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www.rbbertomeu.es
rbbertomeu@rbbertomeu.es

Document RB-9

INCRUSTATIONS IN FUEL OIL STEAM BOILERS

rb bertomeu S.L.
Technical Dept.
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It is well known that one of the principal problems affecting the energy **performance** and **the longevity of boilers** that burn fuel oil or diesel oil is the formation of crusts from soot and hard deposits in the tubes of heat exchangers, on the side in contact with the hot gases from combustion.

These deposits and incrustations, caused by incomplete combustion and the impurities contained in the fuel, above all in the case of fuel oil, produce a reduction in the speed of heat transfer between both sides of the heat exchanger tubes (the gas side and the water side). The greater the thickness of accumulated deposits, the greater the reduction. With this reduction in heat transfer, the exhaust gases passing out through the chimney are hotter and thus the energy supplied to the boiler is less utilised for steam generation, that is, the energy efficiency of the boiler is reduced and the fuel consumption increases per unit of steam produced.

There are several studies on the subject which quantify these losses. The following table serves as a guide to the relevant data:

Thickness of soot crust in the pipes	Loss of heat caused	Equivalent increase in fuel consumption
0.8 mm	12 %	2.5 %
1.6 mm	24 %	4.5 %
3.2 mm	47 %	8.5 %

Thickness of incrustation of residues in tubes	Heat loss caused	Equivalent increase in fuel consumption
0.8 mm	8 %	2.0 %
1.6 mm	12 %	2.5 %
3.2 mm	20 %	4.0 %

In addition, it is also well known that the residues produced by combustion, from impurities in the fuel, are corrosive at the operating temperature of the boilers. This is fully explained in technical information produced by **rb bertomeu S.L.** (See our study "RB-7 Fuel oil and its corrosive effects in combustion").

Pol. Ind. Fondo de Llitera, Par. 82-83 - E-22520 Fraga, Huesca (España)
Tel. +34 974 47 48 04 / +34 630 43 08 43
www.rbbertomeu.es - rbbertomeu@rbbertomeu.es

The specific additive treatments by "**rb bertomeu"** -formed by Magnesium Organic salts of Fatty acids soluble (molecules-trade secret) in hydrocarbons- to the fuel oil to be consumed in the burners of boilers and furnaces is designed to improve combustion by reducing soot deposits, by reducing corrosion at high temperature and by minimising the typical hard incrustations of residues, transforming them into powdery deposits which are easy to scrape off. This is achieved by increasing the temperature of fusion of these residues -which are inevitably formed during the combustion- in addition of reduzing the Sulphur Trioxide (SO_3) formation, it is also reduced the formation of Sulphuric Acid (H_2SO_4). See Technical Document RB-7.

In this process, a large proportion of the residues are expelled directly along with the exhaust gases, while those that are deposited in the boiler are easily removed in the routine cleaning program.

For further information, of especial interest to less experienced users, we have compiled a **collection of photographs showing the classic incrustations produced in water-pipe boilers** which run on fuel oil. This study may be extended in the future with new comparative photographs if access to other plants is possible.

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FACILITIES WHERE "rb bertomeu" ADDITIVES HAVE NOT BEEN USED IN THE CONSUMED FUEL OIL.

PHOTO No. 1 : A steam boiler economiser, after several months' operation, with the accumulated residues clearly visible. Note that the carbonaceous incrustations represent apoximately 75% of the pipe's section, which had to be dismantled due to the insufficient flow and fuel temperature feeding the burner.

PHOTO No. 2 : Clean pipe of a fuel oil heater, when the additives **"rb bertomeu"** have been regularly used. Note the absence of incrustations in the pipe's interior.

PHOTO No. 3 : A steam boiler heat exchanger, after several months operating, where the incrustations covering the exchanger tubes are clearly seen.

PHOTO No. 4 : The same heat exchanger as in photo No. 3, after a scheduled cleaning. It can be seen that the pipes are completely incrustations-free.

PHOTO No. 5 : Magnified detail of the heat exchanger with incrustations as shown in Photo No. 3.

PHOTO No. 6 : Magnified detail of the clean heat exchanger as shown in Photo No. 4.

PHOTO No. 7 : A heat exchanger from another steam boiler after several months in operation. The extent of the accumulated incrustations on the heat exchanger tubes can be clearly seen.

PHOTO No. 8 : A fragment of incrustation, extracted from the heat exchanger in photo No. 7, with a thickness of about 10 mm.

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A PLANT WHERE "rb bertomeu" ADDITIVES ARE USED IN THE CONSUMED FUELOIL

PHOTO No. 9 : A steam boiler economiser, after several months operating. Observe the powdery appearance of the residues deposited – in contrast to those in the previous photos.

PHOTO No. 10 : The same economiser as in Photo No. 9 after a routine clean. It can be seen that the heat exchanger tubes are completely clean and free from signs of corrosion.

PHOTO No. 1

PHOTO No. 2

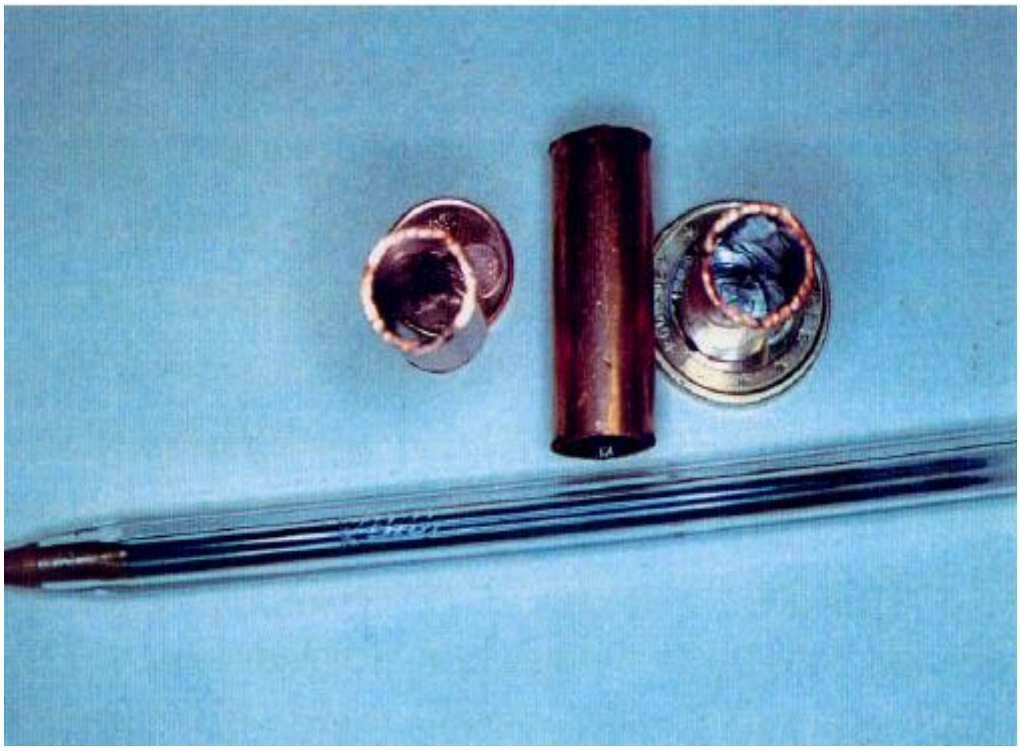

PHOTO No. 3

PHOTO No. 4

PHOTO No. 5

PHOTO No. 6

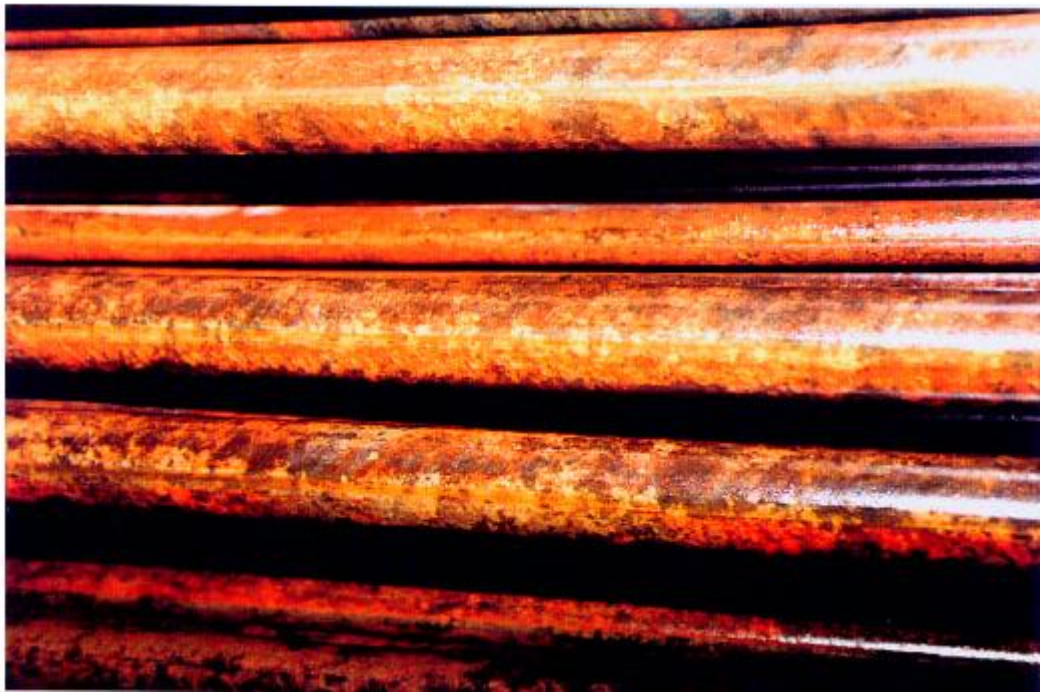

PHOTO No. 7

PHOTO No. 8

PHOTO No. 9

PHOTO No. 10