CORROSION IN TURBO-COMPRESSORS

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The **ash of metallic salts** produced in combustion in a Diesel engine when burning fuels of the fuel oil or residual fuel types are emitted with the combustion gases and **become partially incrusted** on the exhaust gas circuit and especially **in turbo-compressors**.

This **presence of ashes** or residues **is inevitable** because of the existence of Sulphur, Vanadium, Sodium, Potassium and other metals in the fuel oil or residual fuel.

The metallic salts that comprise **these residues incrusted on the turbo-compressors are corrosive** to a greater or lesser degree, according to the **temperature** and the **level of moisture**. The quantity of ash that is formed always depends on the impurities of the fuel, but the **quantity of ash adhering to the turbo-compressor** and the gas circuit also **depends on their physicochemical state:**

- **Normal ashes** (untreated fuel oil) **are more adherent** due to their lower melting point, and **are more corrosive** due to the greater presence of alkaline salts (sodium and potassium)
- **Modified ashes** (fuel oil treated with **"rb bertomeu"** additives) **are less adherent** and **more powdery** due to their higher melting point, and they **are less corrosive** due to the reduced presence of alkaline salts and higher presence of magnesium salts.

The chemical synthesis process by **"rb bertomeu"** produces Fatty acids Organic salts (molecules) completely soluble in hydrocarbons where the Magnesium particles are Mg^{2+} ions, with a radius of 72 picometers (1 picometer is 1,000 times smaller than a nanometer).

The surface reactivity of these magnesium ions over conventional materials (oxides and hydroxides of magnesium) is about 100 times higher.

The **"rb bertomeu"** additives with magnesium are the most reactive agents known to neutralize corrosion by Vanadium pentoxide and Sodium vanadates as well as the fuel oil ashes.

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When an engine runs on heavy fuels, it may occur that the turbo-compressors accumulate a great deal of incrustation (necessitating frequent cleaning) and that corrosion appears in the medium term. In cases where the engine operates discontinuously (e.g., 12-16 hours per day), and the turbo-compressor requires daily cleaning, **the corrosion process in the medium term is accelerated for the following reasons:**

1- **Corrosion at high temperature** (during operation) is caused by the **presence of normal ash** of low melting point. Furthermore, this ash facilitates the adherence to the turbo-compressor of many types of residues.
2- **Corrosion at low temperature** (while the plant is not running after completing the daily operating shift) is caused by the **presence of normal ash solidified** by the cooling of the turbo-compressor, in two possible ways:
   2-1 **If the turbo-compressor is cleaned with water once the engine is stopped**, the damp residual alkaline salts (Sodium, Potassium, etc.) act like seawater. The remaining salinity causes corrosion in the medium term.
   2-2 **If the turbo-compressor is not cleaned with water once the engine is stopped**, the slight condensation of Sulfuric acid and Sulphur produced in the cold gases, in combination with the slight moisture absorbed by the hygroscopic salts, cause the solid and cold salts to become corrosive in the medium term.

To prevent or minimize this corrosion it is necessary to employ a treatment for the fuel, utilizing the specific additives from **rb bertomeu S.L.,** whose effects include following:

- Modification of the physicochemical structure of the ash, making it more powdery, less adherent and less corrosive.
- Inhibition of the formation of SO_3 (which later gives rise to the condensation of Sulfuric acid) from the SO_2 present in the gases, due to reduction of the catalytic action of vanadium and other heavy metals.

This allows us to reduce the quantity of metallic ashes attached to the turbo-compressor and to reduce **its corrosiveness at high temperature** (when the engine is in operation) and **its corrosiveness at low temperature** (when the engine is not in operation) **provided that there is no water** to enhance the salinization of the passive ash, due to residues of alkaline salts being made soluble hidden in the interior of the general mass of the ash.

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In conclusion, in our opinion and following our experience in cogeneration plants with Diesel engines, the following facts are present in that kind of plants :

A- When using fuel oil or residual fuels, corrosion occurs on turbo-compressors, as well as incrusted residues that necessitate relatively frequent cleaning, in plants operating both continuously and discontinuously, although this effect is always greater in the case of discontinuous operation.

B- The treatment of the fuel with the additive **"rb bertomeu" beco F1/ASF** reduces the quantity of residues accumulated on the turbo-compressors and reduces the requirement for cleaning. Depending on the type of fuel, the TBO for cleaning may be doubled.

C- The treatment of the fuel with the additive **"rb bertomeu" beco F1/ASF** minimizes the corrosive effects at high and low temperatures caused by the residues incrusted on turbo-compressors. We have monitored plants that have doubled the operational life of their turbo-compressors in comparison with using fuel oil without additive treatment.

D- In the case of engines operating with daily shutdowns, it is preferable not to clean the turbo-compressors. However, should it be necessary to clean them due to excessive accumulated residues (very low quality fuel), it is preferable to clean them a few hours after starting the engine, rather than after stopping it, in order to minimize the corrosive effects at low temperature caused by residual saline water. If the fuel is not treated with additives, corrosion in the medium term will be much greater.

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