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TECHNICAL RELATION

PROVVEDITORATO GENERALE DELLO STATO

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DIVISIONE IX

Object : **Technical opinion about the functionality of the device named "Super Catalyzer Vosges" proposed by Company Copinform srl.**

TECHNICAL REPORT

Introduction

The main aim of getting under way the device catalyzer is to check the truth of the features declared by manufacturer, that point out a strong global trend to savings on use and to environment respect. The main prearranged targets are the knowledge of plant efficiency, under the point of view both of the quality (air pollution) and of the quantity (energy savings).
It is plain that, in order to appreciate the savings in a thermic plant, it is necessary to know the wastes through the burning parameters, being essential to make the combustion analysis, before and after the device getting under way.
The combustion parameters evidence a phisical state quantity, and are mutually dependent, and from these quantities it is possible to obtaim a diagram, that allows to esteem visually the combustion trend.
In order to make said trial it has been required the cooperation of the concerned plants servicing companies.

A) Thermic plant of : Foreign Trade Ministry, methane boilers.

On 19th January 1998 Messrs. AGIP Servizi, under underwriter's request, installed on the Foreign Trade Ministry thermic plant, precisely on the boiler no. 4 having a capacity of 800.000 Kcal/h, a catalyzer device (Super Catalyzer) proposed by the Company Copinform 93 Srl.
The purpose was to obtain, both an energetic saving in fuel consumption (in this case methane gas), and to improve the combustion and consequently to reduce the air polluting products.
The trial has been effected following this criterion :

Before Catalyzer

It has made a consumption survey for 36” having a value of about 78 cm/h; in the same time it has been made, through an electronic analyser, a combustion parameters exam, as per following values:

Smoke Temperature	°C	205.2
Air Temperature	°C	18.9
CO_2 Carbon dioxide	%	8.1
CO% Carbon Oxide	ppm	0
O_2 Oxygen	%	6.4
Sensible heat loss	%	10.3
Efficiency	%	89.7
Air excess	E	1.44
Draft	hPa	0
CO not diluted	ppm	0
CO_2 theoretical	%	11.7
Discharge temperature	°C	70

Afterwards it has been inserted, on gas adduction circuit, the catalyzer device made in refractory steel (Aisi 316 of 2”).

After Catalyzer

The fuel, affected by the magnetic field, results improved in burning capacity, and in the meantime are improved the combustion parameters. The consumptions relating to the new combustion parameters improved to 55 cm/h, afterwards brought to 60 cm/h in order to make homogeneus the boiler running times.

Hereinafter are evidenced the new combustion parameters :

Smoke Temperature	°C	146.1
Air Temperature	°C	19.4
CO_2 Carbon dioxide	%	10.5
CO% Carbon Oxide	ppm	0
O_2 Oxygen	%	2.2
Sensible heat loss	%	5.7
Efficiency	%	94.3
Air excess	E	1.12
Draft	hPa	0
CO not diluted	ppm	0
CO_2 theoretical	%	11.7
Discharge temperature	°C	70

Under the technical point of view the new parameters can be appreciated evidencing the value of carbon oxide "CO" unchanged also with a reduction of oxygen " O_2", the carbon dioxide "CO_2" value is passed from a rate of 8.1% to 10.5% and the efficiency improved by 4,6%, while the smoke temperature came down from about 205 °C to 146 °C with a greater availement in the boiler firebox for about 59 °C.

An economic evaluation can be done in all: considering both the difference between the value before the insertion of the 78 cm/h catalyzer and the value after the installation of the 60 cm/h catalyzer (equal to 18 cm/h of lower consumption) and the greater efficiency.

On 22nd January the catalyzer has been taken apart in order to start a new trial on the twin boiler n. 3. In this connection we point out that the boiler n. 4 deprived of the catalyzer did not succeed to start and it has been necessary to bring back it to the previous values of consumption.

On 5th February further experimentation has been executed on the boiler n. 3, identical to previous and the values found was the following :

Before Catalyzer

It has made a consumption survey for 36" having a value of about 76 mc/h; in the same time it has been made, through an electronic analyser, a combustion parameters exam, as per following values:

Smoke Temperature	°C	221.4
Air Temperature	°C	20.0
CO_2 Carbon dioxide	%	9.9
CO% Carbon Oxide	ppm	0
O_2 Oxygen	%	3.3
Sensible heat loss	%	9.5
Efficiency	%	90.5
Air excess	E	1.19
Draft	hPa	0
CO not diluted	ppm	0
CO_2 theoretical	%	11.7
Discharge temperature	°C	70

After Catalyzer

It has made a consumption survey for 36" having a value of about 60 mc/h; in the same time it has been made, through an electronic analyser, a combustion parameters exam, as per following values:

Smoke Temperature	°C	207.4
Air Temperature	°C	22.5
CO_2 Carbon dioxide	%	10.9
CO% Carbon Oxide	ppm	0
O_2 Oxygen	%	1.4
Sensible heat loss	%	8.1
Efficiency	%	91.9
Air excess	E	1.07
Draft	hPa	0
CO not diluted	ppm	0
CO_2 theoretical	%	11.7
Discharge temperature	°C	70

Time elapsed, on 28th March 1998, it has been carried out again a control on the plant with following results: counter consumption 60 cm/h.

Combustion parameters analysis :

Smoke Temperature	°C	166.1
Air Temperature	°C	15.2
CO_2 Carbon dioxide	%	10.1
CO% Carbon Oxide	ppm	0
O_2 Oxygen	%	2.9
Sensible heat loss	%	7.0
Efficiency	%	93.0
Air excess	E	1.16
Draft	hPa	0
CO not diluted	ppm	0
CO_2 theoretical	%	11.7
Discharge temperature	°C	70

On this boiler also, after this last analysis we can evidence the “CO” value as unchanged also with oxygen " O_2" reduced”, the smoke temperature is decresed from approximately 221,4°C to 166,1°C with a greater availement in the boiler firebox of approximately 55°C.
Also for the boiler n. 3 we can find considerable difference in the consumptions, between the value before the insertion of the 76 cm/h catalyzer and the value after the installation of the 60 cm/h catalyzer (equal approximately to 16 cm/h of lower consumption) and also a greater efficiency. In order to make a complete evaluation of the proposed device capacities, it has been proceeded to a further trial on a diesel oil system.

B) Thermic Plant of : Provveditorato Generale dello Stato, via Tiburtina 1250 office, “DIESEL OIL” burner.

On 7th May 1998, hours 9.30, in via Tiburtina 1250 office, firm Focalia carried out the setting up of the boiler of the 333.000 Kcal/h capacity, it has been set up the temperature of the water approximately 70°C and timed, starting from the ignition, the time to reach the requested temperature.

- Water temperature from about 30° to 70°C timing 297", plant closed (circulation pumps switched off).

  Subsequently, by means of an electronic analyzer it has been noticed the values of combustion parameters, below evidenced :

Before Catalyzer

Smoke Temperature	°C	165
CO	%	26
O_2 Oxygen	%	4.2
Air excess E	%	23
Efficiency	%	93
LOSS	%	7
CO_2	%	12.1

After Catalyzer

It has been provided after the installation of the catalyzer to find the new parameters of the combustion through an electronic analyzer of the smoke. The data find are the following:

Smoke Temperature	°C	169
CO	%	31
O_2 Oxygen	%	4.1
Air excess E	%	22
Efficiency	%	92.9
LOSS	%	7.1
CO_2	%	12.2

The time of attainment of the temperature of the water from approximatively 40°C to 70°C has been of 227", with the pumps of circulation working.
During the trial it has been decided to replace the 4 gallons/h nozzle of the 1st flame of the burner with a 3 gallons/h nozzle (**1 gallon = lt 3,78**) and then it has been provided to find the new values of the parameters of the combustion, hereafter evidenced :

Smoke Temperature	°C	166
CO	%	33
O_2 Oxygen	%	6.8
Air excess E	%	45
Efficiency	%	91.9
LOSS	%	8.1
CO_2	%	10.3

We must point out that such parameters have been found without any instrumental calibration. Afterwards it has been executed further instrumental calibrations and adjustments analysing every time the new parametrs until the obtaining of the following:

Smoke Temperature	°C	162
CO	%	22
Oxygen O_2	%	6.5
Air excess E	%	42
Efficiency	%	93.3
LOSS	%	6.7
CO_2	%	10.5

After this last analysis we can find the following tendential data:

- reduction of the flow of the diesel oil;
- reduction of the smoke temperature;
- reduction of the CO polluting products;
- increase of the efficiency.

REMARKS

Reviewing the situation we may see immediately a better efficiency in heat production that in economic terms is equivalent to a better efficiency of the system.
Such value has been obtained even if diminished of the 1 gallon/h the first nozzle of the burner, evidencing a remarkable economic advantage obtained from the fuel saving.

The same parameters indicate moreover a significant decrease of CO.

The spontaneous increase and excess of the air and O_2 indicates the prevalence in the mixing of the "parameter" (comburent air) that, if led back to the previous values, would bring further economies to the system.

It is noted also a concentration and a considerable increase of the brightness of the flame, so the transmission of the heat improves also for radiation.

This last phenomenon, obtained without instrumental manipulation, leads to suppose a better combustion capacity.

CONCLUSION

The comparison and the analyses of the outcomes obtained evidence three common and repetitive aspects :

1. The combustion behaviour improves significantly independently of the type of systems feeding.
2. The improvements are not identical for quality and quantity also in similar plant owing to the instrumental limits of the specific system.
3. The effectiveness of the device would be proved not only promptly, but also amplified during the time.

Roma, 5th June 1998

THE TECHNICIAN
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