



5/2018

# Technical Description

Genset

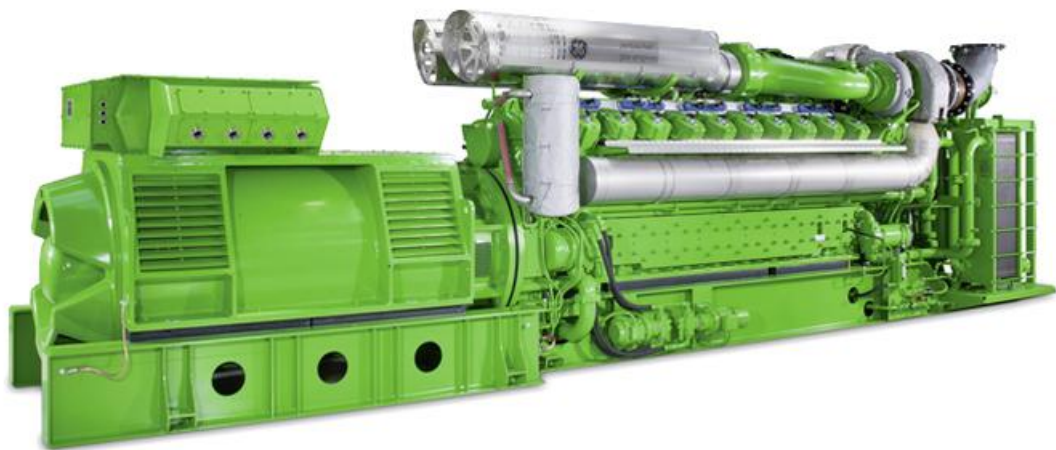
JGS 620 GS-S.L

no special Grid Code

---

**Camda CMM**

---



Rating of the engines is for an installation at an altitude  $\leq 1023$  m and an air intake temperature  $\leq 37$  °C (T1)

Electrical output

3354 kW el.

Emission **values**

NOx  $< 500$  mg/Nm<sup>3</sup> (5% O<sub>2</sub>)



<b>0.01 Technical Data (at genset)</b>	<b>4</b>
Main dimensions and weights (at genset)	5
Connections	5
Output / fuel consumption	5
<b>0.02 Technical data of engine</b>	<b>6</b>
Thermal energy balance	6
Exhaust gas data	6
Combustion air data	6
Sound pressure level	7
Sound power level	7
<b>0.03 Technical data of generator</b>	<b>8</b>
Reactance and time constants (saturated)	8
<b>connection variant 1K</b>	<b>9</b>
<b>0.05 Cooling water circuit</b>	<b>10</b>
Oil - heat (Engine jacket water cooling circuit)	10
Engine jacket water - heat (Engine jacket water cooling circuit)	10
Mixture Intercooler (1st stage) (Engine jacket water cooling circuit)	10
Mixture Intercooler (2nd stage) (Low temperature circuit)	10
<b>0.10 Technical parameters</b>	<b>11</b>
<b>1.00 Scope of supply - Genset</b>	<b>13</b>
<b>1.01 Spark ignited gas engine</b>	<b>13</b>
<b>1.01.01 Engine design</b>	<b>13</b>
<b>1.01.02 Additional equipment for the engine (spares for commissioning)</b>	<b>15</b>
<b>1.01.03 Engine accessories</b>	<b>15</b>
<b>1.01.04 Standard tools (per installation)</b>	<b>15</b>
<b>1.02 Generator-medium voltage</b>	<b>15</b>
<b>1.03 Module accessories</b>	<b>18</b>
<b>1.03.01 Engine jacket water system</b>	<b>19</b>
<b>1.03.02 Automatic lube oil replenishing system incl. extension tank</b>	<b>19</b>
<b>1.05.01 Gas train &lt;500mbar</b>	<b>20</b>
<b>1.07 Painting</b>	<b>21</b>
<b>1.11 Engine generator control panel per module- Dia.ne XT4 incl. Single synchronization of the generator breaker</b>	<b>21</b>
Touch Display Screen:	22
Central engine and module control:	26
Malfunction Notice list:	27
<b>1.11.01 Remote messaging over MODBUS-TCP</b>	<b>29</b>
<b>1.11.06 Remote Data-Transfer with DIA.NE XT4</b>	<b>30</b>



<b>1.20.03 Starting system</b>	<b>33</b>
<b>1.20.05 Electric jacket water preheating</b>	<b>34</b>
<b>1.20.08 Flexible connections</b>	<b>34</b>
<b>2.00 Electrical Equipment</b>	<b>35</b>
<b>2.02 Grid monitoring device</b>	<b>35</b>
<b>2.08 Medium voltage – Junction Box</b>	<b>36</b>
<b>3.10.01 Cooling system - low temperature circuit control</b>	<b>37</b>
<b>3.10.02 Cooling system - high temperature circuit control</b>	<b>37</b>
<b>4.00 Delivery, installation and commissioning</b>	<b>37</b>
4.01 Carriage	37
4.02 Unloading	37
4.03 Assembly and installation	38
4.04 Storage	38
4.05 Start-up and commissioning	38
<b>5.01 Limits of delivery - Genset</b>	<b>38</b>
<b>5.02 Factory tests and inspections</b>	<b>39</b>
5.02.01 Engine tests	39
5.02.02 Generator tests	39
5.02.03 Module tests	39
<b>5.03 Documentation</b>	<b>40</b>



## 0.01 Technical Data (at genset)

			100%	75%	50%	
Power input	[2]	kW	7,755	5,978	4,201	
Gas volume	*)	Nm <sup>3</sup> /h	1,939	1,495	1,050	
Mechanical output	[1]	kW	3,431	2,573	1,715	
Electrical output	[4]	kW el.	3,354	2,510	1,659	
<b>Heat to be dissipated</b>		<b>[5]</b>				
~ Intercooler 1st stage (Engine jacket water cooling circuit)	[9]	kW	970	527	172	
~ Intercooler 2nd stage (Low temperature circuit)		kW	212	158	103	
~ Lube oil (Engine jacket water cooling circuit)		kW	392	326	253	
~ Jacket water		kW	540	453	435	
~ Surface heat	ca. [7]	kW	317	~	~	
Spec. fuel consumption of engine electric		[2]	kWh/kWel.h	2.31	2.38	2.53
Spec. fuel consumption of engine		[2]	kWh/kWh	2.26	2.32	2.45
Lube oil consumption		ca. [3]	kg/h	0.69	~	~
Electrical efficiency				43.3%	42.0%	39.5%
Fuel gas LHV			kWh/Nm <sup>3</sup>	4		

\*) 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  $\pm 8\%$  on the thermal output a further reserve of  $+5\%$  is recommended for the dimensioning of the cooling requirements.



## Main dimensions and weights (at genset)

Length	mm	~ 8,900
Width	mm	~ 2,200
Height	mm	~ 2,800
Weight empty	kg	~ 35,300
Weight filled	kg	~ 36,300

## Connections

Jacket water inlet and outlet	DN/PN	100/10
Exhaust gas outlet [C]	DN/PN	600/10
Fuel Gas (at genset) [D]	DN/PN	100/10
Water drain ISO 228	G	½"
Condensate drain	mm	18
Safety valve - jacket water ISO 228 [G]	DN/PN	2x1½"/2,5
Lube oil replenishing (pipe) [I]	mm	28
Lube oil drain (pipe) [J]	mm	28
Jacket water - filling (flex pipe) [L]	mm	13
Intercooler water-Inlet/Outlet 1st stage	DN/PN	100/10
Intercooler water-Inlet/Outlet 2nd stage [M/N]	DN/PN	65/10

## Output / fuel consumption

ISO standard fuel stop power ICFN	kW	3,431
Mean effe. press. at stand. power and nom. speed	bar	22.00
Fuel gas type		Coalmine gas
Based on methane number   Min. methane number	MZ	107   100 d)
Compression ratio	Epsilon	11.5
Min. fuel gas pressure for the pre chamber	bar	3.95
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	40
Spec. fuel consumption of engine	kWh/kWh	2.26
Specific lube oil consumption	g/kWh	0.20
Max. Oil temperature	°C	80
Jacket-water temperature max.	°C	95
Filling capacity lube oil (refill)	lit	~ 765

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 620 GS-F75
Working principle		4-Stroke
Configuration		V 60°
No. of cylinders		20
Bore	mm	190
Stroke	mm	220
Piston displacement	lit	124.75
Nominal speed	rpm	1,500
Mean piston speed	m/s	11.00
Length	mm	5,542
Width	mm	1,900
Height	mm	2,540
Weight dry	kg	15,000
Weight filled	kg	16,000
Moment of inertia	kgm <sup>2</sup>	69.21
Direction of rotation (from flywheel view)		left
Radio interference level to VDE 0875		N
Starter motor output	kW	20
Starter motor voltage	V	24

### Thermal energy balance

Power input	kW	7,755
Intercooler	kW	1,182
Lube oil	kW	392
Jacket water	kW	540
Exhaust gas cooled to 180 °C	kW	1,223
Exhaust gas cooled to 100 °C	kW	1,634
Surface heat	kW	223

### Exhaust gas data

Exhaust gas temperature at full load	[8]	°C	410
Exhaust gas temperature at bmep= 16.5 [bar]		°C	~ 460
Exhaust gas temperature at bmep= 11 [bar]		°C	~ 507
Exhaust gas mass flow rate, wet		kg/h	17,072
Exhaust gas mass flow rate, dry		kg/h	15,861
Exhaust gas volume, wet		Nm <sup>3</sup> /h	13,552
Exhaust gas volume, dry		Nm <sup>3</sup> /h	12,045
Max.admissible exhaust back pressure after y-pipe		mbar	50

### Combustion air data

Combustion air mass flow rate		kg/h	14,617
Combustion air volume		Nm <sup>3</sup> /h	11,311
Max. admissible pressure drop at air-intake filter		mbar	10



## Sound pressure level

Aggregate a)		dB(A) re 20 $\mu$ Pa	101
31,5	Hz	dB	88
63	Hz	dB	95
125	Hz	dB	101
250	Hz	dB	99
500	Hz	dB	94
1000	Hz	dB	93
2000	Hz	dB	92
4000	Hz	dB	94
8000	Hz	dB	95
Exhaust gas b)		dB(A) re 20 $\mu$ Pa	123
31,5	Hz	dB	112
63	Hz	dB	121
125	Hz	dB	131
250	Hz	dB	119
500	Hz	dB	117
1000	Hz	dB	118
2000	Hz	dB	117
4000	Hz	dB	112
8000	Hz	dB	98

## Sound power level

Aggregate	dB(A) re 1pW	122
Measurement surface	m <sup>2</sup>	125
Exhaust gas	dB(A) re 1pW	131
Measurement surface	m <sup>2</sup>	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=22 bar. (for higher bmep add safety margin of 1dB to all values per increase of 1 bar pressure).

Engine tolerance  $\pm$  3 dB



### 0.03 Technical data of generator

Manufacturer		AVK(+10%-20%) e)
Type		DIG 142 g/4 e)
Type rating	kVA	5,050
Driving power	kW	3,431
Ratings at p.f. = 1,0	kW	3,354
Ratings at p.f. = 0.8	kW	3,337
Rated output at p.f. = 0.8	kVA	4,171
Rated reactive power at p.f. = 0.8	kVar	2,503
Rated current at p.f. = 0.8	A	229
Frequency	Hz	50
Voltage	kV	10.5
Speed	rpm	1,500
Permissible overspeed	rpm	1,800
Power factor (lagging - leading)		0,8 - 1,0
Efficiency at p.f. = 1,0		97.8%
Efficiency at p.f. = 0.8		97.3%
Moment of inertia	kgm <sup>2</sup>	208.00
Mass	kg	11,950
Radio interference level to EN 55011 Class A (EN 61000-6-4)		N
I <sub>k</sub> " Initial symmetrical short-circuit current	kA	1.62
I <sub>s</sub> Peak current	kA	4.12
Insulation class		F
Temperature (rise at driving power)		F
Maximum ambient temperature	°C	40

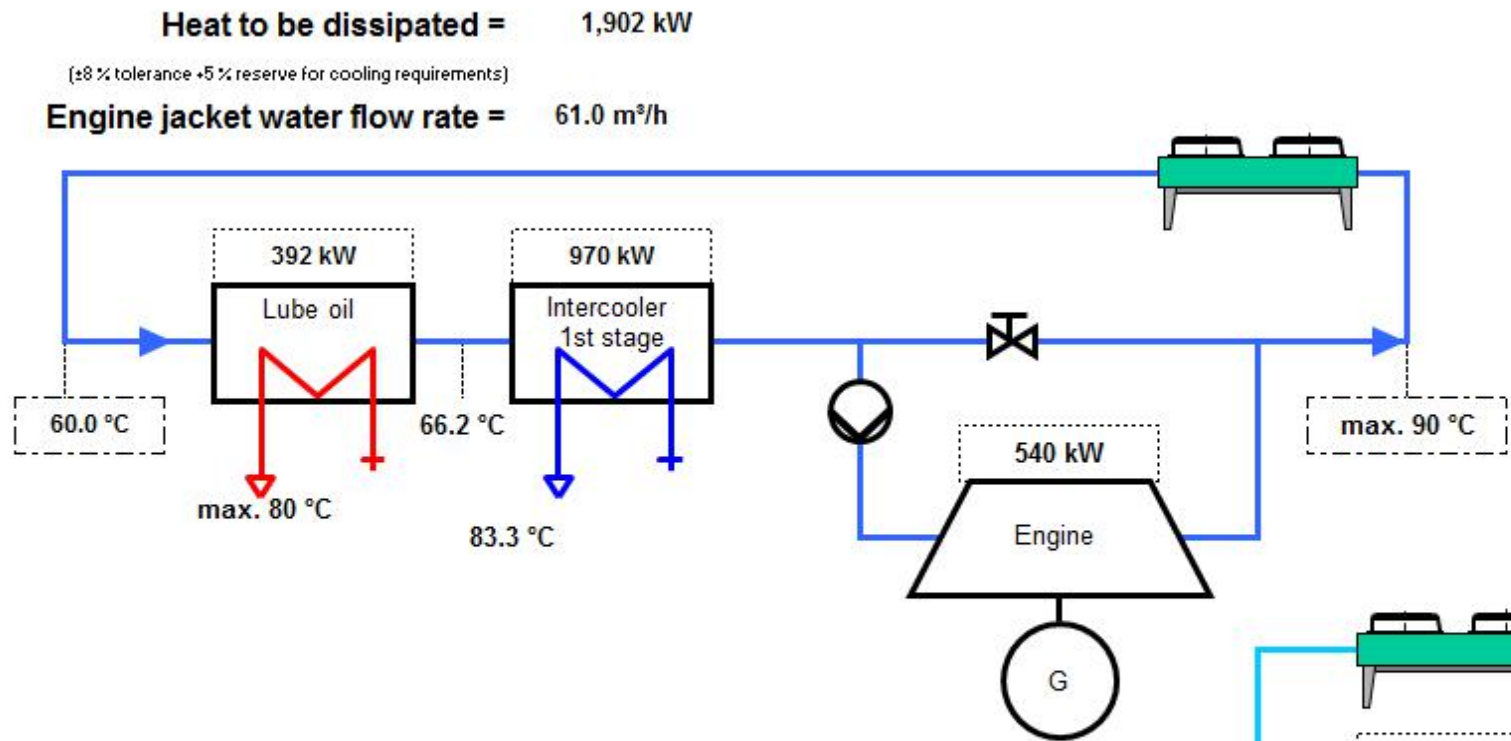
#### Reactance and time constants (saturated)

x <sub>d</sub> direct axis synchronous reactance	p.u.	2.09
x <sub>d</sub> ' direct axis transient reactance	p.u.	0.19
x <sub>d</sub> " direct axis sub transient reactance	p.u.	0.14
x <sub>2</sub> negative sequence reactance	p.u.	0.14
T <sub>d</sub> " sub transient reactance time constant	ms	20
T <sub>a</sub> Time constant direct-current	ms	120
T <sub>do</sub> ' open circuit field time constant	s	4.00

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.



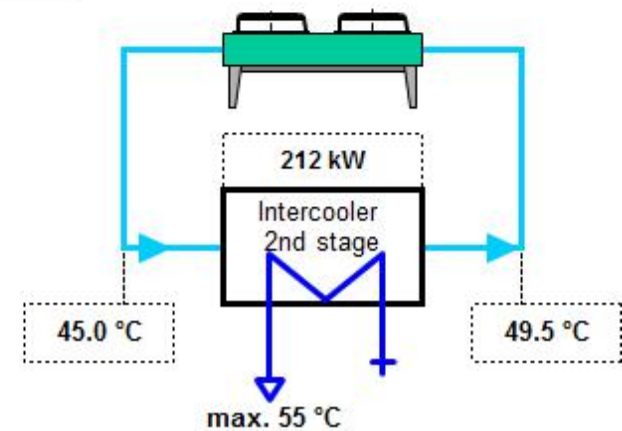
**Engine jacket water cooling circuit (calculated with Glykol 37%)**



**Low temperature circuit (calculated with Glykol 37%)**

Heat to be dissipated = 212 kW  
 (±8 % tolerance +5 % reserve for cooling requirements)

Cooling water flow rate = 45.0 m³/h





## 0.05 Cooling water circuit

### Oil - heat (Engine jacket water cooling circuit)

Nominal output	kW	392
Max. Oil temperature	°C	80
Loss of nominal pressure of engine jacket water	bar	0.40
Safety valve - max press. set point	bar	3.50

### Engine jacket water - heat (Engine jacket water cooling circuit)

Nominal output	kW	540
Max. engine jacket water temperature (outlet engine)	°C	90
Engine jacket water flow rate	m <sup>3</sup> /h	61.0
Safety valve - max press. set point	bar	3.50

### Mixture Intercooler (1st stage) (Engine jacket water cooling circuit)

Nominal output	kW	970
Max. inlet cooling water temp. (intercooler)	°C	66.2
Nominal pressure of cooling water / (max. operating pressure)	PN	10
Loss of nominal pressure of engine jacket water	bar	0.50
Safety valve - max press. set point	bar	3.50

### Mixture Intercooler (2nd stage) (Low temperature circuit)

Nominal output	kW	212
Max. inlet cooling water temp. (intercooler)	°C	40
Aftercooler water flow rate	m <sup>3</sup> /h	45.0
Nominal pressure of cooling water / (max. operating pressure)	PN	10
Intercooler water pressure drop	bar	0.60
Safety valve - max press. set point	bar	3.50

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



## 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 / 35%CO2**
- (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  $\pm 8$  %
- (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) ,(guiding value)
- (8) Exhaust temperature with a tolerance of  $\pm 8$  %
- (9) Intercooler heat on:
  - \* **standard conditions (Vxx)** - If the turbocharger design is done for air intake temperature  $> 30^{\circ}\text{C}$  w/o de-rating, the intercooler heat of the 1st stage need to be increased by  $2\%/^{\circ}\text{C}$  starting from  $25^{\circ}\text{C}$ . Deviations between  $25 - 30^{\circ}\text{C}$  will be covered with the standard tolerance.
  - \* **Hot Country application (Vxxx)** - If the turbocharger design is done for air intake temperature  $> 40^{\circ}\text{C}$  w/o de-rating, the intercooler heat of the 1st stage need to be increased by  $2\%/^{\circ}\text{C}$  starting from  $35^{\circ}\text{C}$ . Deviations between  $35 - 40^{\circ}\text{C}$  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:	$25^{\circ}\text{C}$ ( $77^{\circ}\text{F}$ ) or 298 K
Relative humidity:	30 %
- Volume values at standard conditions (fuel gas, combustion air, exhaust gas)

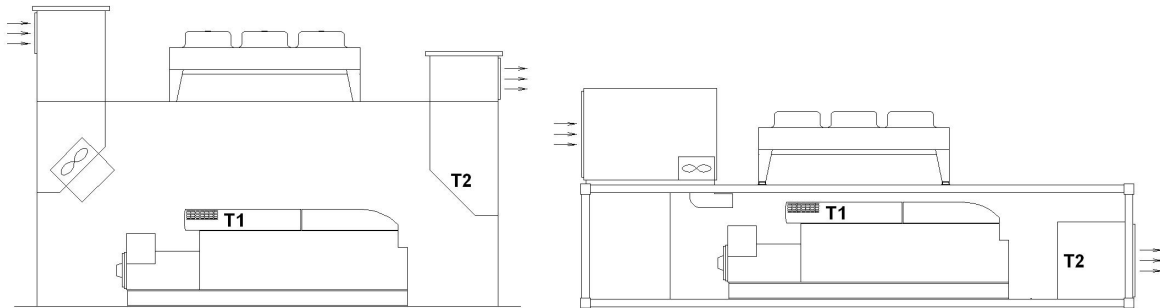
Pressure:	1013 mbar (14.7 psi)
Temperature:	$0^{\circ}\text{C}$ ( $32^{\circ}\text{F}$ ) or 273 K



### Output adjustment for turbo charged engines

Rating of the engines is for an installation at an altitude  $\leq 1023$  m and an air intake temperature  $\leq 37$  °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 fulfills 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.

### Technical parameters for operation with coal mine gas:

The engine can be operation down to a minimum CH<sub>4</sub> content of 25%vol, and a maximum O<sub>2</sub> content of 12%vol.

### Safety parameters for operation with coal mine gas:

An appropriately certified measurement device for continuous and redundant measurement of methane concentration is required which will close the gas supply via a safety shut-off valve once the methane content goes below 25%vol (or exceeds an O<sub>2</sub> concentration of 12%vol) is required. The concentration measurement must be designed so that the engine demand signal will be cancelled before an explosive mixture can reach the gas train.



### **Compliance with local regulations:**

The buyer is herewith advised that national regulations and standards may be in existence which differ to the manufacturers guidelines for plant operation with coal mine gas (especially in regard to minimum CH<sub>4</sub> and maximum O<sub>2</sub> concentrations). In such cases where the national regulations and standards differ to the manufacturers guidelines for plant operation, the buyer and/or operator bear sole responsibility for adherence to the national regulations and standards.

## **1.00 Scope of supply - Genset**

### **Design:**

The genset 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 genset 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: grooved 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 and additionally screwed on.

##### **Pistons**



Single-piece made of steel, 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 optimized 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; Pre-chamber with check-valve.

#### **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-medium 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 5/6 Pitch
- Rotor consist 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
- 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% I<sub>2</sub> [continuous](#), in case of fault I<sub>2</sub> x t = 20
- Altitude: < 1000m
- Permitted generator [intake](#) air [temperature](#): 5°C - 40°C
- Max. [relative air humidity](#): 90%
- Voltage curve THD Ph-Ph: <3% at idle operation and <3% 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 per 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 set point follow up over CAN communication. (Option)
- 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 parameters are stored on non volatile memory.
- Set point 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 50 ms. 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 ( $2 \times U_{nom.} + 1000 \text{ V}$ ) 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: 1300 mm (51 in) **(2100mm bei 624)**
- Width: 1200 mm (47 in) **(1000mm bei 624)**
- Depth: 400 mm (16 in) **(600mm bei 624)**



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 **400/230 V**, **50 Hz**, 50 A

**Essential components installed in interface panel:**

- Terminal strip
- Decentralized 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
- Air conditioning system (**option**)

**Exhaust gas scavenging blower**

The exhaust gas scavenging blower is used to scavenge the remaining exhaust gas out of the exhaust gas pipe work, to prevent the appearance of deflagrations.

**Function:**

Before each start scavenging by blower is done for app. 1 minute (except at black out – start)

**Supervisions:**

- Scavenging air fan failure
- Scavenging air flap failure

**Consisting of:**

- Fan
- Exhaust gas flap
- Temperature switch
- Compensator and pipe work

## **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 (delivered loose) 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 both pumps

Aftercooling: 15 minutes from engine stop only the **400/230 V** pump

Consisting of:

- 1 piece oil pump 1500 W, **400/230 V**
- 1 piece oil pump 1500 W, 24 V
- All necessary vents
- Necessary pipework

## 1.05.01 Gas train <500mbar

Pre-assembled, delivered loose, for installation into gas pipework to the module.

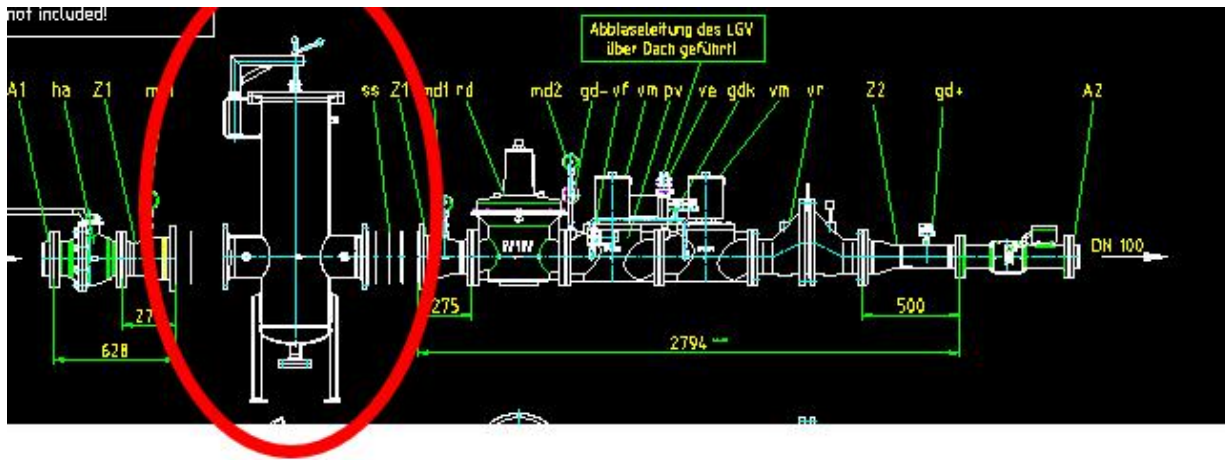
**Consisting of:**

- **Main gas train:**
  - Shut off valve
  - Gas filter, filter fineness <3µm
  - Adapter with dismount to the pre-chamber gas train
  - Gas admission pressure regulator
  - Pressure gauge with push button valve, 0-500mbar (0-7,25psi)
  - Solenoid valves
  - Gas pressure switch (min.)
  - Leakage detector
  - Gas pressure regulator
  - TEC JET (has to be implemented horizontal)
  - Gas flow meter (option)
  - p/t compensation (option)

The gas train complies with DIN - DVGW regulations.

Maximum distance from TEC JET outlet to gas entry on engine, including flexible connections, is 1 m (39,37 in).

GEJ will deliver also the gas filter marked red below.



• **Pre-chamber gas train:**

- Ball valve
- Gas filter, filter fineness <math><3\mu\text{m}</math>
- Solenoid valves
- Pressure regulator
- Calming distance with reducer
- Pressure gauge with push button valve, 1-5bar (0-72,5psi)

Pre chamber gas pressure regulator (incl. stabilization section) assembled at the flexible connection pre chamber gas.

**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 against 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

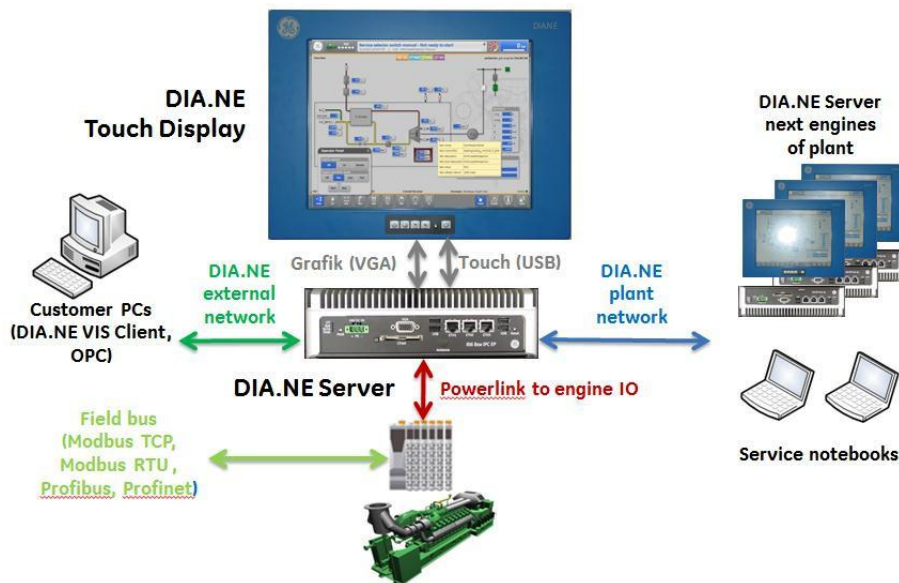
Auxiliaries power supply: (from provider of the auxiliary supply)  
3 x 400/230 V, 50 Hz

### 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



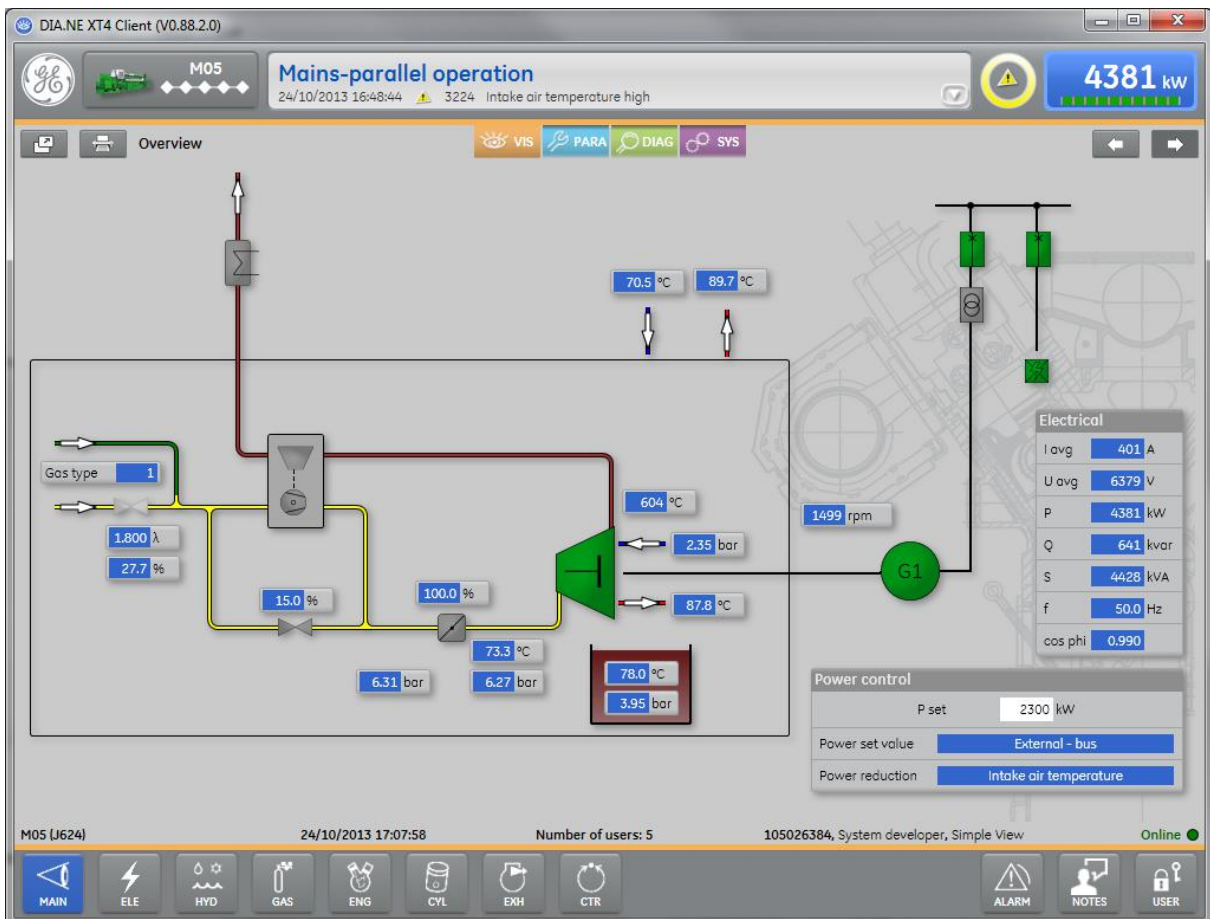
The screen shows a clear and functional summary of the measurement values and simultaneously shows a graphical summary.

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.

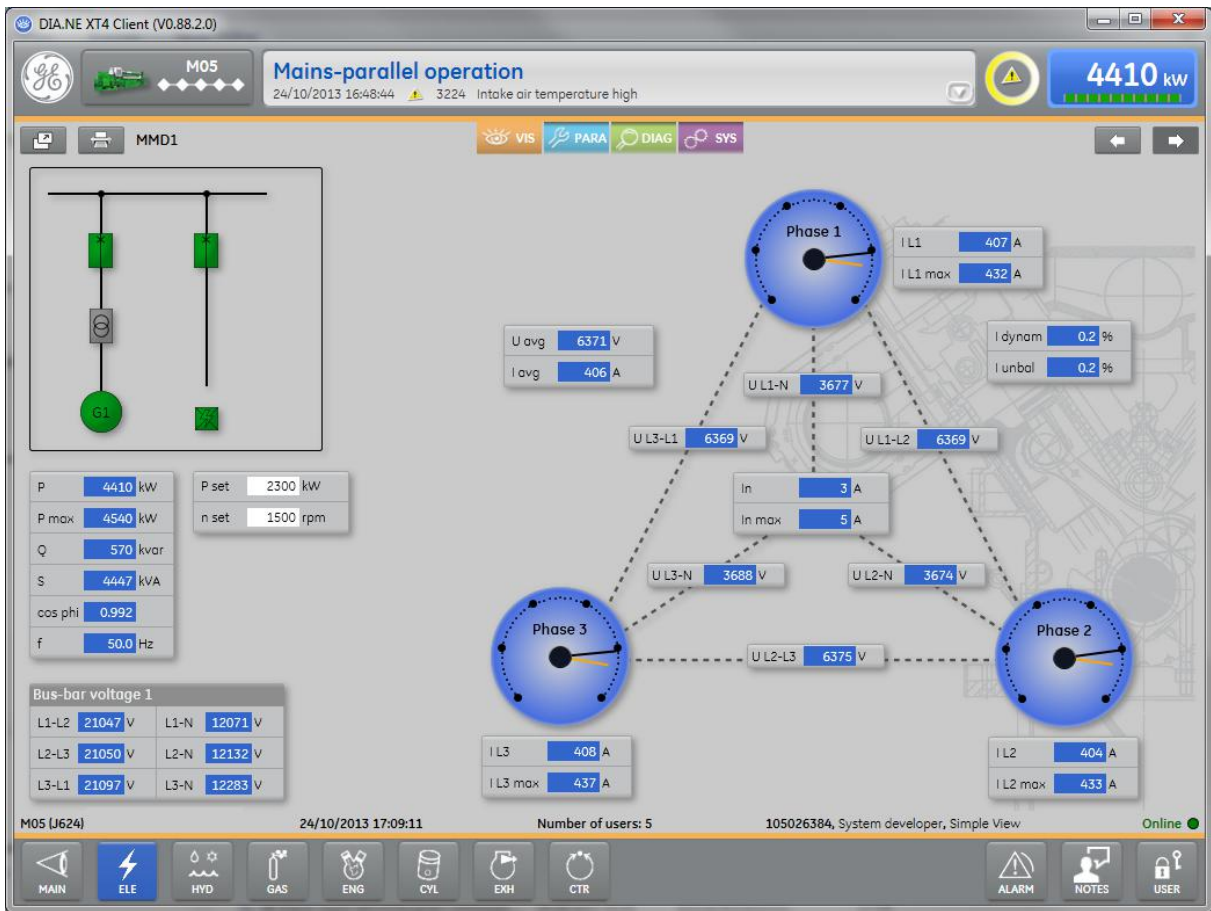
### Main screens (examples):

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

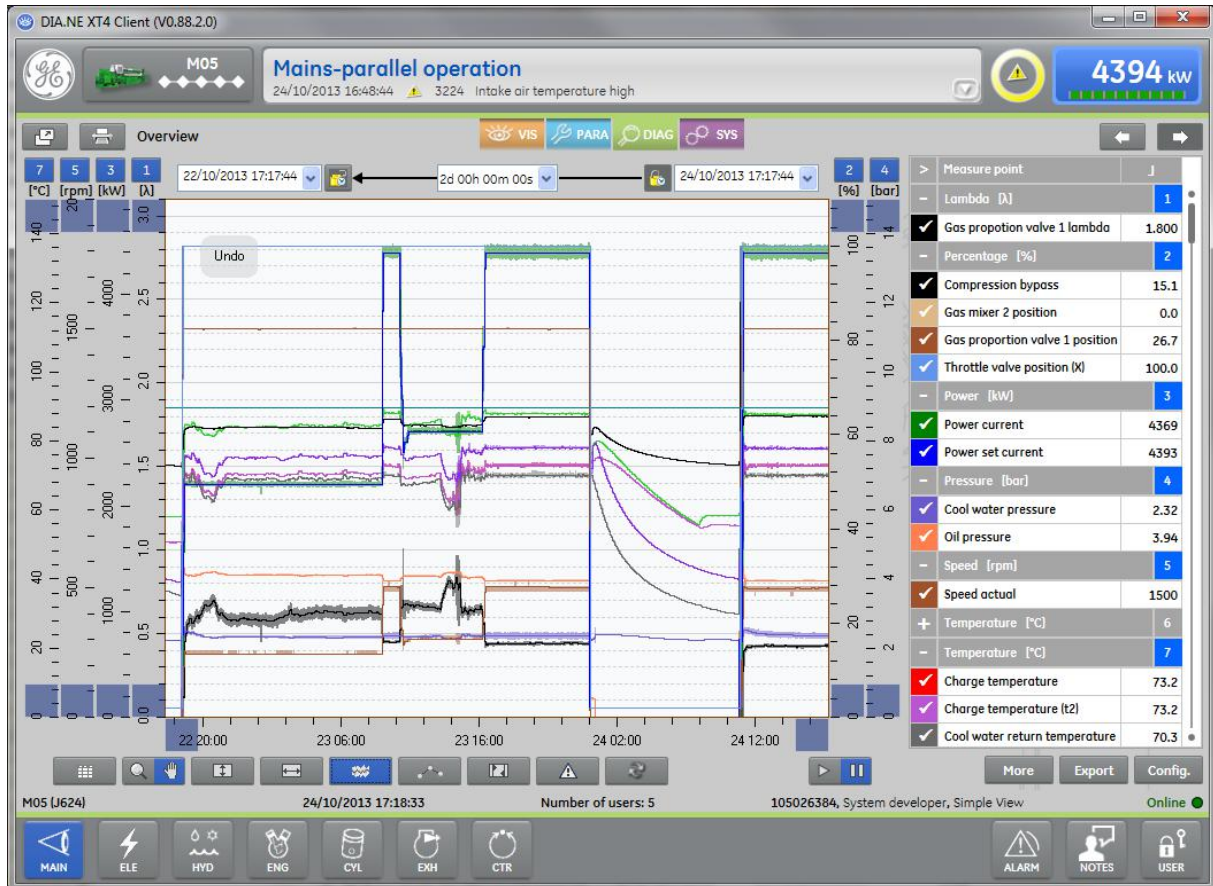








## Trending Trend with 100ms resolution



### Measurement values:

- 500 data points are stored
- Measurement interval = 100ms
- Raw data availability with 100ms resolution: 24 hours + max. 50.000.000 changes in value at shut down (60 mins per shut down)
- Compression level 1: min, max, and average values with 1000ms resolution: 1 day
- Compression level 2: min, max, and average values with 30s resolution: 1 month
- Compression level 3: min, max, and average values with 10min resolution: 10 years

### Messages:

1.000.000 message events

### Actions (operator control actions):

100.000 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

### **Connection to the local building management system according to the GE Jenbacher option list (OPTION)**

- MODBUS-RTU Slave
- MODBUS-TCP Slave,
- PROFIBUS-DP Slave (160 words),
- PROFIBUS-DP Slave (190 words),
- ProfiNet
- OPC DA

### **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“)
- override 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 **400/230V** or 3x 110V/v3 other measurement voltages available on requestBus bar voltage 3 x **400/230 V** or 3x 110V/v3 – other measurement voltages available on requestGenerator voltage 3 x **10.5 kV** 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

### 1.11.01 Remote messaging over MODBUS-TCP

Data transfer from the Jenbacher module control system to the customer's on-site central control system via MODBUS TCP using the ETHERNET 10 BASE-T/100BASE-TX protocol TCP/IP.

The Jenbacher module control system operates as a SLAVE unit.

The data transfer via the customer's MASTER must be carried out in cycles.

**Data transmitted:**



Individual error messages, operational messages, measured values for generator power, oil pressure, oil temperature, cooling water pressure, cooling water temperature, cylinder and collective exhaust gas temperatures.

**GE Jenbacher limit of supply:**

RJ45 socket at the interface module in the module control cabinet

## 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, Windows 10)

### 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, Windows 10
- DirectX 9.0 c compatible or newer 3D display adapter with 64 MB or higher memory

### 2.) myPlant™

myPlant™ is the GE Jenbacher remote monitoring and diagnostic (RM&D) service

	Offering Feature	Connect	Protect
<b>Asset Management</b>	Online data transfer	✓	✓
	Big Data cloud storage	✓	✓
	Engine status visibility	✓	✓
	Control alarms visibility	✓	✓
	Basic data trends	✓	✓
	Remote access to DIA.NE HMI	-	✓
	Unlimited data trending	-	✓
	Advanced diagnostics	-	✓
<b>Fleet Management</b>	Fleet status on world map	-	✓
	Fleet summaries and reporting	-	✓
<b>Mobility</b>	SMS/Email notifications	-	✓
	Smartphone app	✓	✓

Web application with following features:

- Visualization of the current state of the engine (available, in operation, fault)
- View of various readings of the Gen-set
- Visualization of counts as a trend graph (if plant available online, or by manually entering of the counter readings)
- Trend graph of the performance value (low resolution; only if system available online)



**myPlant™ Connect** is free of charge for registered customers  
**myPlant™ Protect** is free of charge within the warranty period (limited to 1 year) and is also included as part of any contractual service agreement (CSA).

#### **Scope of supply**

- Access to myPlant™
- Connection between plant server and myPlant™ system

#### **Customer requirements**

- Permanent Internet line (wired or mobile, (see option 4))
- See technical instruction TA 2300-0008
- Outbound data connectivity (from plant server to Internet) ONLY – INBOUND connections must NOT be allowed!

#### **CAUTION!**

It is in the responsibility of the customer to prevent direct access from the Internet to the plant server using technical equipment like firewalls.

GE Jenbacher does not provide such security devices and services as part of this option!

#### **3.) Mobile Internet (OPTION)**

Connection Plant - Customer via secured Internet - connection

See also technical instruction **TA 2300 - 0006**

#### **Scope of delivery**

- Mobile Internet router with antenna to connect to the DIA.NE Server XT4

#### **Customer requirements**

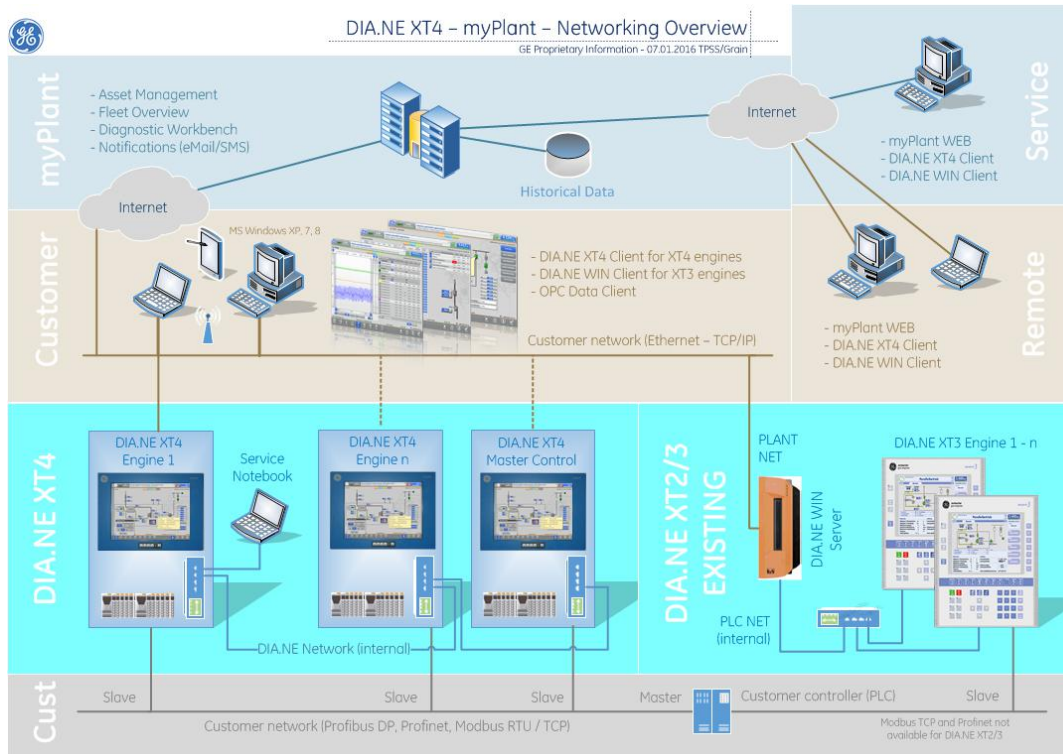
- SIM card for 3G / 4G





## 4.) Network overview

For information only!



### 1.20.03 Starting system

#### Starter battery (is not included in GE Jenbacher scope):

4 piece 12 V Pb battery, 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	<b>3 x 320 - 550 V, 47 - 63 Hz</b>
• max. power consumption	2120 W
• Nominal D.C. voltage	24 V(+/-1%)
• Voltage setting range	24V to 28,8V ( adjustable)
• Nominal current (max.)	2 x 2 x 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	<b>DN/PN</b>	<b>100/10</b>	Stainless steel
1 Exhaust gas outlet	<b>DN/PN</b>	<b>600/10</b>	Stainless steel
1 Fuel gas inlet	<b>DN/PN</b>	<b>150/16</b>	Stainless steel
2 Intercooler in-/outlet	<b>DN/PN</b>	<b>65/10</b>	Stainless steel
2 Lube oil connection	<b>mm</b>	<b>28</b>	Hose

Seals and flanges for all flexible connections are included.



## 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
$f < [\text{ANSI 81U}]$	49Hz	0,5	Load reduction with 10% /HZ below 49Hz!
$f << [\text{ANSI 81U}]$	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

## 2.08 Medium voltage – Junction Box

### Dimensions:

- Height: xx mm
- Width: xx mm
- Depth: xx mm

### Electrical Data:

- Rated voltage 12 kV
- Rated short-circuit breaking current I<sub>k</sub>“ \_\_ kA (20 or 31,5) BIL 75kV

### Essential components installed in the medium voltage panel:

- 1 surge arrester
- 3-pole design

**Standards:** DIN-EN 62271-200, DIN-VDE 0671, part 200 and EN 60204-11

### Option:

- 3 Stk. Voltage transformer
- 3x10.5 kV /1,73/110V/1,73, 20VA , Cl. 0,5
- 3x10.5 kV/1,73/110V/3, 20VA , 3P, with damping resistor



### 3.10.01 Cooling system - low temperature circuit control

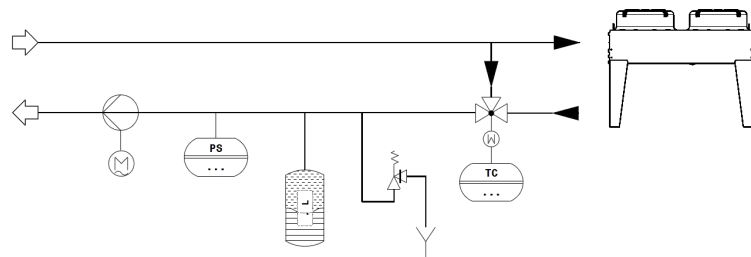
Radiator is used to dissipate the heat from the intercooler circuit.

**Sound pressure level 65 dB(A) at 10 m (32 ft)**

(as measuring area level according to ISO 3744 acc. EN 13487)

**Consisting of (delivered loose):**

- Radiator (Not GEJ scope of supply)
- Pump
- Short-circuit thermostat
- Safety valve
- Pressure switch
- Expansion tank
- TCV



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

### 3.10.02 Cooling system - high temperature circuit control

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

The radiator is integrated with a glycol circuit which itself is integrated in the warm water circuit by means of a plate type heat exchanger.

**Sound pressure level: 65 dB(A) in 10 m (32 ft)** (as measuring area level according to ISO 3744 acc. EN 13487)

**Consisting of:** (delivered loose)

- Radiator(Not GEJ scope of supply)
- 3-way-walve

The radiator is designed for an ambient temperature of 35°C (95°F). Special versions for higher ambient temperatures are available upon request.

## 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.

## **5.01 Limits of delivery - Genset**

### **Electrical:**

- Genset:
  - At terminals of genset interface panel
  - At terminals of generator terminal box (screwed glands to be provided locally)
- Genset control panel:
  - At terminal strips
- Auxiliaries:
  - At terminals of equipment which is supplied separately

### **Cooling water**

At inlet and outlet flanges on genset

### **Exhaust gas**

At the exhaust gas exit of the engine

### **Combustion air**

The air filters are set mounted

### **Fuel gas**

- At inlet and outlet flange of gas train
- At inlet flange of gas pipework on genset
- At outlet flange of the pre-chamber gas train
- At inlet flange of pre-chamber gas pipework on genset
- At connection for boost pressure compensation on genset
- At connection for boost pressure compensation on gas pressure regulator of the pre-chamber gas train

### **Lube oil**

At lube oil connections on genset

### **Draining connections and pressure relief**

At genset



### **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 genset, (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 genset 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 for operating frequency 50 Hz and 6,3-6,6kV / 10,5kV-11kV 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.

## 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