dimensions as well as monitoring by itself.

Grid protection values:

Parameter	Parameter limit	Max time delay[s]	**Comments**
49-51Hz			Do work normal
f<[ANSI 81U]	49Hz	0,5	Load reduction with 10% /HZ below 49Hz!
f<<[ANSI 81U]	48.5Hz	0,1	
f>[ANSI 81O]	51,5Hz	0,1	Load reduction with 30% /HZ higher 51Hz!
U<[ANSI 27]	90%	1	Load reduction with 1%P /%U below 95%
U<<[ANSI 27]	80%	0,2	Load reduction with 1%P /%U below 95%
U>[ANSI 59]	110%	30	Load reduction with 1%P /%U above 105%

U>>[ANSI 59]	115%	0,2	Load reduction with 1% P/%U above 105%
Df/dt [ANSI 81R] **Or** **Vector shift** [ANSI 78]	2Hz/s, 5 Periods Or 8° -3pol		Cos phi range: 0,8ind (overexcited) - 1

2.03.02 Power control

According to external signal
Function:
An external potential free (0/4 - 20 mA = 50 - 100 % of nominal power) signal is a set value for the power control.

At plants with multiple modules, this signal can be used in a series loop on every Engine Management System. This provides an equal load sharing between all modules.

2.04 Generator circuit breaker panel, IEC/EN

Nominal voltage:	3x**400**/230V, **50**Hz
Nominal current:	**3200**A
Earthing system:	TN-CS
Protection:	IP54 external, IP20 internal
Ambient temperature:	+5°bis 40°C (50°C with de-rating)
Standard:	IEC/EN61439-2 und IEC/EN60204-1
Color:	RAL 7035
Dimensions:	Height: 2000mm (+base)
With:	600mm
Depth:	600mm – 800mm
	(depends on cable connection)

Function:
The generator circuit breaker (CB) is the electrical connection between the generator and the grid. Closing of the generator circuit breaker is every time initiated by the gas engine control system. The breaker opens in case of engine shut down.
Cable length between generator CB panel and Module control panel: < 50m

Essential components installed in generator circuit breaker panel:
- 1 circuit breaker:
  Mount type: Fix construction CB
  Motorized 3-phase

Integrated electronic trip unit consisting of:
Adjustable delayed release for overload protection
Adjustable selective short circuit protection
Under voltage trip coil, shunt trip coil, control coil: 24VDC
Status messages and command signals are connected to terminals
Lockable with up to 3 padlocks
CB closing time <70msec
CB opening time <60msec
Short circuit capability 65kA:

Short circuit breaking capacity Icu; Ics (440/690VAC):	65/50kA
Short circuit making capacity Icm (440/690VAC):	143/105kA
Short time withstand current Icw (1 sec):	65kA

- 3 current transformers for measuring: **3200**A/1A, 1FS5, 30 VA (0,5FS5, 15VA)
- 1 copper busbar system (L1, L2, L3, PE, N + PEN bridge) for cable connection
- Terminals for control cables
- Panel fan, temperature controlled
- Surge arrestor type 2 EN 61643-11, Up <2,5kV. for auxiliaries
- Generator voltage for synchronizing and measuring, connected to terminals
- Busbar voltage for synchronizing, connected to terminals
- Auxiliaries power supply for gas engine (3 pol. xxx A, only with 3x230/400V,50Hz)

2.12 Gas warning device

Function:
The gas warning device continuously monitors the radiated air in the engine room and warns against gases which are injurious to persons' health and against explosive gas concentrations.
The measuring head (catalytic sensor) is attached on the covering or nearby the ground, dependent upon the gas source.

Scope of supply:
- Alarm unit voltage: 24VDC
- 2 Gas sensor(s)

2.13 Smoke warning device

Function:
The smoke warning device in combination with the optical smoke detector (installed in the control room) and the thermal smoke detector (installed in the engine room) provide extensive early warning signal.

Design:
The device has an optical display for alarm and operation.
The smoke warning device is installed in a plastic housing.

Scope of supply:
- Alarm unit voltage: 24 VDC
- 2 Smoke detector(s)

3.01 Lube oil system

Consisting of:
- **800** l fresh oil tank
-
- Combined electric driven fresh oil and waste oil pump
- Level switches
- Shut-off devices
- Complete pipework between oil tanks and module

Through simple switch over of the pumps following functions are given:
- Filling of the fresh oil tank from a cask
- Filling of the lube oil tank from a cask
- Filling of the oil pan from a cask
- Emptying of the oil pan into a cask
- Emptying of the waste oil tank into a cask

3.03.01 Exhaust gas silencer

Material:
Steel

Consisting of:
- Exhaust gas silencer
- Flanges, seals, fixings

Insulation:
The insulation for reducing surface irradiations (heat and sound) of the exhaust gas silencer is not included in our scope of supply and must be provided locally. The insulation (100 mm (4 inch) rock wool covered with 0,75 mm (0,03 inch) galvanized steel sheet) is required to keep the sound pressure level of the container (65 dB(A) in 10 m (32 ft)).

3.03.04 Pipe work for condensate

The pipe work for condensate is used to drain off the condensate from the exhaust gas system (exhaust gas silencer, exhaust gas heat exchanger).

Consisting of:
- Tank for condensate made of plastic
  The tank is constructed with two connections DN 15:
  1 connection for the condensate inlet and a second one which is built as an overflow
- Pipe works for condensate DN 15 made of stainless steel
  1 piece/condensate drain of the exhaust gas system. The connections are made of stainless steel (material: AISI 316)

- Thread connections, holding device for pipe work and equipment for the installation

If needed the pipe work has to be insulated and an additional trace heating has to be provided **on site** to prevent freezing of the condensate.

3.05 Air intake and outlet system

Function:
- Supply of the required combustion air for the gas engines
- Supply and exhaust of the required cooling air to purge the radiated heat, especially the heat of the engine and the generator

The air intake system (louver) consists of:
- Weather protection
  - With sloped plating and birdscreen.
  - Material: zinc-coated steel
- Air intake filter according to EN 779 class G4
- Louver damper
  Consisting of:
  - U-profile frame and opposing hollow fins installed in plastic bushings
  - Motor operated with position switch
  - Material: zinc-coated steel
- Noise attenuating system
  Consisting of:
  - Sheet steel cladding
- Attenuator (type: absorption or combination of resonance + absorption depending on sound level requirement)
- Air intake fan, including E-motor, 380/220 V, 50 Hz, frequency controlled

The air outlet system consists of:
- Weather protection
  - Material: zinc-coated steel
- Birdscreen, to protect against rain and/or inclement weather
  - Louver damper
  - Motor operated
- Noise attenuating system

The air intake jalousie flap opens automatically upon engine start.
The air outlet jalousie flap only opens if the room temperature reaches the setpoint at which the air intake fan must start.

3.10.03 Cooling system - dual-circuit radiator

The heat produced by the engine (jacket water, lube oil, intercooler) is dumped through a radiator, installed outside.

Consisting of:

- Radiator
- Pump
- Electrical control
- Expansion tank

The radiator is designed for an ambient temperature of -25…35°C (95°F).

3.20 Container

STEEL-CONTAINER for module

Dimensions:

- Lenght: 12192 mm
- Width: 3000 mm
- Height: 2670 mm

Sound pressure level
65 dB(A) at 32 ft (10 m) (surface sound pressure level according to DIN 45635)
See comments under MC 3.03.01

Ambient temperature:
The container is designed for a ambient temperature from -25°C to 35°C.
Other temperatures are available upon request.

Base frame:
Self-supporting, i.e. the base frame is designed to withstand static loads from the installation of parts such as the engine, control panels, exhaust gas silencer and radiator.

To lift (to load) the container 4 screw able carrier are mounted at the top of the container.

Construction:
Trapezoidal corrugated steel sheeting welded between the base frame and the top frame.
The sound absorbent surfaces are comprised of rock wool covered with perforated plating.
The container is of a weatherproof design and the roof is suitable for construction work.

A dismountable section to bring in the engine is situated at the front of the container beside the air outlet.
There is a door into the control room at the front wall on the side of air inlet.
A door into the engine room is situated at the long side of the container.

The doors (engine room and control room) are fitted with identical cylinder locks. The doors are designed as emergency doors which can be opened in direction of the escape route. They are identified as such and can be opened from the inside without other assistance (panic lock).

Dimension of door: appr. 1000 mm x 2000 mm (W x H)

Engine room:
The floor is made of steel sheet (checker – or nipple plate) and designed as a tightly shut pan. This pan is used to collect an oil-leak of the lube oil circuit (engine and extension tank).

Connections from/to the engine room consist of:

- Top: Gas inlet; welded flange
  Cooling water in/outlet; welded flange
  Exhaust gas outlet; tightly closed
- Roof:
  Suspensions for cable trough, gas train, gas pipes, ...
- Wall:
  The wall between engine room and control room is design with recesses for the cables.

Control room:
The control room is ventilated by a lockable air intake opening. The air is aspirated by the fans of the engine room. For the cables a recess at the floor of the control room is planned. The control room is equipped with a plastic covering.

Module and container installation are essentially performed as follows:

- Installation and setup of the module
- Installation of the control equipment in a separate control equipment room
- Installation of the gas train
- Installation of the lube oil equipment
- Installation of the air intake and outlet ventilation system
- Installation of the exhaust silencer on the roof
- Installation of the radiator on the roof
- Installation of lighting in the container
- Installation of the auxiliary electrical installations
- Completion of exhaust, fuel, oil and water piping, according to the defined scope of supply, including all necessary fittings, flexible connections and reinforcements.
- Footboard above the tubes
- Gutters
- Total signage

Fire protection classification:
The container is not classified for fire protection.

Coating:

- Installation:
  - Oil resistant base
  - Synthetic resin as coating varnish
- Colour Container:
  RAL6018 (green)
- Colour roof installation:
  RAL7035 (grey)

4.00 Delivery, installation and commissioning

4.01 Carriage

According to contract.

4.02 Unloading

Unloading, moving of equipment to point of installation, mounting and adjustment of delivered equipment on intended foundations is not included in GE Jenbacher scope of supply.

4.03 Assembly and installation
Assembly and installation of all GE Jenbacher -components is not included in GE Jenbacher scope of supply.

4.04 Storage
The customer is responsible for secure and appropriate storage of all delivered equipment.

4.05 Start-up and commissioning
Start-up and commissioning with the GE Jenbacher start-up and commissioning checklist is not included.
Plants with island operation require internet connection.

4.06 Trial run
After start-up and commissioning, the plant will be tested in an 8-hour trial run. The operating personnel will be introduced simultaneously to basic operating procedures.
Is not included in GE Jenbacher scope of supply.

5.01 Limits of delivery - Container

Electrical
- Module:
  At terminals of generator circuit breaker

Warm water
At inlet and outlet flanges on container

Exhaust gas
At exhaust gas outlet flange on top of the container; special stack provided locally

Combustion air
The air filters are set mounted, no external ductwork is necessary

Fuel gas
At inlet flange of the container

Lube oil
At lube oil connections on container

Condensate
At condensate drain on container.

Insulation
Insulation of heat exchangers, pipework and exhaust gas silencer is not included in our scope of supply and must be provided locally.

First filling

The first filling of module, (lube oil, engine jacket water, anti freeze-, anti corrosive agent, battery acid) is not included in our scope of supply.

The composition and quality of the used consumables are to be strictly monitored in accordance with the "Technical Instructions" of GE JENBACHER.

Suitable bellows and flexible connections **must be provided locally** for all connections.
Cables from the module must be flexible.

5.02 Factory tests and inspections

The individual module components shall undergo the following tests and inspections:

5.02.01 Engine tests

Carried out as combined Engine- and Module test according to DIN ISO 3046 at GE Jenbacher test bench. The following tests are made at 100%, 75% and 50% load, and the results are reported in a test certificate:

- Engine output
- Fuel consumption
- Jacket water temperatures
- Lube oil pressure
- Lube oil temperatures
- Boost pressure
- Exhaust gas temperatures, for each cylinder

5.02.02 Generator tests

Carried out on test bench of the generator supplier.

5.02.03 Module tests

The engine will be tested with natural gas (methane number 94). The performance data achieved at the test bench may therefore vary from the data as defined in the technical specification due to differences in fuel gas quality.
Carried out as combined Engine- and Module test commonly with module control panel at GE Jenbacher test bench, according to ISO 8528, DIN 6280. The following tests are made and the results are reported in a test certificate:
Visual inspection of scope of supply per specifications.

- Functional tests per technical specification of control system.
  - Starting in manual and automatic mode of operation
  - Power control in manual and automatic mode of operation
  - Function of all safety systems on module
- Measurements at 100%, 75% and 50% load:
  - Frequency
  - Voltage
  - Current
  - Generator output
  - Power factor
  - Fuel consumption
  - Lube oil pressure

- Jacket water temperature
- Boost pressure
- Mixture temperature
- Exhaust emission (NOx)

The module test will be carried out with the original generator, except it is not possible because of the delivery date. Then a test generator will be used for the module test.
To prove characteristics of the above components, which are not tested on the test bench by GE JENBACHER, the manufacturers' certificate will be provided.
In the case of a container unit the above mentioned test procedure for the module is performed in Jenbach. GE Jenbacher reserves the right to perform the functional test of the container in a GE facility elsewhere.

5.03 Documentation

Preliminary documentation 60 days after receipt of a technically and commercially clarified order:

- Module drawing 1)
- Technical diagram 1)
- Drawing of control panel 3)
- List of electrical interfaces 2)
- Technical specification of control system 2)
- Technical drawing auxiliaries (if included in GE Jenbacher-limit of delivery) 1)

At delivery:

- Wiring diagrams 3)
- Cable list 3)

At start-up and commissioning (or on clients request):

- Operating and maintenance manual 4)
- Spare parts manual 4)
- Operation report log 4)

Available Languages
1) DEU, GBR
2) DEU, GBR, FRA, ITA, ESP
3) DEU, GBR, FRA, ITA, ESP, NLD, HUN, RUS, POL, TUR, CZE
4) DEU, GBR, FRA, ITA, ESP, NLD, HUN, RUS, POL, TUR, CZE, SLOWEN, SLOWAK, SERB, SCHWED, ROM, PRT, NORWEG, LITAU, LETT, BULGAR, CHINA, DNK, ESTN, FIN, GRC, KROAT