



# REPORT

issued by an Accredited Laboratory



Calimax GmbH  
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A-6830 Rankweil  
Austria

Handläggare, enhet / <i>Handled by, department</i>	Datum / <i>Date</i>	Beteckning / <i>Reference</i>	Sida / <i>Page</i>
Mathias Johansson, Energy Technology, mj +46 (0)33 16 56 61	2001-11-01	P1 03815	1 (3)

## Testing a pellets stove (5 appendices)

### Work requested

Testing a pellets stove for P-marking in accordance SP Test Method no. 2453 and SP Certification Rules SPCR 093.

### Item for testing

A Calimax Sandor pellets stove, manufactured by Calimax GmbH, Austria. The stove was delivered to SP by the manufacturer, arriving at SP on 15th August 2001. It was in new condition. The stove is manufactured in two versions: one with a 7 kW output, and one with 10 kW output. The two versions are physically the same stove: it is only the output power setting in the control system that is altered. This report relates to both variants.

### Technical description

Pellets are fed from the fuel hopper by a screw feeder to a drop chute, down which they fall into the burner bowl. Air is supplied to the bowl by a flue gas fan. The stove supplied to us was fitted with electrical ignition. It has three fixed power outputs. It can be operated either continuously on a selected setting, or it can be controlled by its integral room thermostat, which reduces the stove output as the room temperature approaches the set temperature. If the set temperature is reached, the stove 'turns off', re-igniting when the temperature falls.

The stove has a convection fan, so that heat is supplied to the room by radiation and by forced convection.

### Additional material supplied

- A manual entitled 'Baxi Sandor Pellets Stove, Edition 2001-10-23, Revision 3.
- Drawings:

Drawing no.	Date
Sandor	18.06.2001
94-347-1	18.12.00

## Test arrangement

The stove was placed in a black corner, at distances from flammable parts of the building in accordance with its installation instructions. It was connected to a 100 mm diameter chimney, rising to a height of 6 m above floor level. Flue gas temperature was measured at a distance equal to two chimney diameters from the stove.

The following parameters were measured or calculated:

- Duration of the test.
- Quantity of fuel used.
- Ambient temperature.
- Flue gas temperature
- Negative pressure in the chimney.
- CO<sub>2</sub> concentration
- O<sub>2</sub> concentration
- CO concentration
- THC concentration
- Output power
- Efficiency
- Dust content
- CO concentration in mg/m<sup>3</sup><sub>n</sub> dry gas at 10 % O<sub>2</sub>
- OGC concentration in mg/m<sup>3</sup><sub>n</sub> dry gas at 10 % O<sub>2</sub>

## Test equipment

Inventory numbers in the list below refer to the numbers in SP Energy Technology's quality system.

Test corner KH2 in accordance with Etf-QD Ca1	
Type K thermoelement in accordance with ETf-QD Db 3	
Data-logging system	SP inventory no. 200699
Differential pressure gauge, FCO 14	SP inventory no. 200 628
Weighing instrument, Sartorius LC 34	SP inventory no. 201 639
CO <sub>2</sub> /CO analyser, Binos	SP inventory no. 201 668
CO <sub>2</sub> /CO analyser, Binos	SP inventory no. 201 672
CO <sub>2</sub> /CO analyser, Binos	SP inventory no. 201 623
THC analyser, J.U.M. Flame ion instrument, VE5	SP inventory no. 200 626
O <sub>2</sub> analyser, M. & C. PMA 10	SP inventory no. 201 625

## Uncertainty of measurement

Flue gas temperature	±3 °C
Ambient temperature	±1 °C
Surface temperature	±1 °C
Negative pressure	±10 %
Fuel quantity	±0,01 kg
CO <sub>2</sub> concentration	±0,2 % CO <sub>2</sub>
O <sub>2</sub> concentration	±0,4 % O <sub>2</sub>
CO concentration (Max. power)	±6 ppm CO
CO concentration (Min. power, day 7)	±50 ppm CO

CO concentration (3-5 kW, thermostat + Day 1)	±60 ppm CO
THC concentration	±10 ppm THC
OGC (organic gaseous compound)	±15 % of relevant OGC concentration
CO	±15 % of relevant CO concentration
Dust concentration	±5 % of relevant dust concentration
Output power	±6 % of relevant power
Efficiency	±3 percentage points

**Analysed calorific value of fuel**

Effective calorific value ±0,12 MJ/kg

**Test procedure**

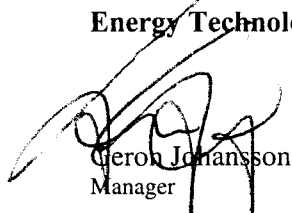
This test report relates only to the item tested. Testing was carried out at and by SP's Energy Technology Department during August and September 2001, in accordance with SP Test Method no. 2453 and SP Certification Rules SPCR 093.

**Results**

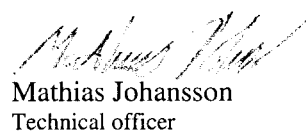
The results of the tests are given in the following appendices:

- Appendix 1: Identification
- Appendix 2: Design scrutiny
- Appendix 3: Results of safety testing
- Appendix 4: Results of efficiency and emission testing
- Appendix 5: Fuel analyses

**SP Swedish National Testing and Research Institute**  
**Energy Technology / Combustion Technology**



Geron Johansson  
Manager



Mathias Johansson  
Technical officer



## Identification

On arrival, the stove carried a rating and data plate with the following information::

Manufacturer: Calimax, Entwicklungs- und Vertriebs GmbH, Austria

Type designation / serial number: PR 07 (01 02) / NO. 10509

Construction year: 2001

Power range: 2,5 bis 7,5 kW

Authorized fuel: Holzpellets 6 mm, Holzpellets 8 mm

Gemäss DIN 51731 oder ÖNORM 7135

Boiler class: pellet kaminofen

Electric connection: 230 Volt 50 Hz, 10 Amp

Electrical power consumption in watt: 25 bis 80 watt bei Heizbetrieb  
400 W während der Zundphase



## Design scrutiny

The results given below relate to the corresponding points as given in SP Test Method no. 2453.

### 3.1 Safety system against burnback

The stove incorporates the following safety systems to protect against burnback:

1. Drop chute with a drop height of 250 mm. **Satisfactory**
2. Temperature switch on the back of the firebox. **Satisfactory**
3. Pressure switch on the flue gas fan **Satisfactory**

### 3.2 Fuel hopper

The fuel hopper is securely fastened, so that fuel cannot come into contact with the outer casing of the stove, and nor can it come into contact with the outer surfaces of the firebox. The seal of the hopper is not reliant only on the sealing material.

**Satisfactory**

### 3.3 Feed screws

The stove does not have a water sprinkler safety system, and so this test was not performed.

### 3.4 Ease of cleaning, accessibility for service

The burner head is easy to clean.  
The flue gas paths are easily accessible for inspection and cleaning.  
Wearing parts and temperature sensors are easy to inspect and replace.

**Satisfactory**

### 3.5 Ash handling

It is easy to clean ash out of the stove.

**Satisfactory**

## Results of safety testing

### Safety test

The results given below relate to the corresponding points as given in SP Test Method no. 2453.

#### 4.1 Surface temperatures

Glass pane	480 °C
Handle (for emptying ash)	36 °C
The side (hottest part)	130 °C
Rear (hottest part)	50 °C
Top (hottest part)	102 °C
Temperature in the fuel hopper	63 °C

#### 4.2 Performance of safety systems

\*

1. Drop chute works regardless of power supply. **Satisfactory**
  
2. The temperature sensor operated at about 135 °C and interrupted the power supply to the stove. The temperature in the fuel hopper was then about 80 °C. The temperature sensor resets automatically when the temperature drops, but the stove must be restarted manually. **Satisfactory**
  
3. The pressure switch on the flue gas fan turns off the stove if a positive pressure develops after the fan. The stove must then be restarted manually. **Satisfactory**

#### 4.3 Function in the event of power failure

No blowback or burnback was noted when the power supply was interrupted. **Satisfactory**

#### 4.4 Function in the event of interruption of fuel supply

The feed screw was blocked mechanically. The item causing the blockage was then removed, and the screw was inspected to see if damage had been caused to mechanical or electrical components. No damage was found. **Satisfactory**

#### 4.5 Temperature at warm air discharge openings

The temperature at the air discharge opening from the stove was measured as 140 °C with maximum rate of burning. **Satisfactory**

**4.6 Temperatures of flammable building parts**

Wall diagonally in front	79 °C
Side wall	44 °C
Rear wall	30 °C
Floor beneath the stove	32 °C
Floor in front of the stove	59 °C

Distance from stove to side wall: 30 cm

Distance from stove to rear wall: 7 cm

**Satisfactory**

**4.7 Water shock on the glass**

Water was sprayed on to the glass when the stove was burning at its maximum rate. No cracks were noted.

**Satisfactory**

**4.8 Impact test on the glass (toughened glass only)**

The manufacturer states that the stove has ceramically toughened glass. This test was therefore not performed.

**4.9 Noise**

Sound power level: 44,5 dB

Stove settings:

AL = 3,0, CbL = 30, CnL = 35

See the separate report, SP reference no. P1 05137

**Satisfactory**

**4.10 Airtightness of covers**

The air intake and chimney connection were sealed and a smoke bomb was placed in the stove. Leakage was noted around the top of the glass window.

**Satisfactory**

## Results of efficiency and emissions testing

The results given below relate to the corresponding points as given in SP Test Method no. 2453.

Two versions of the stove are available: with 7 kW maximum output, and with 10 kW maximum output. The mechanical parts of the two stoves are the same: it is only the control systems that have different settings. The maximum output power test was performed using the 10 kW stove setting, while the minimum output test was performed using the 7 kW setting.

The designations used below to indicate the stove settings are as used in, or as apply to, the stove control system.

### 5.2.1 Part load test

	Maximum power	3-5 kW	Minimum power
Test duration [h]	2,0	4,0	16,2
Fuel feed setting	AH=0,5	AL=3,0	AL=3,4
Air setting	CbH=35	CbL=30	CbL=28
Convection fan setting	CnH=45	CnL=35	CnL=35
Fuel quantity supplied [kg]	4,9	3,2	12,4
Effective calorific value [MJ/kg]	17,49	17,49	17,49
CO <sub>2</sub> [%]	9,9	5,0	5,2
O <sub>2</sub> [%]	10,8	15,6	15,5
CO [ppm]	97	405	430
THC [ppm]	13	29	28
Flue gas temperature [°C]	239	147	134
Room temperature [°C]	22,9	21,0	24,6
Negative pressure [Pa]*	12	7	8
Output power [kW]	9,8	3,2	3,1
Dust content [mg/m <sup>3</sup> <sub>n</sub> dry gas, 10 % O <sub>2</sub> ]		58,5	
Efficiency [%]	82	81	84
OGC [mg/m <sup>3</sup> <sub>n</sub> dry gas, 10 % O <sub>2</sub> ]	8	34	32
CO [mg/m <sup>3</sup> <sub>n</sub> dry gas, 10 % O <sub>2</sub> ]	131	1036	1080

\* The negative pressure was set in accordance with the manufacturer's instructions.

**5.2.2 Pellets stove intended to operate under thermostatic control**

	Thermostatic operation
Test duration [h]	4,1
Fuel feed setting	AM=1,4
Air setting	CbM=33
Convection fan setting	CnM=40
Fuel quantity supplied [kg]	3,6
Effective calorific value [MJ/kg]	17,49
CO <sub>2</sub> [%]	5,8
O <sub>2</sub> [%]	15,0
CO [ppm]	369
THC [ppm]	35
Flue gas temperature [°C]	155
Room temperature [°C]	21,3
Negative pressure [Pa]	10
Dust content [mg/m <sup>3</sup> <sub>n</sub> dry gas, 10 % O <sub>2</sub> ]	62
Efficiency [%]	82
OGC [mg/m <sup>3</sup> <sub>n</sub> dry gas, 10 % O <sub>2</sub> ]	25
CO [mg/m <sup>3</sup> <sub>n</sub> dry gas, 10 % O <sub>2</sub> ]	636

**5.3 Wrong pellets diameter (8 mm)**

	Thermostat control
Test duration [h]	4,2
Fuel feed setting	AM=1,4
Convection fan setting	CbM=33
Fuel quantity supplied [kg]	CnM=40
Effective calorific value [MJ/kg]	17,36
CO <sub>2</sub> [%]	5,8
O <sub>2</sub> [%]	15,0
CO [ppm]	261
THC [ppm]	22
Flue gas temperature [°C]	163
Room temperature [°C]	21,2
Negative pressure [Pa]	9
Efficiency [%]	81
OGC [mg/m <sup>3</sup> <sub>n</sub> dry gas, 10 % O <sub>2</sub> ]	28
CO [mg/m <sup>3</sup> <sub>n</sub> dry gas, 10 % O <sub>2</sub> ]	699

#### 5.4 Testing of availability (under thermostat control)

	Day 1	Day 7
Test duration [h]	4,1	3,4
Fuel supply setting	AM=1,4	AM=1,4
Air setting	CbM=33	CbM=33
Convection fan setting	CnM=40	CnM=40
CO <sub>2</sub> [%]	5,8	4,9
O <sub>2</sub> [%]	15,0	15,4
CO [ppm]	369	326
THC [ppm]	35	69
Flue gas temperature [°C]	155	166
Negative pressure [Pa]	10	10
OGC [mg/m <sup>3</sup> <sub>n</sub> dry gas, 10 % O <sub>2</sub> ]	25	50
CO [mg/m <sup>3</sup> <sub>n</sub> dry gas, 10 % O <sub>2</sub> ]	636	582

#### Comments

The burner head was inspected on conclusion of the tests, looking for slag build-up. A lump of slag had formed in the burner.



# RAPPORT

utfärdad av ackrediterat laboratorium/REPORT issued by an Accredited Laboratory



ETu (Mathias Johansson)

Handläggare, enhet / Handled by, department	Datum / Date	Beteckning / Reference	Sida / Page
M Johansson, Kemi och Materialteknik Tel +46 (0)33 16 56 69	2000-03-22	KMoo IO 209:A	1(2)

## Analys av träpellets

### Föremål

Ett pelletsprov insänt av uppdragsgivaren.

Provmärkning:	SÅBI 6 mm V
Provmängd:	Cirka 1 kg
Förpackning:	Plastpåse
Ankom KM:	2000-03-15
Provningsdatum:	Vecka 11-12, 2000

### Uppdrag

Bestämning av fukt, aska, kol, väte, kväve, syre, svavel, kalorimetriskt värmevärde samt beräkning av effektivt värmevärde.

### Metod

Total fukt:	SP 0517 (Torkning vid 105 °C )
Aska:	SP 0502 (mod. SS 18 71 71)
Svavel:	SP 0504 (= SS 18 71 77)
Kol, väte, kväve:	SP 0503 (elementaranalysator)
Syre:	Beräknat som differens
Värmevärde:	SP 0492 (= ISO 1928)

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SP, Swedish National Testing and Research Institute, Box 857, S-501 15 BORÅS, SWEDEN, Telephone + 46 33 16 50 00, Telefax + 46 33 13 55 02, E-mail info@sp.se, Reg.No 556464-6874

Uppgift om mätosäkerhet kan fås på begäran. Resultatet avser enbart det provade objektet. Information about measurement uncertainty will be given on request. The result concerns the tested object only. KMoo IO 209A

Akkrediterat laboratorium utses av Styrelsen för ackreditering och teknisk kontroll (SWEDAC) enligt lag. Verksamheten vid de svenska ackrediterade laboratorier uppfyller kraven enligt SS-EN 45001 (1989), SS-EN 45002 (1989) och ISO/IEC Guide 25 (1990:E). Denna rapport får endast återges i sin helhet, om inte SWEDAC och SP i förväg skriftligen godkänt annat.

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## Resultat

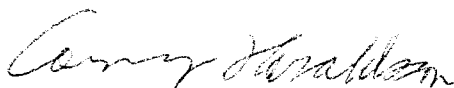
### På prov i inlämningstillstånd

Total fukt, vikt-%	7,1
Aska, vikt-%	0,4
Svavel, S, vikt-%	<0,01
Kalorimetriskt värmevärde vid konstant volym, MJ/kg	18,88
Effektivt värmevärde vid konstant tryck, MJ/kg	17,49

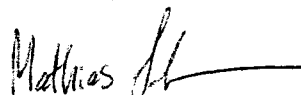
### På torrt prov

Aska, vikt-%	0,4
Svavel, S, vikt-%	<0,01
Kol, C, vikt-%	50,4
Väte, H, vikt-%	6,0
Kväve, N, vikt-%	0,11
Syre, O, (diff) vikt-%	43,0
Kalorimetriskt värmevärde vid konstant volym, MJ/kg	20,32
Effektivt värmevärde vid konstant tryck, MJ/kg	19,01

**SP Sveriges Provnings- och Forskningsinstitut**  
**Oorganisk analytisk kemi**



Conny Haraldsson  
Tekniskt ansvarig



Mathias Johansson  
Teknisk handläggare



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ETu  
Henrik Persson

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M Johansson, SP Kemi och Materialteknik Tel +46 (0)33 16 56 69	2000-10-20	KMoo I0237	1(2)

## Analys av pellets

### Föremål

Ett prov träpellets insänt av uppdragsgivaren.

Provmärkning:	SÅBI 8 mm VII
Provmängd:	Cirka 1,6 kg
Förpackning:	Plastpåse
Ankom KM:	2000-10-13
Provningsdatum:	Vecka 42, 2000

### Uppdrag

Bestämning av fukt, aska, kol, väte, kväve, syre, svavel, kalorimetriskt värmevärde samt beräkning av effektivt värmevärde.

### Metod

Total fukt:	SP 0517 (Torkning vid 105 °C )
Aska:	SP 0502 (mod. SS 18 71 71)
Svavel:	SP 0504 (= SS 18 71 77)
Kol, väte, kväve:	SP 0503 (elementaranalysator)
Syre:	Beräknat som differens
Värmevärde:	SP 0492 (= ISO 1928)

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SP, Swedish National Testing and Research Institute, Box 857, S-501 15 BORÅS, SWEDEN, Telephone + 46 33 16 50 00, Telefax + 46 33 13 55 02, E-mail info@sp.se, Reg.No 556464-6874

Uppgift om mätosäkerhet kan fås på begäran. Resultatet avser enbart det provade objektet. Information about measurement uncertainty will be given on request. The result concerns the tested object only.

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Kmoo I0237

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Bilaga 5:2  
Sida/Page  
2(2)

## Resultat

### På prov i inlämningstillstånd

Total fukt, vikt-%	7,6
Aska, vikt-%	0,5
Svavel, S, vikt-%	<0,01
Kalorimetriskt värmevärde vid konstant volym, MJ/kg	18,74
Effektivt värmevärde vid konstant tryck, MJ/kg	17,36

### På torrt prov

Aska, vikt-%	0,5
Svavel, S, vikt-%	<0,01
Kol, C, vikt-%	50,2
Väte, H, vikt-%	5,9
Kväve, N, vikt-%	0,08
Syre, O, (diff) vikt-%	43,2
Kalorimetriskt värmevärde vid konstant volym, MJ/kg	20,27
Effektivt värmevärde vid konstant tryck, MJ/kg	18,98

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Oorganisk analytisk kemi

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