



Type 3

efficient
durable
reliable

For more than 45 years we have specialized in developing and producing gas engines for optimized power and heat generation. Drawing on our vast experience, we are able to supply our customers with fully developed products to cover their specific needs. Our high-tech engines in the 0.3 - 3 Megawatt range are designed for stationary, continuous operation and are characterized by extremely high degrees of efficiency, low exhaust gas emissions, durability and a high level of reliability. GE Jenbacher engines can be operated using a broad spectrum of different gases to ensure our customers the best possible availability of fuel for an efficient and safe energy supply. Our comprehensive product and service portfolio includes a full range of equipment from generator sets to complete cogeneration systems and an extensive selection of maintenance and service packages.

efficient

Long service intervals, maintenance-friendly engine design and low fuel consumption ensure maximum efficiency.

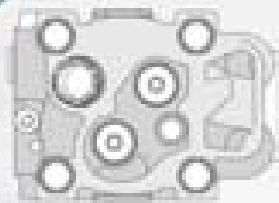
durable

Optimized engine components enable prolonged component service life, even when using polluted fuel gases such as landfill gas.

reliable

Type 3 stands out in its power range of 600 to 1,100 kW because of its technical maturity and high degree of reliability.

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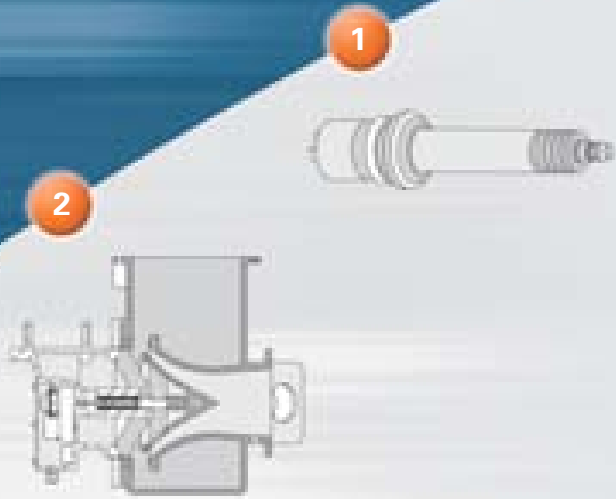
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6



Type



Technical Features

1 Spark plug We continuously develop and optimize the electrode alloys and geometry to keep pace with the requirements of modern gas engines.

- long adjustment cycles
- service life of up to 15,000 operating hours
- outstanding reliability of operation, even at low emission levels

2 Gas mixer The gas mixer we have developed functions according to the equal-pressure principle and has been optimized over the years to meet the requirements of modern gas engines.

- optimized geometry and short floating times
- low pressure losses and high degree of efficiency at full load
- strict adherence to NOx emission values
- trouble-free operation with alternative gas types (2-gas operation)
- simple adaptation for special gases with large calorific value differences
- high degree of mixing efficiency
- reliable starting behaviour

3 Crossflow cylinder head Our unique engine design concept utilizes a crossflow of gases through individual cylinder heads.

- separation of cold mixture side and hot exhaust gas side
- long cylinder head service life of up to 30,000 operating hours
- exhaust gas manifold easily accessible

4 Turbocharger bypass An electronically controlled valve installed behind the compressor enables an efficient mixture return and supports the output control through the throttle valve.

- high dynamism in the output control over the entire control range
- high degree of control over the system when in isolated operation, increased reserve for adding and/or shedding load
- optimal adaptation to varying ambient conditions (intake temperature, altitude)

5 Dry exhaust gas manifold The uncooled exhaust gas manifold enables a maximum energy supply to the exhaust gas turbocharger.

- high specific output
- increased electrical efficiency
- increased usable energy content in exhaust gas

6 Crack connecting rod We successfully apply this technology – tried and tested in the automotive industry – in our powerful stationary engines.

- high dimensional stability and accuracy
- reduced connecting rod bearing wear
- easy to maintain

• Combustion Optimized combustion is the basis for high engine efficiency at the lowest emission rates. This is one of the core areas of research & development activities at GE Jenbacher.

- maximum degree of efficiency and environmental compatibility

• Scraper ring Integrated into the cylinder liner to prevent carbon deposit on the piston crown.

- stabilized oil consumption
- reduced risk of piston seizing
- reduced wear
- perfect partial load behaviour

Technical Data

Configuration	V 70°		
Bore (mm)	135		
Stroke (mm)	170		
Displacement/cylinder (lit)	2.43		
Speed (rpm)	1,500 (50 Hz); 1,200/1,800 (60 Hz)		
Mean piston speed (m/s)	8.5 (1,500 rpm); 6.8 (1,200 rpm); 10.2 (1,800 rpm)		
Scope of supply	Generator set, Cogeneration system, Generator set/Cogeneration in container		
Applicable gas types	Natural gas, flare gas, propane, biogas, landfill gas, sewage gas Special gases as coal mine gas, coke gas, wood gas, pyrolysis gas, ...		
Engine type	J312 GS	J316 GS	J320 GS
No. of cylinders	12	16	20
Total displacement (lit)	29.2	38.9	48.7
Dimensions (l x w x h in mm)			
Generator set	4,500x1,700x2,300	5,100x1,700x2,300	5,200x1,700x2,300
Cogeneration system	4,600x2,300x2,300	5,300x2,300x2,300	5,200x1,900x2,300
Container (Generator set/Cogeneration)	12,200x2,500x2,600	12,200x2,500x2,600	12,200x2,500x2,600
Weights empty (kg)			
Generator set	7,900	8,800	10,800
Cogeneration system	9,300	9,900	11,300
Container (Generator set/Cogeneration)	19,200/20,600	22,100/23,200	25,300/25,800

Scope of supply Our scope of supply comprises electrical power generator sets and cogeneration systems for optimized heat and electrical power generation. Depending on customer specifications, various heat sources such as engine cooling water, oil, mixture and exhaust gas can be

incorporated, resulting in increased levels of efficiency. In addition, our type 3 modules can be supplied as turnkey installations in 40-foot containers. Before being shipped to our customers, all modules are performance and load tested at our manufacturing facilities in Jenbach.

Applicable gas types Increased ecological consciousness and the need to reduce air emissions have led to an increased use of alternative energy sources. Along with natural gas operation, our technology makes it possible to dispose of environmentally offensive gases (e.g. from landfill sites, agriculture, mining and chemical industries) while

simultaneously using these gases for power generation. This helps to reduce industrial emissions and encourage efficient use of natural resources while ensuring the efficiency of a plant. The continuous refinement of our engines and our focus on special gas applications enable the use of a broad spectrum of gases with different calorific values (see table 1).

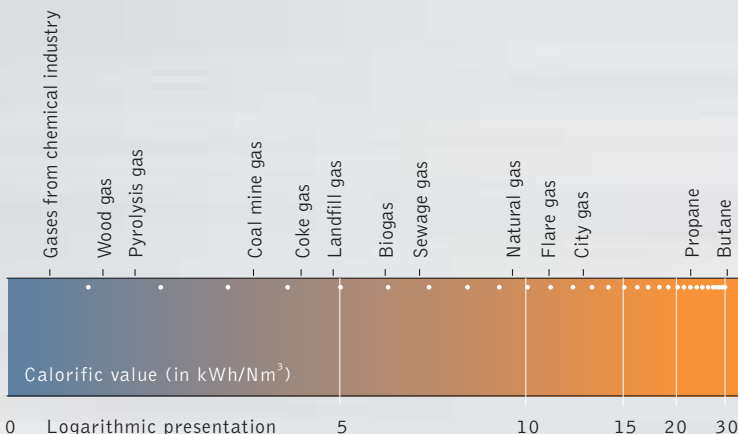


table 1

Type

Outputs and Efficiencies

Natural gas

1,200 rpm | 60 Hz

1,500 rpm | 50 Hz

1,800 rpm | 60 Hz

NOx <	Type	1,200 rpm 60 Hz					1,500 rpm 50 Hz					1,800 rpm 60 Hz				
		Pel (kW) ₁	ηel (%)	Pth (kW) ₂	ηth (%)	ηtot (%)	Pel (kW) ₁	ηel (%)	Pth (kW) ₂	ηth (%)	ηtot (%)	Pel (kW) ₁	ηel (%)	Pth (kW) ₂	ηth (%)	ηtot (%)
500 mg/Nm ³	312	437	40.1	501	45.7	85.8	625	39.8	746	47.6	87.4	633	38.1	815	49.0	87.1
	316	582	40.1	666	45.6	85.7	836	40.0	997	47.7	87.7	848	38.2	1,087	49.0	87.2
	320	729	40.3	845	46.4	86.7	1,065	40.9	1,197	45.9	86.8	1,060	39.0	1,322	48.7	87.7
250 mg/Nm ³	312	420	39.1	504	46.6	85.7	601	38.9	733	47.4	86.3	633	36.7	861	49.9	86.6
	316	560	39.2	671	46.5	85.7	803	39.0	975	47.4	86.4	848	36.9	1,149	50.0	86.9
	320	729	39.3	873	46.8	86.1	1,065	39.9	1,241	46.5	86.4	1,060	38.1	1,366	49.1	87.2
350 mg/Nm ³	312						601	39.1	741	48.2	87.3					
	316						803	39.2	991	48.4	87.6					
	320						1,065	40.2	1,225	46.2	86.4					

Biogas

1,500 rpm | 50 Hz

1,800 rpm | 60 Hz

NOx <	Type	1,500 rpm 50 Hz					1,800 rpm 60 Hz				
		Pel (kW) ₁	ηel (%)	Pth (kW) ₂	ηth (%)	ηtot (%)	Pel (kW) ₁	ηel (%)	Pth (kW) ₂	ηth (%)	ηtot (%)
500 mg/Nm ³	312	625	39.7	698	44.4	84.1	633	38.1	765	46.0	84.1
	316	836	39.9	930	44.4	84.3	848	38.2	1,020	46.0	84.2
	320	1,065	40.9	1,099	42.2	83.1	1,060	39.0	1,258	46.3	85.3
250 mg/Nm ³	312						633	36.7	811	47.0	83.7
	316						848	36.9	1,081	47.0	83.9
	320						1,060	36.9	1,364	47.5	84.4

Propane

1,200 rpm | 60 Hz

1,500 rpm | 50 Hz

NOx <	Type	1,200 rpm 60 Hz					1,500 rpm 50 Hz				
		Pel (kW) ₁	ηel (%)	Pth (kW) ₂	ηth (%)	ηtot (%)	Pel (kW) ₁	ηel (%)	Pth (kW) ₂	ηth (%)	ηtot (%)
500 mg/Nm ³	312	338	36.3	464	49.7	86.0	407	36.0	580	51.2	87.2
	316	456	36.6	619	49.8	86.4	544	36.1	773	51.3	87.4
	320	570	36.7	774	49.8	86.5	682	36.2	965	51.2	87.4
250 mg/Nm ³	312						407	33.9	634	52.8	86.7
	316						544	34.0	846	52.8	86.8
	320						682	34.1	1,056	52.7	86.8

- 1 electrical output based on ISO standard output and standard reference conditions according to ISO 3046/I-1991 and p.f. = 1.0/low voltage alternator according to VDE 0530 REM with respective tolerance; minimum methane number 70 for natural gas
- 2 Total heat output with a tolerance of +/- 8%, exhaust gas outlet temperature 120 °C, for biogas exhaust gas outlet temperature 180 °C

All data according to full load and subject to technical development and modification.



1

DIA.NE[®] – Dialog Network

DIA.NE[®] XT is the new GE Jenbacher engine management system designed for use with all GE Jenbacher engines. The system comprises powerful central industrial controls that handle master control and feedback control for the engine-plant, as well as visualization. A link with central process control is provided to meet the specific requirements of each customer, via standardized industry buses or using direct signal lines.

The particular focus of the DIA.NE[®] XT design lies in combining powerful and flexible open- and closed-loop control electronics with a user-friendly operating concept. The novel hardware design employs the most modern components and sets new standards for performance, functionality and operating safety. The visual display uses a color graphics display screen, providing clear and comprehensible presentation of information and measured values while offering the greatest possible ease of use.

Features of our DIA.NE[®] XT module control system:

- control of all systems relevant to the module (closed-loop LEANOX[®], speed, output, knocking and isolated operation control system, ignition system)
- 8 additional controllers available
- clear visualization of the systems and display of all relevant data
- graphical online trends and alarm management

Using the following additional components, DIA.NE[®] can be customized to individual needs:

- DIA.NE[®] RMC – Dialog Network for Remote Message Control
- DIA.NE[®] WIN – Dialog Network for Windows Systems: Analysis and trend identification in the familiar Windows environment
- HERMES – Data remote transmission (via LAN or modem)
- MONIC – Monitoring Ignition Control: Ignition voltage monitoring

LEANOX[®] Lean mixture combustion This lean mixture combustion control was developed and patented by GE Jenbacher. It ensures the correct air/gas ratio under all operational circumstances in order to simultaneously achieve the lowest exhaust gas emission rates and stable engine operation.

- sensors used in non-critical measurement ranges
- permanent monitoring of emission limit values using stable sensor technology
- controlled combustion resulting in controlled loading of the components surrounding the combustion chamber (resulting in longer service life for the cylinder head, valves, spark plugs, pistons, ...)
- compensation for deviating gas characteristics

Ignition system The microprocessor-controlled ignition system is connected to DIA.NE[®] XT via CAN (Controlled Area Network) bus. This makes it possible to vary the

firing point depending on operating conditions and/or type of fuel gas used.

Knock control system All GE Jenbacher gas engines come standard with a knock control system. The resulting specific firing point, output and mixture temperature

control protects the engine from inadmissible loads, resulting in increased reliability and availability.

Type

Reference Installations

1 J312 GS

Plant: Exxon Mobil – Refinery; Seine Maritime, France

Type of gas: Natural gas

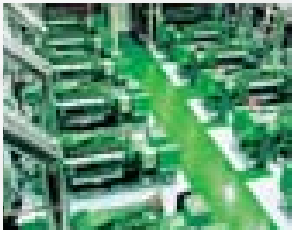
Engine type: 1 x JGS 312 GS-N.LC

Electrical output: 625 kW

Start-up: December 1999

2

Exxon Mobil produces lubricants for gas engines. The R&D department of Mobil's European Technology Centre uses our generator set for testing purposes.



2 J316 GS

Plant: Profusa – Producer of coke; Bilbao, Spain

Type of gas: Natural gas and coke gas

Engine type: 12 x JGS 316 GS-S.L

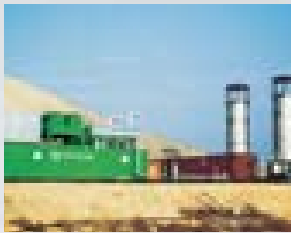
Electrical output:

a) with 100% coke gas: 5,642 kW

b) with 60% coke gas /40% natural gas or 100% natural gas: 6,528 kW

Start-up: 1995

The installation designed by GE Jenbacher enables Profusa to convert the residual coke gas with a hydrogen content of approx. 50% into valuable electrical energy.



3

3 J320 GS – Containerized solution

Plant: Landfill site Nent; Hongkong

Type of gas: Landfill gas

Engine type: 2 x JGC 320 GS-L.L

Electrical output: 1,844 kW

Start-up: 1997

Instead of letting landfill gas escape into the environment or burning it, the gas is converted into electricity using two containerized generator sets.



4

4 J320 GS – Containerized solution

Anlage: Pakmaya – Food industry; Düzce, Turkey

Type of gas: Natural gas

Engine type: 2 x JMC 320 GS-N.L

Electrical output: 2,096 kW

Thermal output: 2,320 kW

of which steam production: 1,644 kg/h at 8 bar

Start-up: February 2001

In Pakmaya, two GE Jenbacher containerized modules run parallel to a gas turbine. The generated power covers the entire electrical and thermal energy requirement of the factory. Each module has a steam boiler that uses the hot exhaust gas to produce saturated steam.



GE Jenbacher

GE Jenbacher is one of the world's leading manufacturers of gas-fueled reciprocating engines, packaged generator sets and cogeneration units for power generation. It is one of the only companies in the world focusing exclusively on gas engine technology.

GE Jenbacher's engines range in power from 0.3 to 3 MW and run on either natural gas or a variety of other gases (e.g. biogas, landfill gas, coal mine gas, sewage gas, combustible industrial waste gases). Patented combustion systems, engine controls, and monitoring enable its products to meet the strictest international emission standards, while offering high levels of efficiency, durability, and reliability.

GE Jenbacher's products are used by a broad range of commercial, industrial, and municipal customers for on-site generation of power, heat, and cooling. In addition, the company offers a comprehensive spectrum of services including full plant operation and maintenance as well as turnkey packages.

GE Jenbacher has its headquarters and production facilities with 1,000 of its more than 1,300 worldwide employees in Jenbach, Austria.

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