Product Presentation

Cat® CG Series Container
Agenda

1. Caterpillar Mannheim

2. Advantages of a Cat® CG Series Container

3. Technical Data

4. References
Mannheim History

A tradition lasting over 140 years which has always been accompanied by innovations.

1871: Car inventor Carl Benz set the basis with the foundation of his "Mechanical Workshop", in Mannheim.


1985: Klöckner-Humboldt-Deutz AG took over MWM.

2005: Deutz AG spun off a division known as DEUTZ Power Systems.

2007: Deutz sold it to the investment firm of 3i in the fall of 2007.

2008: Re-Branding to MWM.

2011: MWM becomes part of Caterpillar Inc.
CG Sourced Products

Gas Gen Sets
- Electrical output 300 – 4,300 kWₑ per unit

Cogeneration/Trigeneration
- Project-specific layout of plant components
- Modular concepts for easy installation

Turn-Key-Solutions
- Consultancy, Engineering, Design
- Complete delivery and assembly of power plants

Different gas types can be used – for all applications.
- natural gas
- bio, landfill and sewage gas
- special gases
Service

Maintenance
Caterpillar systems, expertise and responsiveness ensure that your demands are met at all anytime.

Documentation
Modern software enables identification of spare parts for all CG engines in use worldwide, quickly and precisely.

Logistics Center
Optimized processes allow extremely short lead times of parts.

Service
Worldwide 24-hour support, professional consultancy, customer support agreements, and performance guarantees help ensure maximum uptime.

Training Center
Permanent training allows for the qualification of service personnel. Training also provided locally.

Exchange Center
For cost & time savings, Caterpillar offers to exchange recycled heads and major components.
CG Series of Gas Generator Sets

Electrical output per genset in kWₑ

Legend:
- 50 Hz
- 60 Hz

CG260
CG170
CG132
Advantages of a Cat CG Container

Engineering, production, service – The one-stop solution

- Applicable universally for different gas types with an all-embracing plant concept
- Container solutions enables an optimized plant configuration
- Low costs of ownership due to efficient and especially for your needs designed gensets
- High availability and low service costs based on optimal container design and long maintenance intervals
- Easy logistics as a result of modular assembly and pre-assembled components
Advantage: The one-stop solution

- Best performance results as the operation of all components is tuned on each other by the genset manufacturer. Control of the whole plant by the Caterpillar TEM-System, all circuits are perfectly coordinated.

- Optimal service by the manufacturer of engine and genset. Therewith access to all enhancements and product improvements.

- Highest reliability due to container quality from Cat CG Products

- Worldwide applicable by international admissions, e.g. CE, Russia, Kazakhstan, Eastern Europe, Canada (CSA)
Advantage: Optimal design of your power plant through container solutions

- Container can easily be adapted to different gas quantities (like landfill or sewage gas), as more container can be added or abolished.

- Considerably lower planning, construction and commissioning periods.

- Low investment costs especially by power plant expansions.

- Reducing of risk, because container can easily be abolished or reused.

- Capabilities especially for fixed-term utilizations, e.g. field tests or construction periods
Advantage: Advanced fields of application by all-embracing power concepts

Emission reduction bonus according to German's EEG by formaldehyde reductions
  - Activated carbon-desulfurization and catalyst for formaldehyde reductions
  - Extended maintenance intervals due to gas processing

Concepts for an optimal plant configuration
  - CHP or electricity container
  - Gas condenser and gas cooling and dehumidification (as appropriate).
  - Optional connection for propane supply.
  - Optimal gas mixer and gas control train according to the gas quality.
Advantage: Sophisticated container concept

- Welded steel structure with single wall segments. Heat and noise insulation through space-saving isolation; soundproof, air conditioned switchboard room.

- Circulation air steering for an ideal internal temperature even by low outside temperatures, less dust loading due to gauge pressure inside the container.

- The container basement serves as an oil collecting tray if necessary.

- Cable exits underneath the switchboards, connections for gas and heating water in the side wall.

- The roof system an be delivered completely pre-assembled for an easy and fast installation on site or as pre-assembled modules packed inside the container for lowest transport costs
Advantage: Low costs of ownership

Up to 15% less gas consumption – CG132 and CG170 have the best efficiencies in their power class
- Special piston layout for biogas and natural gas applications for the CG132.
- Optimized camshafts and chamber spark plugs.
- Higher efficiency and less HC- and CO-emissions due to reduced dead space in the combustion chamber.

Up to 50% reduced lube oil consumption lead to low costs of ownership
- Less lube oil consumption through optimal cylinder liner, piston and ring package dimensioning.
- This reduces the total costs of ownership by a considerable amount.
Advantage: Long engine lifetime and utilization of a variety of gases

- TEM (Total Electronic Management) controls the genset by the temperature of every individual cylinder and protects by the anti-knocking control.

- This leads to a longer engine lifetime without additional maintenance costs.

- TEM and the multi gas mixer enable the genset to run with fluctuating gas qualities and different gas types, like:
  - Natural gas
  - Coal mine gas
  - Bio-, landfill and sewage gas
  - Coke-, pyrolysis and synthesis gas
Benefit: Total Electronic Management, the all-encompassing control system

Main functions

- The basis for the high efficiency of CG gensets
- All necessary engine control- and regulation functions
- Many possibilities of extension in order to create a complete plant control
- Genset control and parameterization from any location in the world is possible
- Optimal solution for your power generation
Advantage: Low maintenance costs and increased engine runtime

- 9.8 ft width and height as well as unruffled walls lead to more space at the inside for perfect maintenance work

- All components are easy accessible

- Beam for fastening hoisting devices

- Rails at the container's bottom and a front door enable a fast disassembling of the genset

- More than 50% time savings at the overhauls with Xchange short blocks

- Longer maintenance intervals due to gas conditioning
Advantage: Long maintenance intervals

CG132 and CG170-12

Natural gas and purified bio-, landfill-, and sewage gas

- Spark plug change: 4,000 h
- Cylinder head inspection on demand, but not later than: 32,000 h
- General overhaul: 64,000 h
Dimensioning data for the container

- For ambient temperatures between: -20° and +35°C
- Noise emissions for a 32 ft distance: 65 dB(A)
- Heating water temperatures: 70°C / 90°C
- Generator voltage: 400V – 600V (CG170 medium voltage)
General design of a container

- Intake air filter
- Intake air fan
- intercooler circuit
- Fresh oil tank
- Gas control train
- Wiring system
- Engine cooling system
- Switchboard room
- Air-conditioner
- Exhaust noise insulation
Switchboard inside the container

- TEM panel
- Auxiliary panel
- Alternator breaker panel
### Technical Data CG132

**Natural gas applications, NO\textsubscript{x} ≤ 500 mg/m\textsubscript{n} / 1.0 g/bhph**

<table>
<thead>
<tr>
<th>Engine type</th>
<th>CG132-8</th>
<th>CG132-12</th>
<th>CG132-16</th>
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<td>el. Power</td>
<td>kW</td>
<td>400</td>
<td>600</td>
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<td>th. Power</td>
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<td>654</td>
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<td>%</td>
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<td>42,0</td>
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<td>th. Efficiency</td>
<td>%</td>
<td>45,2</td>
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**Bio, landfill- and sewage gas applications, NO\textsubscript{x} ≤ 500 mg/m\textsubscript{n} / 1.0 g/bhph**

<table>
<thead>
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<td>kW</td>
<td>400</td>
<td>600</td>
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<td>th. Power</td>
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*5% O\textsubscript{2} and dry exhaust gases*
# Technical Data CG170

## Natural gas applications NOx ≤ 500 mg/mₗ₃ / 1.0 g/bhph*

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<th>CG170-16</th>
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## Bio-, landfill- and sewage gas applications NOx ≤ 500 mg/mₗ₃ / 1.0 g/bhph*

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<td>kW</td>
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<td>±8 %</td>
<td>kW</td>
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<td>%</td>
<td></td>
<td>%</td>
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* 5% O₂ and dry exhaust gases
# Dimensions and weights

## CG132

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<td>mm</td>
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</tr>
<tr>
<td>height</td>
<td>mm</td>
<td>3.000</td>
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<tr>
<td>weight*</td>
<td>kg</td>
<td>22.000</td>
<td>25.000</td>
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</table>

## CG170

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</tr>
</thead>
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<td>mm</td>
<td>13.500</td>
<td>14.000</td>
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<td>width</td>
<td>mm</td>
<td>3.000</td>
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<td>height</td>
<td>mm</td>
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<tr>
<td>weight*</td>
<td>kg</td>
<td>41.000</td>
<td>44.000</td>
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*weights for the CHP-layout
References

- CG Series Containerized Gensets (146MW)
Anderlingen-Ohrel, Germany

- **Genset/Engine (R 029):**
  - 1 x MWM TCG 2016 V08C Cat (CG132-8), container
  - 1 x MWM TCG 2016 V16B Cat (CG132-16)

- **Segment/fuel type:**
  - Biogas

- **Customer:**
  - Anderlingen-Ohrel, Germany

- **Total output:**
  - 400 kWel + 716 kWth

- **Installation/Commissioning:**
  - 2009 + 2007

A MWM TCG 2016 V08C (Cat CG132-8), packed in a container provides 3200 MWh electrical and 2552 MWh thermal power per year, that is used for the fermentation process. An earlier installation of a biogas-fired TCG 2016 V16B (Cat CG132-16), that uses the same gas, supplies heat to a district heating network. The integrated biogas conditioning allows for financial incentives associated with reduced emissions.
The sewage plant in Mannheim, Germany expands with a MWM TCG 2020 V12 (Cat CG170-12) packaged in a container. The genset heat is used for heating the digestion towers. The plant produces produced electrical power of 1 MW_{el}. The sewage plant houses a total of 5 gensets rated for 4.5 MW_{el}.

- **Genset/Engine (R 033):**
  - 1 x MWM TCG 2020 V12 Cat (CG170-12), container

- **Segment/fuel type:**
  - Natural gas/sewage gas

- **Customer:**
  - Sewage plant, Mannheim

- **Total output:**
  - 4.5 MW_{el}

- **Installation/Commissioning:**
  - 2009
Xiamen, CDM Project, China

• **Genset/Engine (R 037):**
  • 1 x MWM TCG 2020 V12 Cat (CG170-12) container

• **Segment/fuel type:**
  • Landfill gas

• **Customer:**
  • Perfect New Energy Co, Ltd., China

• **Total output:**
  • 1.0 MWₑ₁

• **Installation/Commissioning:**
  • 2009

• By using gas gensets, 80,000t of CO₂ will be reduced per year over 10 years. The project has been listed to the CDM project without any local government subsidy.
Buttcon Energy, Canada

- This container is located at the factory premises of “Go Transit” and runs in parallel with utility. In case of grid problems, the container is also able to run on island mode operation and supplies the area with power and hot water. The engine heat is used for facility hot water.

**Genset/Engine (R 052):**
- 1 x MWM TCG 2020 V12 Cat (CG170-12), container

**Segment/fuel type:**
- Cogeneration/natural gas

**Customer/Operator:**
- Buttcon Energy, Canada

**Total output:**
- 1.15 MW_{el} (60Hz)

**Installation/Commissioning:**
- 2008
Product Presentation

Cat CG Series Container

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