

Ämari airbase boilerhouse, pellet burner PV-700 testing protocol.

Purpose of the test was to measure installed pellet burner burning quality and boiler efficiency. Installed setup of equipment:

1. Boiler - Viessmann Vitoplex 200 900kW
2. Burner - Pelltech PV-700 700kW
3. Asch cyclon/air preheater (requperator)
4. Fluegas fan 700W, 600Pa@1800m³

Measurements were taken using flue gas analyser TESTO 325-1. Tests were held 07.12.2008 on boiler no. 2. During the tests the temperature in the boilerhouse was 25°C and outside temperature was 0°C.

As the avarage heat demand from boilerhouse was only 70 kW, the heat consumers was switched off 15 hours before performing the tests. Before the test cycle the boiler was heated up 80°C, next the heat consumers were switched on and started the burning cycle. Duration of the burning cycle was 59 min. during which the power output was increased 2 times at :

- 10. minute from 300kW to 500kW
- 23. minute from 500kW to 700kW

During the burning cycle, there were taken 16 random measurments with following results:

| Test no. | Time min. | Boiler °C | KW | λ | CO (ppm) | CO ₂ | Efficiency | O ₂ | Smoke °C |
|----------|-----------|-----------|-----|--------|----------|-----------------|------------|----------------|----------|
| 1 | 8 | 46 | 300 | 2,4 | 187 | 8,5 | 92,6% | 12,2 | 109,8* |
| 2 | 12 | 46 | 500 | 1,53 | 32 | 13,3 | 94,2% | 7,3 | 129,7* |
| 3 | 14 | 47 | 500 | 1,55 | 24 | 13,1 | 96,8% | 7,5 | 80,5 |
| 4 | 16 | 48 | 500 | 1,54 | 22 | 13,2 | 97,0% | 7,4 | 78,6 |
| 5 | | 50 | 500 | 1,49 | 18 | 13,6 | 97,0% | 6,9 | 79,6 |
| 6 | 22 | 52 | 500 | 1,42 | 16 | 14,3 | 97,1% | 6,2 | 80,1 |
| 7 | 26 | 56 | 700 | 1,26 | 45 | 16,1 | 97,1% | 4,3 | 87,9 |
| 8 | 28 | 58 | 700 | 1,24 | 132 | 16,4 | 97,1% | 4 | 89,1 |
| 9 | 30 | 60 | 700 | 1,2 | 194 | 16,9 | 97,1% | 3,5 | 90,8 |
| 10 | 32 | 62 | 700 | 1,22 | 98 | 16,6 | 97,0% | 3,8 | 91,9 |
| 11 | 35 | 63 | 700 | 1,2 | 277 | 16,9 | 97,0% | 3,5 | 93,7 |
| 12 | 37 | 64 | 700 | 1,71** | 62 | 11,9 | 95,3% | 8,7 | 101,1 |
| 13 | 40 | 64 | 700 | 1,23 | 81 | 16,5 | 96,8% | 4 | 95,3 |
| 14 - | - | | 700 | 1,27 | 62 | 16 | 96,5% | 4,4 | |
| 15 | 51 | 66 | 700 | 1,27 | 62 | 16 | 96,5% | 4,4 | 100,7 |
| 16 | 56 | 72 | 700 | 1,17 | 1339 | 17,3 | 96,5% | 3,1 | 106,3 |

* Flue gas temperature was measured at boiler output during test no. 1 and 2. For other tests, the fluegas temperature was measured at requperator output.

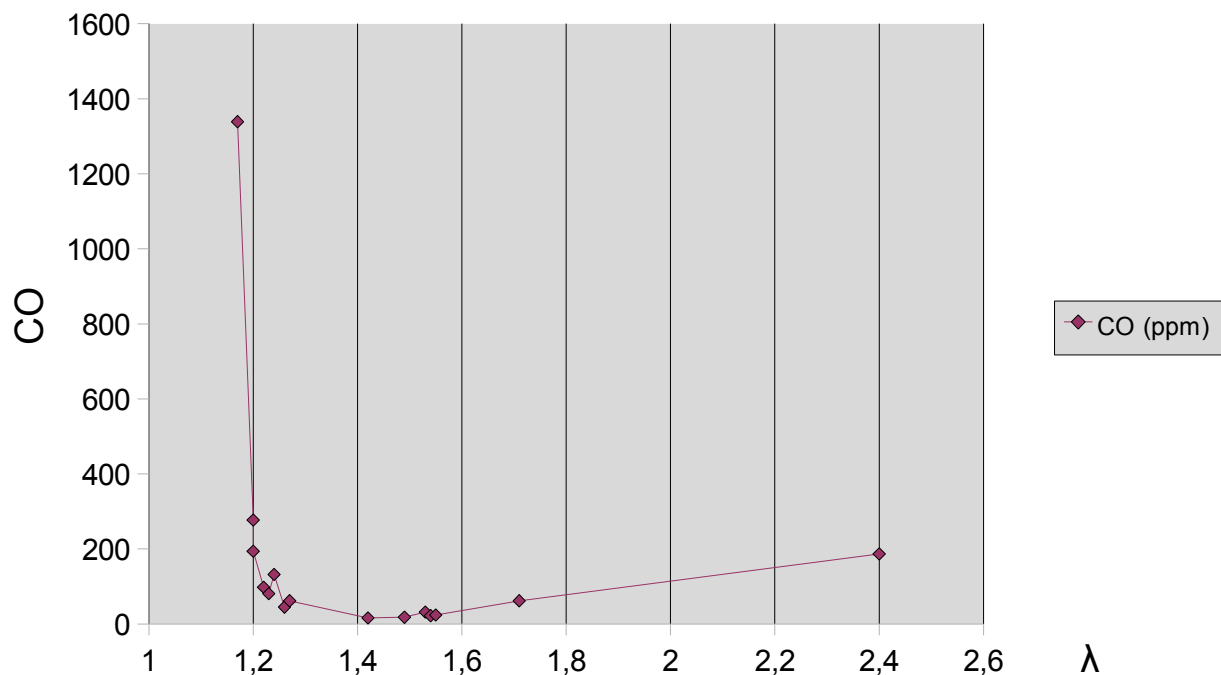
** During test no. 12 the fluegas fan was working at its peak power, during other measurments there was

held 40Pa negative pressure in the burning chamber.

In the results table there is following data about every measurement :

- Test (measurement) number
- Time elapsed from the beginning of the burning cycle to the point of measuring in minutes
- Boiler temperature °C
- Burner power output in kW (considering given fuel amount and heating value of 4,7kWh/kg)
- Excess air ratio - λ
- Carbon monoxide (CO) level in flue gas in ppm (parts-per-million)
- Carbon dioxide (CO₂) level in flue gas (percentage)
- Efficiency (percentage) – Measuring device was calibrated with air temperature inside boilerhouse.
- Oxygen (O₂) level in flue gas (percentage)
- Flue gas temperature °C

Following table shows measured CO level dependence of excess air.



Measurements were carried out by Aavo Isak and Priit Kotli.

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