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STUDY OF SUPER CATALYZER TOP CALOR C/O PROFESSIONAL INDUSTRIAL SCHOOL «PIERRE ET MARIE CURIE» OF MENTON

TRANSLATED FROM THE FRENCH ORIGINAL

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super catalyzer ®™

1. TEST METHOD

The tests were carried out on the gas oil heating plant of the school and in the boiler room of the primary school “André Guillevin” which is located near the school. We had free access following the authorisation by the municipal authorities.
The tests were mainly carried out on four types of equipment :

- IDEAL STANDARD boiler for sanitary hot water production, with internal tank, output 100 Kw, fitted with a M 401 burner;
- WEISSMAN DUO-PAROLA boiler for heating only, output 100 Kw, fitted with an ELCO EL 2A burner;
- DE DIETRICH boiler, output 24 Kw, burner DN 12R;
- GUILLOT boiler, output 24 Kw, burner GUILLOT.

2. PARAMETERS MEASURED

- Gas oil temperature at pump inlet.
- Temperature of atomised gas oil.
- Cold water inlet temperature.
- Hot water outlet temperature.
- Ambient temperature.
- Flame temperature.
- Appearance of flame.
- Atomised gas oil flow.
- Hot water flow.
- Cold water flow.
- Burner operating temperature.
- Duration of experiment.
- Burner operating sequence.
- Atomisation pressure.
- Combustion gases temperature.
- Smoke opacity.
- CO_2 percentage.
- O_2 percentage.
- CO percentage.
- Combustion efficiency.
- Utilisation efficiency.

3. INFLUENCE OF VISCOSITY ON FLOW

Although it may appear surprising, flow diminishes as viscosity falls, with the atomisation pressure remaining constant.
Atomisation requires that centrifugal force and rotation speed of the liquid in the centrifuge chamber become higher as the viscosity falls.
The high speed of rotation causes a great loss of energy and the liquid film which tries to emerge from the jet through the calibrated orifice will become thinner as the viscosity becomes lower.
Only when in contact with the air this film will be transformed into a fine mist (see encl. fig.).

4. INFLUENCE OF THE CATALYZER ON THE VISCOSITY AND SPECIFIC MASS

We know that the viscosity of gas oil changes with temperature.
When this latter falls, the viscosity increases.
We also know that the specific mass of gas oil varies with its temperature.
The types of gas oil on sale today can have different viscosity and specific mass.
On a traditional atomising burner, the flow varies as a function of the temperature and specific mass of the fluid.
This demands a regulation of combustion with minimum 20% excess of air, if we wish to avoid that with every change in atmospheric conditions or with each delivery of gas oil the combustion deteriorates, producing unburnt fuel and carbon monoxide.
In the course of our tests we were able to note that the Catalyzer acts as a **viscosity regulator**, allowing combustion to remain constant and perfect with 14,5 to 15,2 % of CO_2 and 0 ppm of CO, irrespective of the source and temperature of the gas oil.

5. INFLUENCE OF THE CATALYZER ON FLAME APPEARANCE AND TEMPERATURE

During our tests, keeping flow constant, we observed that the visible length of the flame decreases when the Catalyzer is operative.
Combustion is more complete and a good part of the unburnt solids which colour the flame are consumed.

The flame temperature increases by 5 to 6%, the emission properties of the flame are changed and heat exchanges in the boiler are improved.
The temperature readings for the combustion gases tend to prove this, since we not a fall of 20°C when the flame temperature rises.

6. INFLUENCE OF THE CATALYZER ON FLOW AND ATOMISATION

During our tests we noted that it is possible to reduce nominal burner flow (reducing jet size but not pressure) down to a value of around 20% while maintaining combustion close to stoichiometric conditions.
This canbe explained by the fact that the magnetic field modifies the surface tension of the gas oil.
The droplets formed on contact with the air contain more oxygen and this ensures better vaporisation.
The speed of flame propagation, the quality of combustion and flame stability at the head of combustion are all improved.
At every start up of the burner, this better atomisationn and speed of propagation provide a significant reduction in unburnt materials.
It is impossible to obtain the same reduction of flow with a classic burner, since closure of the butterfly valve leads to excessive airflow speed and when the flow speed of the fluid exceeds the flame propagation speed we have a “detachment” effect.
The Catalyzer therefore permits the field of utilisation of a burner to be widened.
This is particularly interesting since a large proportion of the boilers in use in France are oversized.
The Catalyzer therefore allows the overall efficiency in use to be significantly increased.

CONCLUSION

To meet the requirements of a constantly growing market, the oil industry has had to develop the processes of catalytic cracking, visbreaking, hydrocracking and deasphalting.
These conversion operations have led to an increase in the specific mass and viscosity of domestic gas oil (the specific mass at 15°C from 840 to 860 Kg/mc – the viscosity at 20°C from 4,5 to 7 cst).
The increase in the viscosity range, even if it does not cause a lowering of product quality, does however significantly disturb the operation of heating plants during the cold season.

Catalyzer Top Calor therefore becomes indispensable when gas oil viscosity is above 9 cst, that is, for temperatures lower than 10°C.
The magnetiser allows an improvement in the Bacharach index, and also leads to better atomisation and optimised combustion.
The start-up in cold conditions is improved : smoke is paler at start-up since combustion quality is no longer linked to external phenomena; great reliability over the long term means good utilisation efficiency.
It appears therefore that with gas oil, the Catalyzer offers interesting advantages as regards the level of combustion and operation of atomising burners.
It allows excess air to be significantly reduced, to approach stoichiometric conditions and consequently to obtain a net improvement in utilisation efficiency.

REPORT ON EXAMINATION OF SAVINGS ON GAS OIL OFFERED BY THE SUPER CATALYZER TOP CALOR

For several weeks we have conducted numerous comparative tests on various types of boilers and burners.
In particular we carried out a series of tests on an IDEAL STANDARD boiler, output 26 Kw, for hot water production with internal tank, fitted with an M 401 preventilated burner with 0,60 jet, operating at 12 bar and 60°C.

Test conditions

- All power dedicated to production of sanitary hot water.
- Permanent production regime : ACS (sanitary hot water), Q = 200 l/h.
- Permanent flow control with flowmeter and micrometer regulation.
- Control of constant temperature with hot water outlet temperature and cold water inlet temperature registred on a disc.
- Control of volume of gas oil used for each experiment, using a flowmeter at 20°C.
- Control of operating times of the burner, using a clock linked to the electrovalve.
- Combustion optimised in all cases. Bacharach index between 0 and 1 (between 0 and 5 ppm of CO).

SUMMARY OF RESULTS OBTAINED

PARAMETERS CONTROLLED	BURNER W/O TOP CALOR			BURNER WITH TOP CALOR		
TEST	**1**	**2**	**3**	**1 bis**	**2 bis**	**3 bis**
Combustion efficiency	88%	88%	88%	93%	93%	93%
Total lenght of test	54 min	7 h 40	16 h 17	65 min	7 h 10	16 h
Litres of sanitary hot water produced	182	1524	3313	222	1446	3184
Litres of gas oil consumed	1,55	12,59	27,62	1,60	9,32	20,30
Temperature of sanitary hot water	72°	72°	70°	72°	72°	70°
Temperature of cold water	20°	20°	20°	20°	20°	20°
No. of Kwh produced/total	10,978	91,92	192,154	13,391	87,222	184,672
No. of Kwh produced per litre of gas oil	7,082	7,301	6,957	8,369	9,35	9,09
Litres of sanitary hot water produced per litre of gas oil	117,4	121	119,9	138,7	155,1	155,16
Saving obtained				15,3%	21,9%	22,6%
Overall olant efficiency	59%	60%	58%	69%	77,9%	75,7%

Remarks

This report is the summary of the detailed report concerning tests of reliability and performance of the TOP CALOR equipment and it integrates the APAVE report.

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