Lubricants for Gas cogeneration engines
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1. Introduction

When you choose Repsol Lubricants, you get so much more. Because in addition to a product of the highest quality, you also get the Repsol guarantee: an integrated global energy company which carries out exploration, production, refining, distribution and marketing activities in more than 90 countries. It provides millions of people and companies all over the world with the most efficient, responsible and innovative energy solutions.

And you also choose the maximum innovation. Because at Repsol we have our research center Repsol Technology Lab. at the forefront of R&D&I worldwide, where our technicians and researchers are constantly striving to improve every product, ensuring maximum efficiency and enhanced technical and environmental quality.

Maximum quality

In this sector, gas-fuelled engines are used for electricity generation and cogeneration (simultaneously generating electrical energy and useful thermal energy which is used to generate steam, hot domestic water, etc.). The use of gases from different processes (biogas, landfill gas, purifier gas and other types of non-conventional gases) results in significant savings in the operating costs of these types of engines, as well as an environmental solution for the process.

The Repsol range of oils for gas-fuelled engines meets market needs by adapting to the demands of each type of customer according to their engine, type of gas and application. These products have been approved for use in the engines of leading manufacturers (MWM Deutz, Jenbacher, MAN, Bergen, WÄRTSILÄ and Cummins).

Repsol markets lubricants used in other energy generation machinery, such as turbines (water, steam and gas) and diesel/petrol engines. For further information please see our catalogues at www.repsol.com.
2. Lubricants for gas-fuelled cogeneration engines

**Generator Synthetic Motor Gas 404**

Lubricant oil designed to lubricate engines using special or enriched gases, where combustion may be highly sensitive to ash or deposits in valves and pistons. When using hydrogen as a fuel, it is especially necessary that the lubricant doesn’t contribute to the generation of ash. The use of synthetic components and low ash additives minimizes the formation of deposits and contributes to preventing explosions or anomalies.

**QUALITY LEVELS, APPROVALS, AND RECOMMENDATIONS**

INNIO JENBACHER TA 1000-1109* for special gases type S (high hydrogen content) / CAT (catalytic converter)

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**Generator Extra Long Life Gas 4005**

High-performance lubricating oil specially designed for stationary gas engines. This product has been developed to respond to the new generation of engines that work at higher pressures and temperatures in the combustion chamber to achieve greater efficiency and performance. Its formulation incorporates base oils with a refining grade higher than conventional ones, alongside an advanced additive technology that provides superior performance in cleaning and reduction of deposits in the engine. This prevents phenomena such as valve recession and pre-ignition, protecting the internal parts of the engine exposed to high loads.

**QUALITY LEVELS, APPROVALS, AND RECOMMENDATIONS**

BERGEN* for engines B36/45, B35/40, K-GAS, C26:33
INNIO JENBACHER TA 1000-1109 * for engines type 2, 3, 4 and 6 H&K, including 624 with gas fuel type A
MWM [Approval in process]
WÄRTSILÄ [Approval in process]
WAUKESHA Cogeneration/gas Compression Applications*

*Formal approval.
State-of-the-art lubricant oil designed specially for stationary gas-fuelled engines which require extremely long oil change intervals. This product is formulated using base oils which are more highly refined than conventional oils. It also incorporates innovative additive technology, giving it excellent performance, extremely high resistance to oxidation and optimum TBN retention. This means that oil change intervals can be increased more than in other products designed for similar applications.

**QUALITY LEVELS, APPROVALS, AND RECOMMENDATIONS**

BERGEN* for engines B36:45, B35:40, K-GAS, C26:33
CATERPILLAR [Test filed G-3516]
WÄRTSILÄ for 175SG, 220SG, 25SG, 28SG, 31SG, 34SG, 50SG, 20DF, 31DF, 32DF, 34DF, 46DF, 50DF* engines

**Generator Long Life Gas 4005**

Extremely long-lasting lubricant oil which incorporates hydrogenated base oils and state-of-the-art additives that allow oil change intervals to be increased in comparison with mineral oils. Suitable for modern stationary engines fuelled by gas which require the use of oil with a maximum ash content of 0.5%.

Its balanced formulation means that its resistance to the oxidation and nitration present in these types of engines, which operate under severe conditions, is better than that of conventional lubricants. In applications where the gas used as fuel is biogas or any other type of gas, the useful life of the lubricant will depend on the contaminant level of the gas in question.

**QUALITY LEVELS, APPROVALS, AND RECOMMENDATIONS**

BERGEN* for engines B35:40, K-GAS, C2-G
CATERPILLAR TR 2105 engines CG132, CG170, CG260*
CUMMINS* engines QSK60
INNIO JENBACHER TA 1000-1109* for all types of engines Series 2, 3, 4 and 6 (F&J) that use natural gas as a fuel. Also valid for CAT.

*Formal approval.
Generator Long Life Biogas 4005

Extremely long-lasting lubricant oil specifically developed for stationary engines which run on landfill gas, biogas and process gas (with a low methane content and a high concentration of corrosive gases). Its formula incorporates highly-refined base oils which ensure that the lubricant is long-lasting in severe operating conditions with landfill gases. The product specifications have been verified with state-of-the-art engines operating at full load.

### QUALITY LEVELS, APPROVALS, AND RECOMMENDATIONS

| CATERPILLAR TR 2105 | MAN M3271-4&5 [Approval in process] |
| GUASCOR | MWM TR 2105 |
| INNIO JENBACHER TA 1000-1109* for engines Series 2, 3, 4 and 6 (E) for gases type B and C as a fuel | WAUKESHA |

Generator Super Motor Gas 4005

Extremely long-lasting mineral lubricant oil especially designed to meet the lubrication requirements of modern stationary engines fuelled by natural gas. Its formulation has a maximum ash content of 0.5%, minimising deposit formation and guaranteeing maximum performance and uptime. It enables longer oil change intervals, thereby minimising maintenance costs.

### QUALITY LEVELS, APPROVALS, AND RECOMMENDATIONS

| BERGEN for engines K-G1/K-G2/K-G3 | MWM TR 2105* |
| CATERPILLAR TR 2105 engines CG132, CG170, CG260* | WAERTSILÅ |
| GUASCOR | WAUKESHA |
| INNIO JENBACHER TA 1000-1109* for engines 2,3,4,6C&E for gas type A (natural gas) | BAUDOUIN [Approval in process] |

Generator Motor Gas HTM 40

Mineral lubricant oil for naturally aspirated and turbocharged stationary gas-fuelled engines. Suitable for a wide range of gases, such as natural gas, biogas, landfill gas, process gas and other gases with a higher sulphur content than natural gas (check with manufacturer).

It has been especially formulated for applications in which manufacturers require a product with a high alkaline reserve and medium ash content.

### QUALITY LEVELS, APPROVALS, AND RECOMMENDATIONS

| API CD | INNIO JENBACHER 1000-1109 [for engines installed up to September 2009] |
| BERGEN old engines K-G1/K-G2/K-G3 [for biogas] | PERKINS 4008 TESI |
| GUASCOR | WAUKESHA |

*Formal approval.
3. Approvals and quality levels

<table>
<thead>
<tr>
<th>Product name</th>
<th>BERGEN</th>
<th>JENBACHER</th>
<th>MAN</th>
<th>CUMMINS</th>
<th>GUASCOR</th>
<th>CATERPILLAR</th>
<th>WÄRTSLÄ</th>
<th>WAUKESHA</th>
<th>BAUDON</th>
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<tr>
<td><strong>GENERATOR SYNTHETIC MOTOR GAS 404</strong></td>
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<td>Special gases type S (high hydrogen content) / CAT (catalytic converter)</td>
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<td>B35-40</td>
<td>C26-33</td>
<td>K-G</td>
<td>2, 3, 4 and 6 HdE, including 6H4 with gas fuel type A</td>
<td>Approval in process</td>
<td>175SG, 205SG, 255G, 265G, 31 SG, 34 SG, 505G, 20DF, 31DF, 34DF, 46DF, 50DF</td>
<td>Gas cogeneration / gas compression applications</td>
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<tr>
<td><strong>GENERATOR LONG LIFE BIOGAS 4005</strong></td>
<td>2, 3, 4,6G and 6E for gases type B and C</td>
<td>Quality level</td>
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<td>2, 3, 4 6E6E for gas type A</td>
<td>TR 2105</td>
<td>Quality level</td>
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<td>Biogas: K-G1/K-G2/K-G3</td>
<td>Engines until September 2009</td>
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4. Packs

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<tr>
<th>PRODUCT</th>
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<tr>
<td>GENERATOR MOTOR GAS HTM 40</td>
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*For bulk packs, please consult your sales manager*
5. Used oil analysis service for stationary engines

At Repsol we know how important it is to ensure that your engines work in the best possible conditions. It is therefore essential to ensure that they are adequately lubricated.

The used oil analysis service for stationary engines programme is an exclusive service we offer our customers, based on more than 15 years’ experience in the analysis of lubricants. Through the periodic laboratory analysis of a sample of oil in service, the expert system tells you the condition and performance of your engines, whilst predicting any mechanical failures before they occur.

Advantages of the programme

- Improves the performance and productivity of your equipment.
- Reduces maintenance costs and unscheduled stoppages.
- Extends the useful life of lubricants and mechanical components, thereby minimising the associated replacement costs and the capital tied up in replacement parts.
- Enables maintenance and control activities to be scheduled.
- Leads to a significant improvement in the optimum working conditions of lubricants and components.

The used oil analysis service for stationary engines programme is designed to meet the growing demand of customers with large engines used in cogeneration which use gas as a fuel, primarily natural gas.

The programme takes into account the particular characteristics of the lubricants especially designed for these engines, as well as the type of gas used and the special maintenance plans applied to this industrial sector.

The results obtained after the analysis are eventually summarised in a personalised report for each customer.

How to access the programme

Becoming a user of the used oil analysis service for stationary engines system is very simple. Just get in touch with our sales network or contact our Customer Service Department [901 111 999, lubricantes@repsol.com].

You’ll be provided with a customer code, as well as a sampling kit which will include the following:

- Special 125ml containers to take samples.
- Barcode labels to identify the samples.
- Cards to send information on each sample.
- Postage-paid envelopes to send the samples to our laboratory.

You can find out the results of the analyses carried out using the system by email or through the interactive services available at www.repsol.com.
Gas cogeneration report

Interpretation of results:

Correct: value within appropriate margins.

Alert: slight variation against normal value.

Alarm: value above acceptable level. These values are adjusted to the limits provided by engine manufacturers.

Diagnosis and recommendations

Our Technical Assistance and Development Department issues a diagnosis which details any anomalous results and sets out the possible causes of the failure. Finally, a set of recommendations on possible alternatives or actions to be adopted in each case are given. In this case, the oil may continue in service.

Contamination rate

Analysis and Diagnosis of Lubricant in Service

Wear rate

Degradation rate

Personalised charts

Making it easier to monitor the results and analyse trends.
6. Commercial offices

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