

**HISTORICAL STUDY ON THE MAINTENANCE
OF THE EXHAUST VALVES IN THE DEUTZ
ENGINES INSTALLED IN THE UFEFYS S.L.
POWER PLANT**

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1 - INTRODUCTION

This historical study has been carried out by **rb bertomeu SL**, with the aim of compiling its experience in power plants equipped with Diesel engines, mainly by reviewing the improvements achieved in the maintenance and conservation of engine exhaust valves, with the use of the “**rb bertomeu**” fuel oil additives, which are dosed to the fuel storage tank.

For this purpose, a power plant has been chosen, located in Spain, which has used “**rb bertomeu**” additives for a long period of time. The selected plant, belonging to the company UFEFYS S.L., is equipped with Diesel engines and uses No. 1 BIA fuel oil as fuel.

The realization of this study has been possible thanks to the compilation of technical data carried out since the commissioning, which has been provided by the owner company itself, and to the photographic reports made by us during the engine reviews that have been periodically carried out.

We are convinced that through the content of this study, it is easy to conclude that the use of “**rb bertomeu**” additives provides significant improvements in engine maintenance costs, as well as increased energy production by reduction of time lost in maintenance shutdowns.

2 - POWER PLANT ARANJUEZ - MADRID

QUANTITY OF ENGINES: 2

ENGINE TYPE: Deutz BV 16 M - 640

START-UP DATE: Engine 1: 10 - Feb - 1996
Engine 2: 6 - Feb - 1996

BRIEF SUMMARY OF OPERATION FROM START UP:

Both engines were started on the dates indicated above, using Fuel Oil No. 1 BIA without any additive.

After operating for 1,200 – 1,400 hours, many corrosion problems appeared in the exhaust valves and many of them had to be mechanically changed (from early March to mid-April).

Due to this, UFEFYS considered the possibility of using fuel oil additives as a way to solve their problems, and, for this purpose, contacted our company, RB BERTOMEU S.L.

About by mid-April, UFEFYS started the fuel oil treatment by using the “rb bertomeu” beco F1/ASF additive. At this time, they had been working for around 1,600 hours using fuel oil without additives, and despite this, it was possible to achieve the first general overhaul of the engines (May 27 and June 5) without any other corrosion problem.

All the engine reviews carried out are detailed below:

1st ENGINES' GENERAL INSPECTION

Inspection date Engine 1 : 05/06/96
Engine 2 : 27/05/96

Service hours Engine 1 : 2.786 (TBO = 2.786 H)
Engine 2 : 2.677 (TBO = 2.677 H)

Fuel oil treatment: All the period
Additive: **“rb bertomeu” beco F1/ASF**

Scale detected at the exhaust valves: 3,57 g/valv. (average)

Corrosion detected at the exhaust valves:

Engine 1 : 18 valve heads / 14 baskets
Engine 2 : 7 valve heads / baskets not counted

Notes : See photo report number 1 at the chapter 3 .
It is accepted, after the subsequent experience, that all the corrosion found was generated during the first period without adding fuel oil.

2nd ENGINES' GENERAL INSPECTION

Inspection date Engine 1: 07/11/96
Engine 2: 05/11/96

Service hours Engine 1 : 6,090 (TBO = 3,304 H)
Engine 2 : 6,178 (TBO = 3,501 H)

Fuel oil treatment: All the period
Additive: **“rb bertomeu” beco F1/ASF**

Scale detected at the exhaust valves: 2.56 g/valv. (average)

Corrosion detected at the exhaust valves:

Engine 1 : None
Engine 2 : None

Notes : See photo report number 2 at the chapter 4 .

Due to the absence of corrosion, only a few valve and basket photographs were taken for the archive.

3rd ENGINES' GENERAL INSPECTION

Inspection date Engine 1 : 26/04/97
Engine 2 : 15/05/97

Service hours Engine 1: 10,496 (TBO = 4,406 H)
Engine 2 : 9,946 (TBO = 3,768 H)

Fuel oil treatment: All the period
Additive: **“rb bertomeu” beco F1/ASF**

Scale detected at the exhaust valves : 4.12 g/valv. (average)

Corrosion detected at the exhaust valves:

Engine 1 : 1 valve head slightly corroded
Engine 2 : None

Notes : See photo report number 3 at the chapter 5.
The slight increase in debris detected in the exhaust valves can be justified by the wide TBO of the period for engine # 1 (+ 46% over the normal TBO).

4th ENGINES' GENERAL INSPECTION

Inspection date Engine 1: 29/09/97
Engine 2: 18/09/97

Service hours Engine 1 : 13.117 (TBO = 2,621 H)
Engine 2 : 12.545 (TBO = 2,599 H)

Fuel oil treatment: All the period
Additive: **“rb bertomeu” beco F1/ASF**

Scale detected at the exhaust valves: 2.22 g/valv. (average)

Corrosion detected at the exhaust valves:

Engine 1 : 1 valve head
11 valve heads with thermal fatigue of metal

Engine 2 : None
21 valve heads with thermal fatigue of metal

Notes : See photo report number 4 at the chapter 6.

We think that the thermal fatigue detected in the engine exhaust valve heads must have an explanation. According to our experience in other plants, the thermal fatigue in valves does not appear before the 15,000 or 18,000 hours of work of the engines at least, against the 12,545 and 13,117 hours as has been the case in the Ufefys plant.

We assume that this shorter duration may have been motivated by the operating conditions:

a) During the 1st general engine overhaul, all exhaust valves were mechanically rectified twice, due to an error in the first rectification. Mechanical grinding was necessary because of the corrosion produced during the period when no fuel oil additive was used, but we consider that two grinding from the beginning can negatively affect the life of the valves.

b) The two engines have been subjected to a hard working regime (power and temperature) in recent months, since the 3rd general review.

5th ENGINES' GENERAL INSPECTION

Inspection date Engine 1 : 9/3/98
Engine 2 : 12/3/98

Service hours Engine 1 : 16,722 (TBO = 3,605 H)
Engine 2 : 16,373 (TBO = 3,828 H)

Fuel oil treatment: All the period
Additive: **“rb bertomeu” beco F1/ASF**

Scale detected at the exhaust valves: 2.45 g/valv. (average)

Corrosion detected at the exhaust valves:

Engine 1 : in 9 valves

Engine 2 : in 3 valves
1 valve head with thermal fatigue

Notes : See photo report number 5 at the chapter 7 .

6th ENGINES' GENERAL INSPECTION

Inspection date Engine 1 : 1/6/98
Engine 2 : 15/6/98

Service hours Engine 1 : 18,619 (TBO = 1,897 H)
Engine 2 : 18,550 (TBO = 2,177 H)

Fuel oil treatment: All the period
Additive: **“rb bertomeu” beco F1/ASF**

Scale detected at the exhaust valves : 1.42 g/valv. (average)

Corrosion detected at the exhaust valves:

Engine 1 : in 1 basket
Engine 2 : in 1 basket

Notes : See photo report number 6 at the chapter 8 .

7th ENGINES' GENERAL INSPECTION

Inspection date Engine 1 : 16/11/98
Engine 2 : 18/11/98

Service hours Engine 1 : 22,265 (TBO = 3,646 H)
Engine 2 : 21,924 (TBO = 3,374 H)

Fuel oil treatment: All the period
Additive: **“rb bertomeu” beco F1/ASF**

Scale detected at the exhaust valves: 1.71 g/valv. (average)
(We didn't weight the valves of the engine #2, which had some inlays, very similar to those of engine #1)

Corrosion detected at the exhaust valves:

Engine 1 : in 1 basket
Engine 2 : in 2 spindles and 2 baskets

Notes : See photo report number 7 at the chapter 9 .

8th ENGINES' GENERAL INSPECTION

Inspection date Engine 1 : 21/05/99
Engine 2 : 03/05/99

Service hours Engine 1 : 26,572 (TBO = 4,307 H)
Engine 2 : 25,721 (TBO = 3,797 H)

Fuel oil treatment: All the period
Additive: **“rb bertomeu” beco F1/ASF**

Scale detected at the exhaust valves: 1.20 g/valv. (average)

Corrosion detected at the exhaust valves:

Engine 1 : in 2 spindles
Engine 2 : in 4 spindles and 1 basket

Notes : See photo report number 8 at the chapter 10 .

MAIN OPERATING DATA FROM START-UP:

- A) Fuel oil consumption..... 212.7 g / kWh
- B) Engine oil consumption..... 2.0 g / kWh
- C) Fuel oil sludge (dry base)..... 1.2 k / MT of fuel oil
- D) Operating temperature (exhaust gases)..... 370 / 376 °C (E-1 / E-2)
- E) Combustion air excess index..... 1.9 / 1.8 (E-1 / E-2)
- F) Exhaust gases analysis

	Engine1	Engine 2
O ₂ (%)	13.3	13.2
CO ₂ (%)	6.0	6.0
CO (mg/Nm ³)	110	90
NO (mg/Nm ³)	1880	1750
NO ₂ (mg/Nm ³)	230	190
SO ₂ (mg/Nm ³)	670	720
Bacharach index	3.2	3.2

CONCLUSIONS:

1 - The corrosion problems in the exhaust valves, which appeared during the first two months after the start-up of the engines, were solved using “**rb bertomeu**” additives for fuel oil.

2 - Over more than 10,000 hours of work (since the 1st general overhaul of engines), it was not necessary to replace any exhaust valve, despite the damaged ones caused during the first period without using additives, and despite the poor mechanical rectification to which the valves were subjected during the 1st general review.

3 - The replacement of the valve heads has begun to be carried out during the 4th general overhaul of the engines due to the thermal fatigue of the metal, but without showing any signs of corrosion.

4 - It is very difficult to calculate other important benefits or advantages obtained with the regular use of our fuel oil additives (fuel oil consumption, motor oil consumption, savings in maintenance and cleaning, etc.), mainly because it would be necessary to compare the data. current with those obtained in hypothetical periods, very broad, without using our products, which is not at all advisable in the current situation, especially taking into account past experience.

5 - Our client UFEFYS, due to his bad experience during the first period and the excellent results obtained afterwards, is offering us his support and acceptance towards our products and services.

3 - PHOTO REPORT Number 1

UFEFYS - POWER PLANT

1st INSPECTION OF ENGINES (3,000 service hours)

	<u>Inspection date</u>	<u>Service hours</u>	<u>TBO (hours)</u>
Engine 1	05/06/96	2,786	2.786
Engine 2	27/05/96	2,677	2.677

Fuel oil treatment: Started at the 1,600 service hours
 The first 1,600 hours without additives

4 - PHOTO REPORT Number 2

UFEFYS - POWER PLANT

2nd INSPECTION OF ENGINES (6,000 service hours)

	<u>Inspection date</u>	<u>Service hours</u>	<u>TBO (hours)</u>
Engine 1	07/11/96	6,090	3,304
Engine 2	05/11/96	6,178	3,501

Fuel oil treatment: All the period

5 - PHOTO REPORT Number 3

UFEFYS - POWER PLANT

3rd INSPECTION OF ENGINES (9,000 service hours)

	<u>Inspection date</u>	<u>Service hours</u>	<u>TBO (hours)</u>
Engine 1	26/04/97	10,496	4,406
Engine 2	15/05/97	9,946	3,768

Fuel oil treatment: All the period

6 - PHOTO REPORT Number 4

UFEFYS - POWER PLANT

4th INSPECTION OF ENGINES (12,000 service hours)

	<u>Inspection date</u>	<u>Service hours</u>	<u>TBO (hours)</u>
Engine 1	29/09/97	13,117	2,621
Engine 2	18/09/97	12,545	2,599

Fuel oil treatment: All the period

7 - PHOTO REPORT Number 5

UFEFYS - POWER PLANT

5th INSPECTION OF ENGINES (16,000 service hours)

	<u>Inspection date</u>	<u>Service hours</u>	<u>TBO (hours)</u>
Engine 1	9/03/98	16,722	3,605
Engine 2	12/03/98	16,373	3,828

Fuel oil treatment: All the period, with “**rb bertomeu**” beco **F1/ASF**

8 - PHOTO REPORT Number 6

UFEFYS - POWER PLANT

6th INSPECTION OF ENGINES (19,000 service hours)

	<u>Inspection date</u>	<u>Service hours</u>	<u>TBO (hours)</u>
Engine 1	1/06/98	18,619	1,897
Engine 2	15/06/98	18,550	2,177

Fuel oil treatment: All the period , with “**rb bertomeu**” beco **F1/ASF**

9 - PHOTO REPORT Number 7

UFEFYS - POWER PLANT

7th INSPECTION OF ENGINES (22,000 service hours)

	<u>Inspection date</u>	<u>Service hours</u>	<u>TBO (hours)</u>
Engine 1	16/11/98	22,265	3,646
Engine 2	18/11/98	21,924	3,374

Fuel oil treatment: All the period, with “**rb bertomeu**” beco **F1/ASF**

Changes made:

Engine 1 : 2 spindles due to out-of-range measurements
1 basket due to corrosion
2 baskets due to out-of-range measurements

Engine 2 : 3 spindles due to out-of-range measurements
3 baskets due to out-of-range measurements

10 - PHOTO REPORT Number 8

UFEFYS - POWER PLANT

8th INSPECTION OF ENGINES (26,000 service hours)

	<u>Inspection date</u>	<u>Service hours</u>	<u>TBO (hours)</u>
Engine 1	21/05/99	26,572	4,307
Engine 2	03/05/99	25,721	3,797

Fuel oil treatment: All the period, with “**rb bertomeu**” beco **F1/ASF**

Changes made:

Engine 1 : -----

Engine 2 : 4 spindles due to out-of-range measurements
4 baskets due to out-of-range measurements