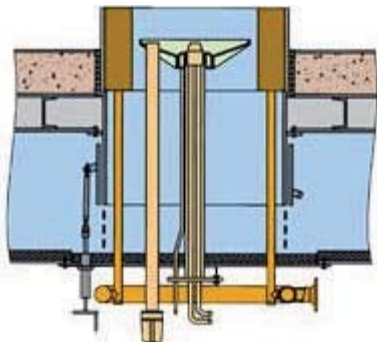


## INSTALLATION OF SIX GRC-TN BURNERS PILLARD'S LATEST GENERATION OF BURNERS FOR VACUUM FURNACES

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CEPSA, belonging to the ELF Group, decided to retrofit six burners installed twenty six years ago at their La Rabida (Huelva) factory, at Cell A Vacuum Furnace (Lube Vacuum) LV-H-1, for burners with a more developed technology that fulfilled environmental conditions currently required by European and Spanish statutory requirements. The burners were to be guaranteed to adapt to the necessities of kiln production and the kiln API sheet, taking into account that its convective section had been modified.



Once the Department of Engineering in the refinery had studied PILLARD ESPANA's proposal, and after visiting EGCI PILLARD's Technology Center and Laboratory in Marseilles (France), a demonstration on a forced draught kiln of GTC-TN equipment similar to that proposed for the retrofit was given.

Under equivalent operating conditions, CEPSA staff checked that the required conditions were fulfilled (reduction of NOx and sound levels, and low excess air), then the exchange at Cell A Vacuum Furnace LV-HI-A for PILLARD GRC-TN burners was carried out.

The dual-fuel GRC-TN burner combines the technology used for firing natural gas and refinery gas (fuel-gas) so that the reduction of NOx emissions is obtained using the following methods :

- Stationary injection for fuel-gas through independent venturi
- Internal recirculation of flue gas

Both methods are combined with a special system to eliminate the formation of coke deposits on the flame stabiliser, which are inevitable due to the vertical position.

The (patented) principle lies in burning any deposits which occur by using a flat flame which covers the whole of the stabilizer cone surface (patent R99/00846).

The flat flame (or primary flame) is produced at the central zone where the refinery gas (fuel-gas) is injected around the fuel-oil gun, improving flame stability with two fuels. Also, this primary flame plays an important rôle for stabilising the pilot flame.



The burner does not require a mobile refractory quarl in order to obtain the flame. It has an air director made of refractory steel (Ni-Cr), which is cylindrical and fixed. The stabilizer cone is manufactured in cast steel, adjustable from outside, having sectional plates that allow the passage of air to the flat flame. The fuel-gas flow used to create this primary flame oscillates between 5 and 10 Nm<sup>3</sup>/h (without the consumption of gas by the fixed ignitor).



Atomization of heavy or light fuel-oil is assisted by steam or compressed air.

The NFPA Class 3 continuous gas ignitor, has flame detection built-in by an ionization electrode, which sends a signal to the Control Center where it is confirmed if burners are operating or shut-down.

Each GRC-TN burner has a plenum that distributes the individual air. This plenum is insulated in order to reduce the sound level of each unit.



The fuels used at the CEPESA La Rabida Refinery are as follows :

Liquid

Fuel-oil n° 2

LHV

Flow rate per burner : 201.4 kg/hr (max.)

Temperature 130°C

Gas

Refinery fuel-gas with important changes in its chemical composition.

LHV (variable) from 7,044 kcal/Nm<sup>3</sup> to 15,832 kcal/Nm<sup>3</sup>.

Atomisation steam

Pressure 8.5 bar

Temperature 238°C

The dual fuel GRC-TN burners fire with a low excess air (oxygen 2 to 3.9 % at full load).

The flame is extremely stable, allowing minimum load firing with maximum air. It is also possible to burn fuel-gas with a high hydrogen content and with high viscosity fuel-oil.

The size of GRC-TN burner used at CEPESA was chosen according to its capacity : 1,930,000 kcal/hr, with natural draft of -5 mm.wc (as per API sheet), and according to the size of the combustion chamber.



**START-UP OF SIX (6) BURNERS INSTALLED AT CELL A**

We must indicate that the unit is comprised of three kilns (or cells) named LV-HI-A, B & C. Kilns B and C continued firing with existing burners, and have been used as a comparison.

Instantaneous readings taken by PILLARD during installation start-up are :

- Production is 81 m<sup>3</sup>/hr per kiln, 5,760 m<sup>3</sup>/d being the total production of the unit. The raw product used is reduced, type ESCRAVOS. The inlet temperature at the first coil is 261°C, at medium coil 307°C and at outlet 399°C. The flue gas temperature, with 3.5 % of O<sub>2</sub>, is 420°C.
- Firing with GRC-TN burners, kiln operation is excellent, obtaining a lower temperature of flue gas and improving heat flux radiation at walls (the difference of flue gas temperature from the radiation section is 30 °C and at walls is 40°C for 95 % load).
- An important aim for these GRC-TN burners was to meet CEPESA's requirement to maintain all installations annexed to the old burners. This includes all the fuel pressure lines and auxiliary fluids that fed the former burners, with the corresponding limitations (deviation from original project parameters, higher pressure drops at fuel lines, vents and steam leaks, etc), and also to increase the services of the kiln.



Unit for Security of Noise Measurement gave the following date :

Former equipment : from 95.5 dB to 103.3 dB at 1 meter

PILLARD burners : from 81.5 dB at 1 m

(measurements dated 1/03/2001)

Start-up readings taken by PILLARD ESPANA S.A.	Fuel-oil		Fuel-gas	
	Measure n°1	Measure n°2	Measure n°1	Measure n°2
Unit flow rate	166.6 l/hr	166.6 l/hr	222.5 Nm <sup>3</sup> /hr	222.5 Nm <sup>3</sup> /hr
Fuel-gas flow rate at burner center	15 Nm <sup>3</sup> /hr	15 Nm <sup>3</sup> /hr	15 Nm <sup>3</sup> /hr	15 Nm <sup>3</sup> /hr

Pressure	12.5 B <sup>*</sup>	12.5 B <sup>*</sup>	1.1 B <sup>*</sup>	1.1 B <sup>*</sup>
Atomising steam pressure	8.2 B <sup>*</sup>	8.2 B <sup>*</sup>		
Temperature	130°C	130°C		
Pressure at furnace	-4/-5 mm.wc <sup>**</sup>	-3/-4 mm.wc <sup>**</sup>	-5/-6 mm.wc <sup>**</sup>	-5/-6 mm.wc <sup>**</sup>
O <sub>2</sub>	3.9 %	2.6 %	5 %	1.7 %
CO	12 ppm	36 ppm	5 ppm	6 ppm
NO flue gas	226 ppm <sup>***</sup>	235 ppm <sup>***</sup>	23 ppm <sup>***</sup>	28 ppm <sup>***</sup>
Ambient temperature	26.3°C	30.3°C	32°C	32°C

<sup>\*</sup> Nowadays, working with fuel-oil pressure of 11.5 kg/cm<sup>2</sup> and steam pressure of 8.5 kg/cm<sup>2</sup>

<sup>\*\*</sup> Nowadays, the pressure in furnaces is -5/-7 mm.wc

<sup>\*\*\*</sup> N<sub>2</sub> content in fuel-oil is from 0.5 % to 0.66 %

The period of time for mounting, substitution and start-up of the equipment was 15 days.

## CONCLUSIONS

- The internal recirculation of flue gas, created by the venturi effect, enables the reduction of NOx emissions.
- High flame stability and high safety level.
- Reduction of sound levels.
- Auto-burning of eventual coke deposits, when firing fuel-oil.
- Improvement of energy efficiency, obtaining a lower flue gas temperature and an improved radiation heat flux at furnace walls.
- Reduction of tube maintenance at furnace walls.
- From ignitor flame detector, a signal is sent according to if the burner is in operation or shut-down (but this is a local signal and it is not sent to the Unit Control Center).

During all the field tests, we collaborated with the Refinery's Department of Engineering, who gave a great deal of support.

In view of the good results of these burners, CEPESA has requested twelve new burners for Cells B and C, which are being carried out.