

Lubricants for
**Gas cogeneration
engines**





REPSOL

Technology Lab



Technology
Lab

INDEX

Introduction.....	4
1. Lubricants for gas cogeneration engines	5
• Repsol Super Long Life Gas 4005	5
• Repsol Long Life Gas 4005	6
• Repsol Long Life Biogas 4005.....	6
• Repsol Synthetic Motor Gas 404	6
• Repsol Super Motor Gas 4005	6
• Repsol Extra Gas 40.....	7
• Repsol Motor Gas HTM 40.....	7
2. Quality levels according to manufacturer	8
3. Packs	8
4. ADOC XXI Gas Cogeneration.....	9
• Advantages of the ADOC XXI Programme.....	9
• How to access the ADOC Gas Cogeneration Programme.....	9
• Gas Cogeneration Report.....	10
5. Commercial offices	11

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, Rolls Royce, WÄRTSILÄ and Cummins) and also meet the technical requirements of Caterpillar and Waukesha, among others.

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**.





1.

Lubricants for gas-fuelled cogeneration engines

REPSOL SUPER LONG LIFE GAS 4005

State-of-the-art lubricant oil designed especially 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 level

- WÄRTSILÄ [approved]
- CATERPILLAR [field test]
- WAUKESHA [approval in process]

REPSOL 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 level

- JENBACHER 1000-1109 [approved]
- MWM DEUTZ [approved]
- ROLLS ROYCE BERGEN BVG/CR-G/K-G1/K-G2/K-G3 [approved]
- MAN Diesel & Turbo medium-speed engines [approved]
- CUMMINS [approved]
- MAN 3271-2
- WAUKESHA
- CATERPILLAR
- WÄRTSILÄ

REPSOL 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 level

- JENBACHER TA 1000-1109 [approved] for type B and C gases

REPSOL SYNTHETIC MOTOR GAS 404

REPSOL SYNTHETIC MOTOR GAS 404 lubricant oil is designed to lubricate engines using special or enriched gases, where combustion may be highly sensitive to ash or deposits in valves and pistons.

Quality level

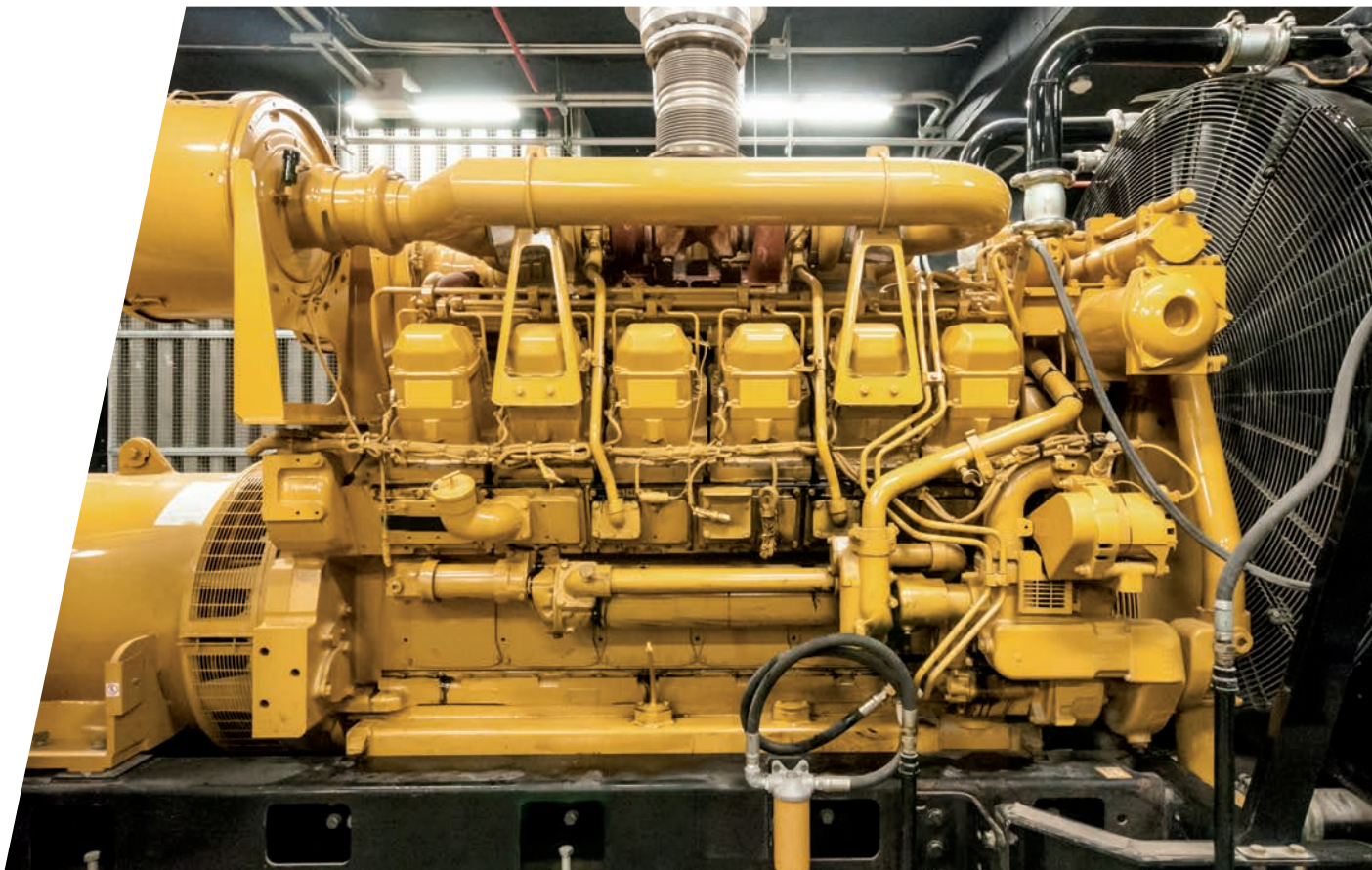
- JENBACHER 1000-1109 [approved for special gases]

REPSOL 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 level

- JENBACHER 1000-1109 [approved]
- MWM DEUTZ [approved]
- ROLLS ROYCE BERGEN K-G1/K-G2/K-G3
- CATERPILLAR
- WÄRTSILÄ
- WAUKESHA
- GUASCOR



REPSOL EXTRA GAS 40

Mineral lubricant oil for use in stationary gas engines with or without turbo blowers, running on natural gas or other gases with a low sulphur content. Its low ash content minimises engine deposits, whilst guaranteeing optimum protection for valves and valve seats. This reduces unscheduled stoppages and saves maintenance costs.

Quality level

- GUASCOR [approved]
- MWM DEUTZ [approved]

REPSOL 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 level

- JENBACHER 1000-1109 [for engines installed up to September 2009]
- ROLLS ROYCE BERGEN K-G1/K-G2/K-G3 [for biogas]

2. Quality levels according to manufacturer

Product name	ROLLS ROYCE	JENBACHER	MWM DEUTZ	MAN	CUMMINS	GUASCOR	CATERPILLAR	WÄRTSILÄ	WAUKESHA
REPSOL SUPER LONG LIFE GAS 4005							Field test G-3516	175SG, 220SG, 255SG, 285SG, 315G, 345G, 505G, 20DF, 31DF, 32DF, 34DF, 46DF, 50DF	Approval in process
REPSOL LONG LIFE GAS 4005	Natural gas: BV-G/CR-G/K-G1/K-G2/K-G3 Biogas: K-G1/K-G2/K-G3	Class A. Natural gas: Series 2, 3, 4 and 6 Suitable for CAT NOTE: Series 4 and 6: extended oil change intervals	Natural gas and biogas	Diesel medium-speed engines in gas operation / 3271-2	QSK 60		Quality level	Quality level	Quality level
REPSOL LONG LIFE BIOGAS 4005		Class B and C							
REPSOL SYNTHETIC MOTOR GAS 404		Special gases							
REPSOL SUPER MOTOR GAS 4005	Natural gas: K-G1/K-G2/K-G3	Class A. Natural gas: Series 2, 3, 4 and 6	Natural gas and biogas		Quality level	Quality level	Quality level	Quality level	Quality level
REPSOL EXTRA GAS 40			Natural gas and biogas			Natural gas			
REPSOL MOTOR GAS HTM 40	Biogas: K-G1/K-G2/K-G3	Class A: Natural gas [*up to Sept '09] Class B and C: Biogas and landfill gas							

3. Packs

PRODUCT NAME	1000 L container	208 L drum
REPSOL SUPER LONG LIFE GAS 4005	✓	✓
REPSOL LONG LIFE GAS 4005	✓	✓
REPSOL LONG LIFE BIOGAS 4005	✓	✓
REPSOL SYNTHETIC MOTOR GAS 404	✓	
REPSOL SUPER MOTOR GAS 4005	✓	✓
REPSOL EXTRA GAS 40	✓	
REPSOL MOTOR GAS HTM 40	✓	✓

ADOC XXI Gas Cogeneration

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 **ADOC XXI 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 ADOC expert system tells you the condition and performance of your engines, whilst predicting any mechanical failures before they occur.

Advantages of the ADOC XXI 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 **ADOC Gas Cogeneration 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.





ADOC Gas Cogeneration **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 ADOC Gas Cogeneration programme

Becoming a user of the ADOC Gas Cogeneration system is very simple. Just get in touch with our **sales network** or contact our **Customer Service Department** [901 111 999, saclubes@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 ADOC Gas Cogeneration 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.

Wear rate



Degradation rate



Contamination rate



Personalised charts

Making it easier to monitor the results and analyse trends.

Analysis service ADOC

Customer: [blank] Facility: Frank, ROLLS ROYCE Power: 80 35-40 V 12

Engine: [blank]

SAMPLE DETAILS

Sample code: [blank] OK (rev): 30980

Oil: REPSOL LONG LIFE GAS 4005 SAE 40 Engine (rev): 30980

Date sampled: 24/11/2015 added volume [L]: [blank]

Date completed: 26/11/2015 Date received: 26/11/2015

Products in use [L]: 4000 Replaced daily [L]: [blank]

DIAGNOSTICS AND RECOMMENDATIONS

The samples readings are within the normal limits. The oil can still be used.

Report daily replacements to us as well as daily hours of operation or the total replacements since the previous sample was sent to:

Technical support: ALEJANDRO.FERNANDEZ.ALEJANDRO (alejandro@repsol.com)

RESULTS

Sample code	ACTUAL	100000000	300000000	1000000000	1000000000	
Date sampled	24/11/2015	01/11/2015	17/10/2015	06/09/2015	21/07/2015	
Engine (rev)	30980	30400	30000	29000	28000	
Oil (rev)	30980	30400	30000	29000	28000	
GLOBAL STATUS						
WEAR STATUS						
Iron, ppm	ASTM D 5085	11.6	11	13.8	14.2	12
Chromium, ppm	ASTM D 5085	0.52	0.31	0.57	0.56	0.39
Aluminum, ppm	ASTM D 5085	1.06	2.28	2.28	3.16	2.94
Copper, ppm	ASTM D 5085	20	21.2	24.8	25.4	26.3
Nickel, ppm	ASTM D 5085	n.d.	n.d.	n.d.	n.d.	n.d.
Lead, ppm	ASTM D 5085	1.39	1.39	1.08	1.46	1.01
Tin, ppm	ASTM D 5085	0.79	n.d.	n.d.	n.d.	n.d.
Silica, ppm	ASTM D 5085	n.d.	n.d.	n.d.	n.d.	n.d.
Vanadium, ppm	ASTM D 5085	n.d.	n.d.	n.d.	n.d.	n.d.
Titanium, ppm	ASTM D 5085	n.d.	n.d.	n.d.	n.d.	n.d.
Phosphorus, ppm	ASTM D 5085	n.d.	n.d.	0.51	n.d.	n.d.
OIL DEGRADATION STATUS						
Viscosity at 40 °C, cSt	ASTM D 445	130.1	132.3	128.4	128.3	128
TBN, mg KOH/g	ASTM D 2896	3.3	3.3	3.8	3.4	3.3
TAN, mg KOH/g	ASTM D 884	2.3	2	2.4	2.4	2.3
Oxidation, Abs/cm	ASTM E 2422	0.8	1.4	20.8	18	16.4
Moisture, Abs/cm	ASTM E 2422	5.7	8.2	10.4	7.8	8
DL CONT STATUS						

OTHER METALS

Element	ASTM D 5085	n.d.	n.d.	n.d.	n.d.	n.d.
Silicon, ppm	ASTM D 5085	1.49	n.d.	1.1	18.2	n.d.
Sodium, ppm	ASTM D 5085	31.3	32.8	31.1	31.6	15.5
Water, %	ASTM D 4277	10.1	-10.1	-10.1	-10.1	-10.1
OTHER METALS						
Selenium, ppm	ASTM D 5085	n.d.	n.d.	n.d.	n.d.	n.d.
Molybdenum, ppm	ASTM D 5085	1.01	0.88	11.7	1.7	12.3
Calcium, ppm	ASTM D 5085	1700	1765	1665	1664	1658
Phosphorus, ppm	ASTM D 5085	308	313	307	316	314
Magnesium, ppm	ASTM D 5085	3.81	4.2	4.57	5.02	4.32
Zinc, ppm	ASTM D 5085	384	387	414	485	409

GRAPHICS

0.0 - below limit detection

Four line charts showing trends for: 1) Iron (ppm), 2) Copper (ppm), 3) Silicon (ppm), and 4) Oxidation (Abs/cm). Each chart plots data from 21/07/2015 to 24/11/2015.

To get the best diagnosis of your samples, remember it is important to correctly fill out the information. You can see the results and historical data of your samples in the Customer Area of repsol.com.

Commercial offices



HEADQUARTERS

c/ Méndez Álvaro, 44
28045 Madrid, Spain
Tel: [+34] 901 111 999
lubricantes@repsol.com



PORTUGAL COMMERCIAL OFFICE

Av. José Malhoa nº 16 B - 8º
1099-091 Lisbon, Portugal
Tel: [+351] 213 119 000
sac.rlesa@repsol.com



PERU COMMERCIAL OFFICE

Roberto Tarazona Caitano
Av. Víctor Andrés Belaúnde 147
Edif. Real 5 Piso 7, San Isidro (Lima) Peru
Tel: [+51] 215-6225
Mobile: [+51] 998 780 183
Fax: [+51] 421-8591
rtarazonac@repsol.com



ITALY COMMERCIAL OFFICE

Paolo Ferro
Centro Uffici San Siro
Via Caldera, 21
20153 Milan, Italy
Tel: [+39] 02 409339.1
Mobile: [+39] 335 7001838
pferro@repsol.com



ASIA-PACIFIC COMMERCIAL OFFICE

Mariano Castro Martínez
10 Marina Boulevard, #14-01
Marina Bay Financial Centre Tower 2
Singapore 018983
Tel: [+65] 6808 1065
mcastrom@repsol.com



FRANCE COMMERCIAL OFFICE

Leticia Lecomte
6 Rue Jean Jaurès
92807 · Puteaux - France
Tel: [+33] 1 46 96 65 23
Mobile: [+ 33] 1 46 96 08 31
Fax: [+33] 1 46 96 66 42
laetitia.lecomte@repsol.com



BRAZIL COMMERCIAL OFFICE

Nuno Miguel Alvarez
Rua Leopoldo Couto de Magalhães Júnior, 758
11º andar, escritórios 111 e 112, Itaim Bibi
04542-000 São Paulo, Brazil
Tel: [+55] 21-25597200
nalvarez@repsol.com



MEXICO COMMERCIAL OFFICE

Justo Aguado
Blvd. Manuel Ávila Camacho 36,
Lomas de Chapultepec V Sección
C.P. 11000 Mexico City
Tel: [+52] 55 9171 1697
jaguadoa@repsol.com





Repsol Lubricantes y Especialidades, S.A.
C/ Méndez Álvaro, 44. 28045 Madrid [Spain]

repsol.com