

**Report on Type-testing
for the Residential Space Heating Appliance
„Ballance / W Typ HP 02“
of the company
“Hapero Energietechnik GmbH”**



Order number	PL-12034/1-P		
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1 The Client

Hapero Energietechnik GmbH
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2 Scope of testing

The client applied for type-testing in accordance with the requirements of EN 14785 and of the agreements pursuant to Article 15a of the Federal Constitution Act on “protective measures related to small scale combustion equipment” and “energy saving” for the residential space heaters fired by pellets with the designation

“Balance / W Typ HP 02“

3 Equipment submitted for testing and documents supplied

Hapero Energietechnik GmbH supplied a residential space heater fired with pellets with the designation

“Balance / W Typ HP 02“

The following documents were provided by the client for the testing:

- Operating instructions
- Installation instructions
- Identification plate
- Technical drawings

4 Product description (equipment to be tested)

4.1 Construction and function

The wood pellets residential space heater “Balance K / Typ HP 02” is equipped with a fuel hopper, screw conveyer, combustion chamber with a fuel pot, electrical ignition and water heat exchanger. The combustion chamber door has a flushed glass window to avoid deposits.

The integrated stoking device feeds the pellets into the fuel pot via an electronic controlled screw conveyer. The required combustion air is sucked by the flue gas fan via the air inlet. Hot combustion gases are led through the heat exchanger to the flue gas exit.

4.2 Technical data of the boiler tested¹ on the test-bench

Name of device		„Balance / W Type HP 02“
Photo of the tested space heater		
Parameters		
Fuel		Holzpellets (ÖNROM M 7135)
Nominal heat output	[kW]	14,9
Heat power range	[kW]	4,3 – 14,9
Fuel amount	[kg/h]	0,8 – 3,0
Water amount	[l]	32
Electric links	[V/Hz]	230 / 50
Dimensions		
Weight	[kg]	107
Fuel hopper capacity	[kg]	15
Base area (B x T)	[mm]	540 x 600
Height	[mm]	1180
Connection outlet/inlet	[inch]	3/4
Flue gas pipe diameter Ø	[mm]	80

5 Test procedure

“Balance / W Type HP 02” was tested on the test-bench as specified in EN 14785.

The space heater was operating according to the manufactures manual.

The following test procedures using wood pellets were undertaken on the stove:

2 test runs using full load (3 hours)

1 test run using part load (6 hours)

Safety-related test

¹ Information provided by the manufacturer

6 Measuring System

The test-bench was constructed in accordance with the requirements of EN 14875. The test-bench is shown together with the measurement devices in diagram form in Figure 1.

A small amount of flue gas was taken out of the exit stream for analysis. The first step was to remove the dust from the sample gas using a heated filter made from quartz wool. The sample gas was then transported along a pipe heated to approximately 180° C to the next preparation stages. The majority of the water was then removed from the gas by cooling to about 5 ° C. After these preparatory stages the gas was fed to several analysis equipments (O₂, CO₂, CO and NO). The flame ionization detector (C_xH_y) was supplied with sample gas through a separate heated pipe (180° C) equipped with a filter.

To determine the dust concentration content a small gas stream was sampled from the flue gas. The particulate matter of this gas stream was collected by a filter. The gas stream was dried (drying tower) and its volume was metered with a gas meter.

The evaluation is carried out according to EN 14785.

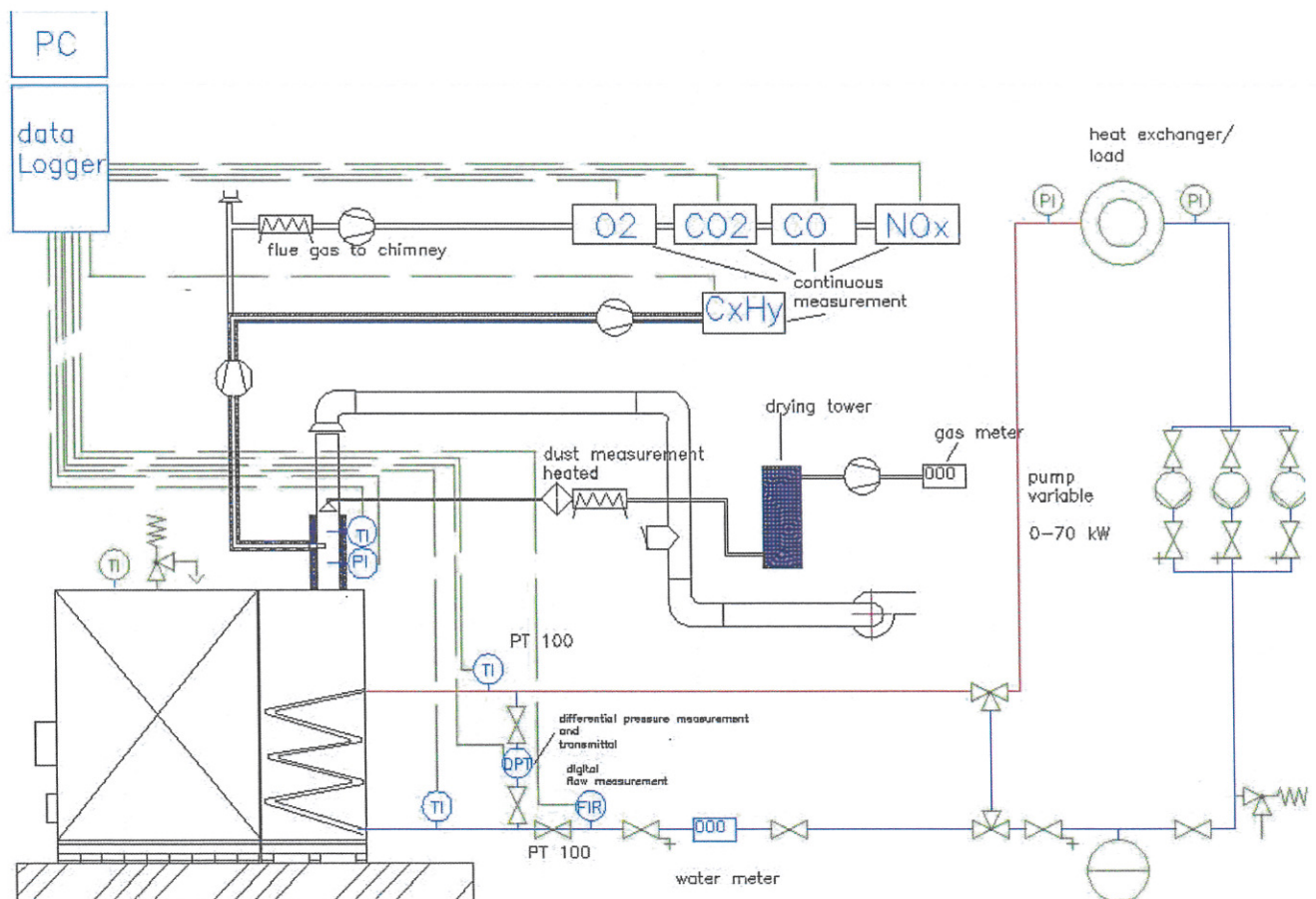


Figure 1: Scheme of the test-bench

7 Measuring equipment and measuring procedures

The measuring equipment and procedures used are listed below.

7.1 Oxygen / Carbon dioxide / Carbon monoxide

Manufacturer/type	: Emerson Process Management AG / MLT 3 IR IR PO ₂
Measuring principle	: Paramagnetic (O ₂) Infrared (CO ₂ , CO)
Measuring range	: 0-25 % O ₂ 0-30 % CO ₂ 0-500 und 0-5000 ppm CO
Measured value output	: 0 bis ±20 mA respectively 0 bis ±10 VDC
Calibration gas	: Air 9,98 % CO ₂ in N ₂ 403,5 ppm CO in N ₂
Zero gas	: Nitrogen
Accuracy of measurement	: Lower detection limit 1% of the upper range value Margin of error 1 %

7.2 Nitrogen oxides

Manufacturer/type	: Maihak UNOR 6N
Measuring principle	: Infrared
Measuring range	: 0-500/0-1500 ppm NO
Measured value output	: 0-1 V, 4-20 mA
Calibration gas	: 98,7 ppm NO in nitrogen
Zero gas	: Nitrogen
Accuracy of measurement	: Lower detection limit 2% of the upper range value Margin of error 1 %

7.3 Organic hydrocarbons in gas form

Manufacturer/type	: Testa 123
Measuring principle	: Flame ionisation detector (FID)
Measuring range	: 10, 100, 1000, 10000, ppm (is switched automatically)
Measured value output	: 0-10 V, 0-20 mA
Combustion gas	: Hydrogen 5.0
Combustion air	: Air free from hydro-carbons
Calibration gas	: 8,15 ppm propane in nitrogen
Zero gas	: Nitrogen
Accuracy of measurement	: Lower detection limit 1% of the upper range value Margin of error 1 %

7.4 Dust

Manufacturer	: Ströhlein
Measuring principle	: Gravimetric
Sampling probe	: Simple probe according to VDI 2066 (made from corrosion-resistant steel with smooth inner walls)
Dust collection	: Stainless steel sleeves with quartz wool located in the probe
Measurement of gas volume	: Gas meter (bellows gas meter)
Suction equipment	: Vacuum pump with 4 m ³ /h rated suction. The partial gas volume stream removed by suction can be adjusted by a bypass regulator
Filter conditioning	: Drying chamber (105 °C, ca. 4 hours, desiccator (ca. 1 hour)
Accuracy of measurement	: +/- 5 mg/Nm ³
Lower detection limit	: 5 mg/Nm ³

7.5 Gas temperature

The gas temperature was measured with a type K NiCr-Ni thermocouple.

7.6 Pressure measurement

The pressure was measured using pressure measuring equipment manufactured by Special Instruments, type Digima LPU, with a measuring range from 0 to 200 Pa.

7.7 Atmospheric humidity

Atmospheric humidity was measured continuously using a data logger manufactured by Testo, type 175-H2.

7.8 Recording equipment

The data obtained from the measurements was recorded electronically using a PC (Pentium) and the National Instruments "Field Point" data recording system.

8 Combustion data and test results

8.1 Fuel

Designation	Wood pellets (ÖNORM M 7135)	
Type	Spruce	
Dimensions		
Diameter	[mm]	6
Length	[mm]	about 20

Elementary analysis¹

Carbon content	c	[%]	47,00
Hydrogen content	h	[%]	5,73
Nitrogen content	n	[%]	0,08
Sulphur content	s	[%]	0,01
Ash content	a ²	[%]	0,31
Oxygen content	o	[%]	39,76
Water content	w ²	[%]	7,21

Calculated values³

O ₂ -demand	(V _{O₂,min})	[m ³ /kg]	0,92
Air-demand	(V _{L,min})	[m ³ /kg]	4,37
Flue gas volume, dry	(V _{A,tr,min})	[m ³ /kg]	4,33
Water vapour	(V _w)	[m ³ /kg]	0,73
Flue gas volume, wet	(V _{A,f,min})	[m ³ /kg]	5,06
CO ₂ , maximum		[%]	20,27
Net calorific value	(H _u)	[kJ/kg]	17588

¹ Elementary analysis Vienna University of Technology, Institute of Chemical Engineering

² Determined in accordance with DIN 51718 and DIN 51719

³ All information on volumes related to 0° C and 1013 mbar.

8.2 Test results

Date of test:		05.08.2008	05.08.2008	06.08.2008
Test run		Full load 1	Full load 2	Partial load
Settings during test runs				
Combustion time	[min]	193	195	370
Fuel quantity	[kg]	10,3	10,2	5,0
Thermal output from fuel	[kW]	15,7	15,3	4,0
Conversion	[kg/h]	3,2	3,1	0,8
Average negative pressure in the interceptor	[Pa]	11,2	11,4	12,1
Ambient conditions				
Atmospheric Pressure	[mbar]	989,3	989,3	992,0
Atmospheric humidity	[%]	46,1	40,9	39,4
Room temp.	[°C]	28,5	29,8	28,8
Operating data				
Air ratio (Lamda)	[-]	1,7	1,7	3,0
Flue gas volume, dry	[Nm ³ /kg]	7,4	7,4	13,1
Flue gas volume, wet	[Nm ³ /kg]	8,1	8,2	13,8
Flue gas flow	[Nm ³ /h]	26,0	25,6	11,2
Flue gas mass flow rate	[g/s]	8,7	8,6	4,0
Average flue gas temperature	[°C]	61,5	62,2	47,7
c _{p,av} water vapour	[kJ/Nm ³ K]	1,50	1,50	1,50
c _{p,av} dry flue gas	[kJ/Nm ³ K]	1,31	1,31	1,31
Loss of sensible heat in the flue gas	[kJ/kg]	375,9	370,1	355,0
	[%]	2,1	2,1	2,0
Loss through CO in the flue gas	[kJ/kg]	4,1	4,5	20,8
	[%]	0,0	0,0	0,1
Heat losses due to combustible constituents in the residue	[kJ/kg]	142,1	142,1	142,1
	[%]	0,8	0,8	0,8
Combustion efficiency	[%]	97,0	97,1	97,1
Total thermal output	[kW]	15,2	14,9	3,8
Water heating output				
Temperature of inlet water	[°C]	57,9	58,1	63,5
Temperature of outlet water	[°C]	74,5	74,6	73,2
Water flow	[m ³ /h]	0,666	0,665	0,294
Water heating output	[kW]	12,7	12,7	3,3

Date of test:		05.08.2008	05.08.2008	06.08.2008
Test run		Vollast 1	Vollast 2	Teillast
Emissions, measured				
Oxygen	[Vol%]	8,5	8,5	13,5
Carbon dioxide	[Vol%]	11,9	11,8	6,7
Carbon monoxide	[ppm]	44	48	126
Nitrogen oxides as NO	[ppm]	109	106	55
Organic hydro-carbons	[ppm]	3	2	5
Dust measurement 1	[mg/Nm ³]	20	16	32
Dust measurement 2	[mg/Nm ³]	15	14	34
Dust measurement 3	[mg/Nm ³]	13	23	38
Dust measurement 4	[mg/Nm ³]	-	-	37
Dust measurement 5	[mg/Nm ³]	-	-	38
Dust measurement 6	[mg/Nm ³]	-	-	31
Emissions, related to 13 vol % O₂ and standard reference conditions				
Carbon monoxide	[mg/Nm ³]	35	38	168
Nitrogen oxides as NO ₂	[mg/Nm ³]	142	139	121
Organic hydro-carbons	[mg/Nm ³]	3	3	9
Dust measurement 1	[mg/Nm ³]	12	10	37
Dust measurement 2	[mg/Nm ³]	10	9	36
Dust measurement 3	[mg/Nm ³]	9	15	41
Dust measurement 4	[mg/Nm ³]	-	-	38
Dust measurement 5	[mg/Nm ³]	-	-	39
Dust measurement 6	[mg/Nm ³]	-	-	31
Emissions related to the energy content of the fuel				
Carbon monoxide	[mg/MJ]	23	25	109
Nitrogen oxides as NO ₂	[mg/MJ]	92	90	78
Organic hydro-carbons	[mg/MJ]	2	2	7
Dust measurement 1	[mg/MJ]	8	7	24
Dust measurement 2	[mg/MJ]	6	6	23
Dust measurement 3	[mg/MJ]	6	10	27
Dust measurement 4	[mg/MJ]	-	-	25
Dust measurement 5	[mg/MJ]	-	-	25
Dust measurement 6	[mg/MJ]	-	-	20
Oxygen reference for dust measurement				
Dust measurement 1	[Vol%]	8,3	8,5	14,1
Dust measurement 2	[Vol%]	8,3	8,4	13,4
Dust measurement 3	[Vol%]	8,6	8,7	13,7
Dust measurement 4	[Vol%]	-	-	13,1
Dust measurement 5	[Vol%]	-	-	13,2
Dust measurement 6	[Vol%]	-	-	13,0

9 Examination of the design and safety related aspects

9.1 Materials, design and construction (testing according to EN 14785)

Requirements of standard (Numbering according to EN 14785)		Conformity
4.1	Production documentation The product documentation of the residential space heater " Balance / W Typ HP 02" is according to the requirements of EN 14785.	Yes
4.2	General construction requirements The general construction requirements are according to EN 14785.	Yes
4.3	Flue spigot or socket The flue spigot has a length of 40 mm requirement: >25 mm for flue spigots diameters of < 160 mm	Yes
4.4	Combustion control device The stove is equipped with a microprocessor based control unit. The operator functions are put together on an operation unit which is easily accessible at the right side of the stove.	Yes
4.5	Flue ways The flue ways are built without an automatic cleaning system. It is possible to clean the flue ways of the appliance completely using commercially available tools or brushes. A description of the cleaning procedure is included in the user operating instructions.	Yes
4.6	Cleaning tools Special cleaning tools are not necessary.	Yes
4.7	Fire doors The fire door can only be opened with a specific tool (is enclosed). During operation an opening is not foreseen. In case of opening of the fire door during operation the control system shuts down the device.	Yes
4.8	Combustion air supply The combustion air can be taken from the ambient room itself or from outside (ambient air independent heater). The air supply system is dimensioned in such a way that the amount of air can not hindered by the ash pan.	Yes
4.9	Internal flue gas diverter There are no moving parts.	Yes
4.10	Retort The retort is removable and is marked to ensure correct reassembly.	Yes
4.11	Ash pan and ash removal The volume of the ash pan is 2,5 l. It is capable to take the residue from two full charges of fuel in the hopper.	Yes
4.12	Integral boiler	n.a
4.13	Control of flue gas The flue gas is determined by a flue gas van.	Yes
4.14	Cleaning of heating surfaces	n.a.

n.a. ... not applicable

9.2 Requirements on the safety (testing according to EN 14785)

Requirements of standard (Numbering according to EN 14785)					Conformity
5.1	Temperatures of adjacent combustible materials (distance 20 cm) Testing according to A.4.7				Yes
	Date of testing		05.08.2008	05.08.2008	
	Test run		Full load 1	Full load 2	
	Rear test wall	[°C]	37,1	36,9	
	Side test wall	[°C]	31,4	32,5	
	Floor	[°C]	34,9	35,6	
	Room temperature	[°C]	28,5	29,8	
5.2	Operating tools				Yes
	Door knob	[°C]	31,3	39,5	
	Room temperature	[°C]	28,5	29,8	
5.3	Safety test for spillage of combustion gas and discharge of embers				Yes
	During the test procedure no leakage of combustion gas could be detected.				
5.4	Temperature in fuel hopper				Yes
	Fuel hopper	[°C]	38,9	40,4	
	Room temperature	[°C]	28,5	29,8	
5.5	Safety against back burning through the fuel conveyor system				Yes
	The pellets are conveyed upwards with a screw feeder and through a downspout into the combustion chamber.				
5.6	Safety against overheating the boiler water see 9.5				Yes
5.7	Thermal discharge control				n.a.
5.8	Strength and tightness of walls of water conducting parts A tightness test was conducted at 3.5 bar water pressure.				Yes
5.9	Electrical safety				Not tested

n.a. ... not applicable

9.3 Performance

Requirements of standard (Numbering according to EN 14785) / Measured values (tested in accordance with A.4.7)					Conformity
	Date of testing	05.08.2008	05.08.2008	06.08.2008	
	Test run	Full load 1	Full load 2	Partial load	
6.1	Flue draught [Pa]				Yes
	Measured value	11,2	11,4	12,1	
	Requirement of EN 14785	12 ±2	12 ±2	10 ±2	
6.2	Average flue gas temperature [°C]				Yes
	Measured value	61,5	62,2	47,7	
	Requirement of EN 14785	To declare			
6.3	Carbon monoxide emission				Yes
	[mg/Nm³] ref. to 13 % O₂	35	38	168	
	[mg/MJ]	23	25	109	
	Requirement of EN 14785 (Austria) [mg/MJ]	500		750	
6.4	Efficient energy utilization [%]				Yes
	Measured value	97,0	97,1	97,1	
	Requirement of EN 14785	>75		>70	
	Austria	> 78			
6.5	Heat output [kW]				Yes
	Measured value	15,2	14,9	3,8	
	Requirement of EN 14785	In accordance to the specifications of 14,9 kW given by the manufacture			
6.7	Water heating output [kW]				Yes
	Measured value	12,7	12,7	3,3	
	Requirement of EN 14785	In accordance to the specifications given by the manufacture			
6.8	Space heating output				Yes
	Measured value	2,5	2,2	0,5	
		In accordance to the specifications given by the manufacture			
6.9	Hopper capacity				Yes
	The hopper capacity amounts about 15 kg which is enough for operating longer as 3 h at nominal heat output and 6 h at reduced heat output.				
6.10	User operations				Yes
	All operations which the user carries out, including loading and emptying of the appliance, adjusting controls and deashing are safe and efficient.				

9.4 Data for the chimney

The following table contains the mean values of two nominal heat output tests.

Flue gas temperature at the flue spigot	[°C]	83,1
Flue gas temperature in measuring section	[°C]	61,9
Average negative pressure in the flue gas draught	[Pa]	11,3
Flue gas mass flow rate	[g/s]	8,7

9.5 Function check of the temperature controller and safety temperature limiter

9.5.1 Reduction of the heat consumption to 40%

The firing was adjusted to achieve the related heat output of a boiler temperature of 85° C. The temperature controller was adjusted to a maximal boiler temperature of 85° C. The output was reduced to 40 % at the beginning of the test.

Immediately the controller reduced the output and after 9 minutes the boiler continued with partial load.

9.5.2 Shut down of the heat consumption

The boiler has no discharge safety device. The test for the emergency shut down is carried out with the loss of the heat consumption and the simulation of a blackout.

For the test with loss of heat consumption, the firing was adjusted to achieve the related heat output of an inlet temperature of 75° C. At the beginning of the test, the heat consumption is shut down. After app. 11 minutes the safety temperature limiter shuts down the firing at 87° C. The boiler maximum temperature was at 95° C.

9.6 Installation instructions

The content of the installation instructions were evaluated according to the requirements of EN 14785 and the agreement pursuant to Article 15a of the Federal Constitution Act. The requirements of the standards are met.

9.7 Operating instructions

The content of the operating manual were evaluated according to the requirements of EN 14785 and the agreement pursuant to Article 15a of the Federal Constitution Act. The requirements of the standards are met.

9.8 Marking

The identification plate meets the requirements of EN 14785.

9.9 Examination of the design

No defects were observed during the examination of the space heater's design (materials, lay-out and workmanship) according to the requirements of EN 14785, as well as during the testing.

10 Summary and assessment of the measurements

Hapero Energietechnik GmbH supplied the pellets fired residential space heating appliance "Balance / W Type HP 02" for type testing as specified in the requirements of the EN 14785 and the agreements pursuant to Article 15a of the Federal Constitution Act on "protective measures related to small scale combustion equipment" and "energy saving".

Wood pellets (ÖNROM M 7135) were used as fuel.

The following test procedures were undertaken:

2 test runs using a full load (3 hours)

1 test run using a part load (6 hours)

Safety-related test

Based on the tests we conducted and the documents supplied, we can make the following assessment:

10.1 Technical documentation

The documentation supplied complies with the requirements of the EN 14785 and the agreement pursuant to Article 15a of the Federal Constitution Act on "protective measures related to small combustion equipment".

10.2 Safety-related assessment

No safety-related defects were observed during testing.

10.3 Output

The rated output of 14,9 kW indicated by the manufacturer is recognised as correct.

10.4 Energy efficiency assessment

The following Table indicates the energy efficiency of the residential heating device.

	Efficiency [%]		
	Full load 1	Full load 2	Part load
„Balance / W Type HP 02“	97,0	97,1	97,1
EN 14785	>78		>70
According Art. 15a B-VG	>78		

10.5 Emissions assessment

The measured emissions are summarised in the following Table. The specified emission limits are also indicated.

		Test results „Balance / W Type HP 02“		Emission limits	
		[mg/Nm ³] at 13 %O ₂	[mg/MJ]	15a B-VG [mg/MJ]	EN 14785 [mg/Nm ³]
CO	Full load 1	35	23	500	500
	Full load 2	38	25		
	Partial load	168	109		750
NO _x	Full load 1	142	92	150	-
	Full load 2	139	90		
	Partial load	121	78		
HC (Org. C)	Full load 1	3	< 3	40	-
	Full load 2	3	< 3		
	Partial load	9	7		
Dust	Full load 1 ¹	10	7	60	-
	Full load 2 ¹	12	8		
	Partial load ²	37	24		

Based on the testing carried out, we can state the following:

- The requirements related to EN 14785 are met.
- The requirements related to the emissions under the agreement pursuant to Article 15a of the Federal Constitution Act on “protective measures related to small scale combustion equipment” are met.
- The requirements related to the energy efficiency under the agreement pursuant to Article 15a of the Federal Constitution Act on “energy saving” are met.

Person responsible for testing

Supervisor

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¹ Mean value of three single measurements, out of which each is below the emission limit.

² Mean value of six single measurements, out of which each is below the emission limit

Appendix

1. Data sheets	3 Pages
2. Technical drawings	4 Pages
3. Marking	1 Page

Order number:	PL-08155-P
Marking	08155/1

Date of test:	05.08.2008
Fuel:	Wood pellets

Elementary analysis		
Carbon content	[%]	47,00
Hydrogen content	[%]	5,73
Nitrogen content	[%]	0,08
Sulphur content	[%]	0,01
Ash content	[%]	0,31
Oxygen content	[%]	39,76
Water content	[%]	7,21

Calculated values		
O ₂ -demand	[m ³ /kg]	0,92
Air consumption	[m ³ /kg]	4,37
Flue gas volume, dry	[m ³ /kg]	4,33
Water vapour	[m ³ /kg]	0,73
Flue gas volume, wet	[m ³ /kg]	5,06
CO ₂ maximum	[%]	20,27
Net calorific value	[kJ/kg]	17588

Load	[-]	Full load
Start	[hh:mm]	10:46
End	[hh:mm]	13:59
Combustion time	[min]	193
Fuel quantity	[kg]	10,3
Thermal output from fuel	[kW]	15,7
Conversion	[kg/h]	3,2
Average negative pressure in the interceptor	[Pa]	11,2

Air pressure	[mbar]	989,3
Atmospheric humidity	[%]	46,1
Room temp.	[°C]	28,5

Flue gas temperature at the flue spigot		
Maximum	[°C]	82,9
Average	[°C]	82,1

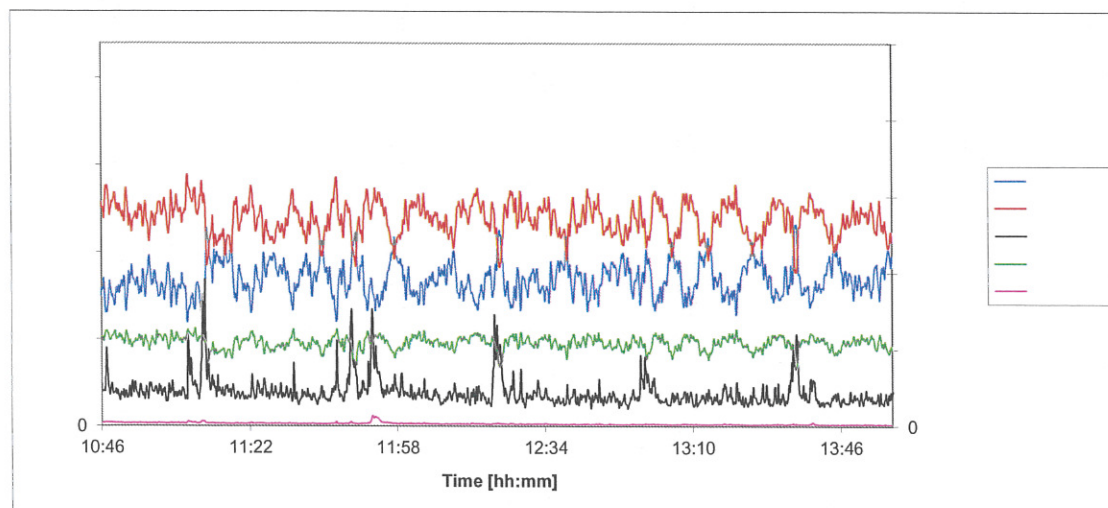
Flue gas temperature in measurement section		
Maximum	[°C]	62,5
Average	[°C]	61,5

Maximum surface temperatures on the test wall		
Side (15cm)	[°C]	31,4
Rear (12 cm)	[°C]	37,1
Floor	[°C]	34,9
Pellets hopper	[°C]	38,9
Hand	[°C]	31,3

Water heating output		
Temperature of inlet water	[°C]	57,9
Temperature of outlet water	[°C]	74,5
Water flow	[m ³ /h]	0,666
Water heating output	[kW]	12,7

Lambda	[-]	1,7
Flue gas volume, dry	[Nm ³ /kg]	7,4
Flue gas volume, wet	[Nm ³ /kg]	8,1
Gas flow	[Nm ³ /h]	26,0
Flue gas mass flow rate	[g/s]	8,7
c _{p,av} water vapour	[kJ/Nm ³ ·K]	1,50
c _{p,av} dry flue gas	[kJ/Nm ³ ·K]	1,31
Loss of sensible heat in the flue gas	[kJ/kg]	375,9
	[%]	2,1
Loss through CO in the flue gas	[kJ/kg]	4,1
	[%]	0,0
Loss through combustible constituents (value from EN 14785)	[%]	0,2
Combustion efficiency	[%]	97,0
Total thermal output	[%]	15,2

Emissions, measured					Dust		
O ₂	CO ₂	CO	NO	C _x H _y	10:48 - 11:29	12:00 - 12:30	13:00 - 13:30
[%]	[%]	[ppm]	[ppm]	[ppm]	[mg/Nm ³]	[mg/Nm ³]	[mg/Nm ³]
8,5	11,9	44	109	3	20	15	13
					O ₂ in %		
					8,3	8,3	8,6
Emissions, related to 10 vol % O ₂ and standard reference conditions							
		[mg/Nm ³]	[mg/Nm ³]	[mg/Nm ³]	[mg/Nm ³]	[mg/Nm ³]	[mg/Nm ³]
		48	196	4	17	13	12
Emissions, related to 13 vol % O ₂ and standard reference conditions							
		[mg/Nm ³]	[mg/Nm ³]	[mg/Nm ³]	[mg/Nm ³]	[mg/Nm ³]	[mg/Nm ³]
		35	142	3	12	10	9
Emissions related to the energy content of the fuel							
		[mg/MJ]	[mg/MJ]	[mg/MJ]	[mg/MJ]	[mg/MJ]	[mg/MJ]
		23	92	2	8	6	6



Order number:	PL-08155-P
Marking	08155/1

Elementary analysis		
Carbon content	[%]	47,00
Hydrogen content	[%]	5,73
Nitrogen content	[%]	0,08
Sulphur content	[%]	0,01
Ash content	[%]	0,31
Oxygen content	[%]	39,76
Water content	[%]	7,21

Load	[-]	Full load
Start	[hh:mm]	14:10
End	[hh:mm]	17:25
Combustion time	[min]	195
Fuel quantity	[kg]	10,2
Thermal output from fuel	[kW]	15,3
Conversion	[kg/h]	3,1
Average negative pressure in the interceptor	[Pa]	11,4

Lambda	[-]	1,7
Flue gas volume, dry	[Nm ³ /kg]	7,4
Flue gas volume, wet	[Nm ³ /kg]	8,2
Gas flow	[Nm ³ /h]	25,6
Flue gas mass flow rate	[g/s]	8,6
c _{p,av} water vapour	[kJ/Nm ³ ·K]	1,50
c _{p,av} dry flue gas	[kJ/Nm ³ ·K]	1,31
Loss of sensible heat in the flue gas	[kJ/kg]	370,1
	[%]	2,1
Loss through CO in the flue gas	[kJ/kg]	4,5
	[%]	0,0
Loss through combustible constituents (value from EN 14785)	[%]	0,2
Combustion efficiency	[%]	97,1
Total thermal output	[%]	14,9

Date of test:	05.08.2008
Fuel:	Wood pellets

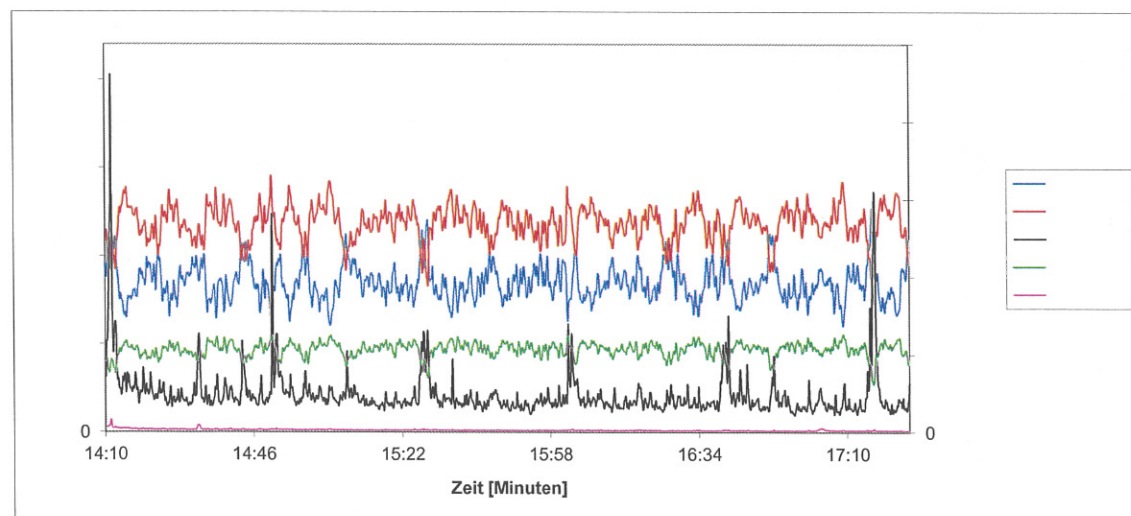
Calculated values		
O ₂ -consumption	[m ³ /kg]	0,92
Air consumption	[m ³ /kg]	4,37
Flue gas volume, dry	[m ³ /kg]	4,33
Water vapour	[m ³ /kg]	0,73
Flue gas volume, wet	[m ³ /kg]	5,06
CO ₂ maximum	[%]	20,27
Net calorific value	[kJ/kg]	17588

Air pressure	[mbar]	989,3
Atmospheric humidity	[%]	40,9
Room temp.	[°C]	29,8

Flue gas temperature at the flue spigot		
Maximum	[°C]	82,5
Average	[°C]	83,2
Flue gas temperature in measurement section		
Maximum	[°C]	62,6
Average	[°C]	62,2
Maximum surface temperatures on the test wall		
Side (15cm)	[°C]	32,5
Rear (15 cm)	[°C]	36,9
Floor	[°C]	35,6
Pellets hopper	[°C]	40,4
Hand	[°C]	39,5

Water heating output		
Temperature of inlet water	[°C]	58,1
Temperature of outlet water	[°C]	74,6
Water flow	[m ³ /h]	0,665
Water heating output	[kW]	12,7

Emissions, measured					Dust		
O ₂	CO ₂	CO	NO	C _x H _y	14:15 - 14:45	15:15 - 15:50	16:40 - 17:10
[%]	[%]	[ppm]	[ppm]	[ppm]	[mg/Nm ³]	[mg/Nm ³]	[mg/Nm ³]
8,5	11,8	48	106	2	16	14	23
					O ₂ in %		
					8,5	8,4	8,7
Emissions, related to 10 vol % O ₂ and standard reference conditions							
		[mg/Nm ³]	[mg/Nm ³]	[mg/Nm ³]	[mg/Nm ³]	[mg/Nm ³]	[mg/Nm ³]
		53	192	4	14	13	21
Emissions, related to 13 vol % O ₂ and standard reference conditions							
		[mg/Nm ³]	[mg/Nm ³]	[mg/Nm ³]	[mg/Nm ³]	[mg/Nm ³]	[mg/Nm ³]
		38	139	3	10	9	15
Emissions related to the energy content of the fuel							
		[mg/MJ]	[mg/MJ]	[mg/MJ]	[mg/MJ]	[mg/MJ]	[mg/MJ]
		25	90	2	7	6	10



Order number:	PL-08155-P
Marking	08155/1

Date of test:	06.08.2008
Fuel:	Wood pellets

Elementary analysis		
Carbon content	[%]	47,00
Hydrogen content	[%]	5,73
Nitrogen content	[%]	0,08
Sulphur content	[%]	0,01
Ash content	[%]	0,31
Oxygen content	[%]	39,76
Water content	[%]	7,21

Calculated values		
O ₂ -consumption	[m ³ /kg]	0,92
Air consumption	[m ³ /kg]	4,37
Flue gas volume, dry	[m ³ /kg]	4,33
Water vapour	[m ³ /kg]	0,73
Flue gas volume, wet	[m ³ /kg]	5,06
CO ₂ maximum	[%]	20,27
Net calorific value	[kJ/kg]	17588

Load	[-]	Partial load
Start	[hh:mm]	10:04
End	[hh:mm]	16:13
Combustion time	[min]	370
Fuel quantity	[kg]	5,0
Thermal output from fuel	[kW]	4,0
Conversion	[kg/h]	0,8
Average negative pressure in the interceptor	[Pa]	12,1

Air pressure	[mbar]	992,0
Atmospheric humidity	[%]	39,4
Room temp.	[°C]	28,8

Flue gas temperature at the flue spigot		
Maximum	[°C]	65,7
Average	[°C]	66,7

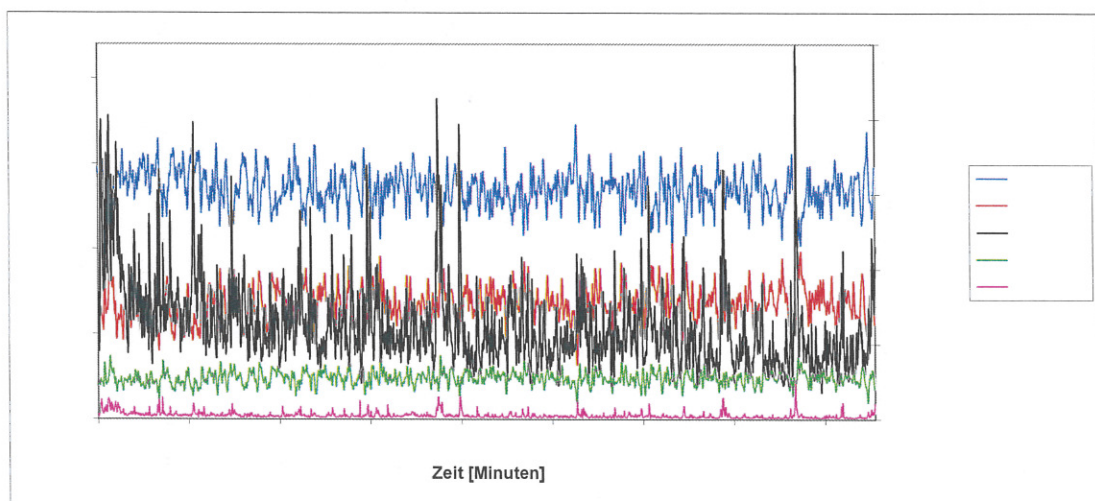
Flue gas temperature in measurement section		
Maximum	[°C]	48,6
Average	[°C]	47,7

Maximum surface temperatures on the test wall		
Side (15cm)	[°C]	31,7
Rear (12 cm)	[°C]	34,9
Floor	[°C]	31,4
Pellets hopper	[°C]	35,6
Hand	[°C]	45,0

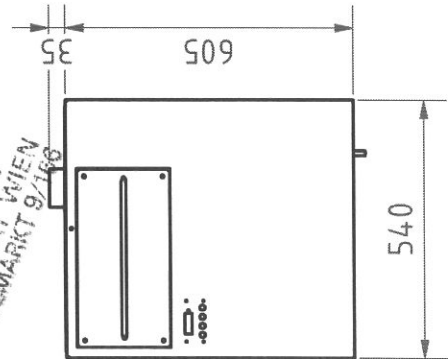
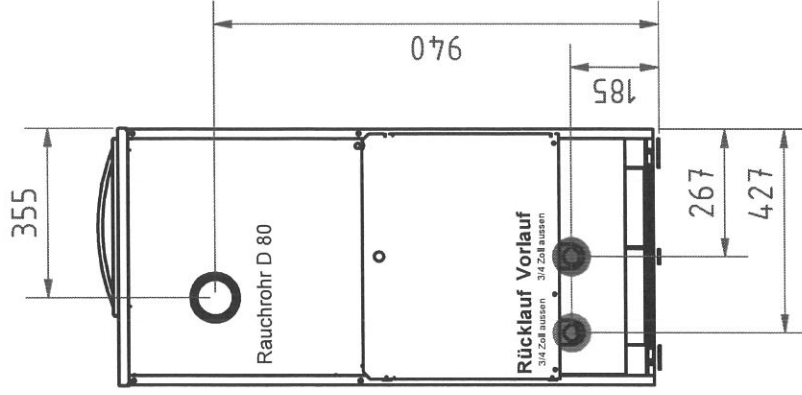
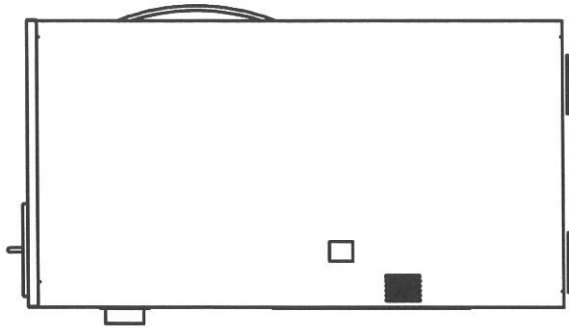
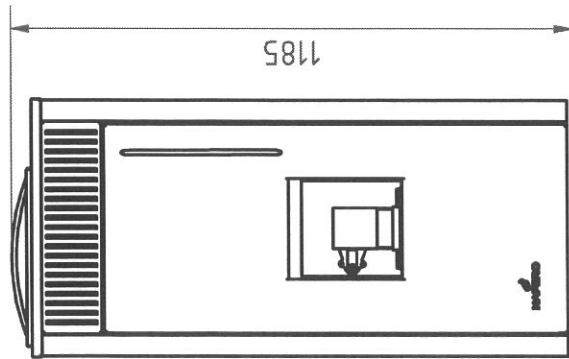
Water heating output		
Temperature of inlet water	[°C]	63,5
Temperature of outlet water	[°C]	73,2
Water flow	[m ³ /h]	0,294
Water heating output	[kW]	3,3

Lambda	[-]	3,0
Flue gas volume, dry	[Nm ³ /kg]	13,1
Flue gas volume, wet	[Nm ³ /kg]	13,8
Gas flow	[Nm ³ /h]	11,2
Flue gas mass flow rate	[g/s]	4,0
c _{p,av} water vapour	[kJ/Nm ³ K]	1,50
c _{p,av} dry flue gas	[kJ/Nm ³ K]	1,31
Loss of sensible heat in the flue gas	[kJ/kg]	355,0
	[%]	2,0
Loss through CO in the flue gas	[kJ/kg]	20,8
	[%]	0,1
Loss through combustible constituents (value from EN 14785)	[%]	0,2
Combustion efficiency	[%]	97,1
Total thermal output	[%]	3,8

Emissions, measured					Dust					
O ₂	CO ₂	CO	NO	C _x H _y	10:05 - 10:35	11:05 - 11:35	12:05 12:35	13:05 - 13:35	14:10 - 14:40	15:20 - 15:50
[%]	[%]	[ppm]	[ppm]	[ppm]	[mg/Nm ³]	[mg/Nm ³]	[mg/Nm ³]	[mg/Nm ³]	[mg/Nm ³]	[mg/Nm ³]
13,5	6,7	126	55	5	32	34	38	37,3	38,1	30,8
					O ₂ in %					
					14,1	13,4	13,7	13,1	13,2	13,0
Emissions, related to 10 vol % O ₂ and standard reference conditions										
					[mg/Nm ³]	[mg/Nm ³]	[mg/Nm ³]	[mg/Nm ³]		
					232	166	13	50	49	56
Emissions, related to 13 vol % O ₂ and standard reference conditions										
					[mg/Nm ³]	[mg/Nm ³]	[mg/Nm ³]	[mg/Nm ³]	[mg/Nm ³]	[mg/Nm ³]
					168	121	9	37	36	41
Emissions related to the energy content of the fuel										
					[mg/MJ]	[mg/MJ]	[mg/MJ]	[mg/MJ]	[mg/MJ]	[mg/MJ]
					109	78	7	24	23	27



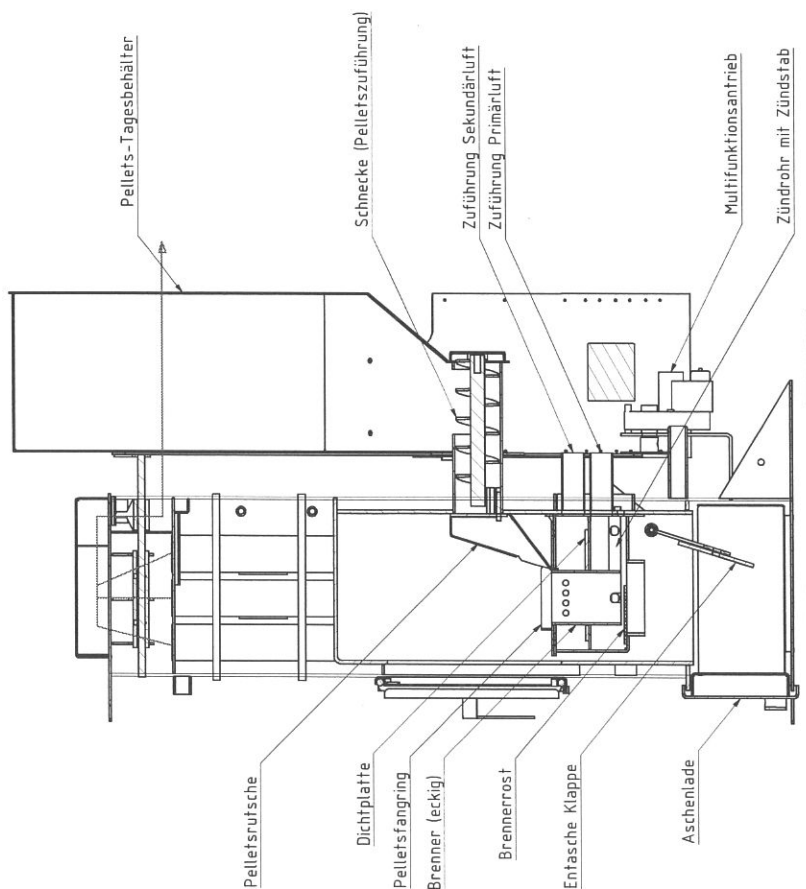
Datenblatt - BALANCE Holzpelletsofen (Wohnraumversion)



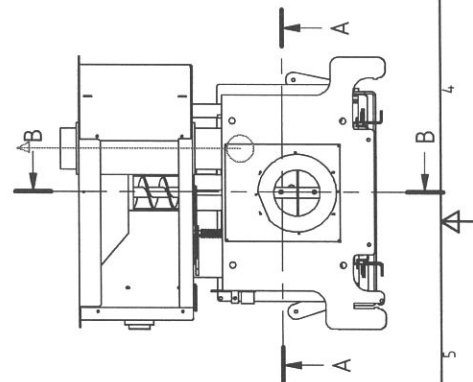
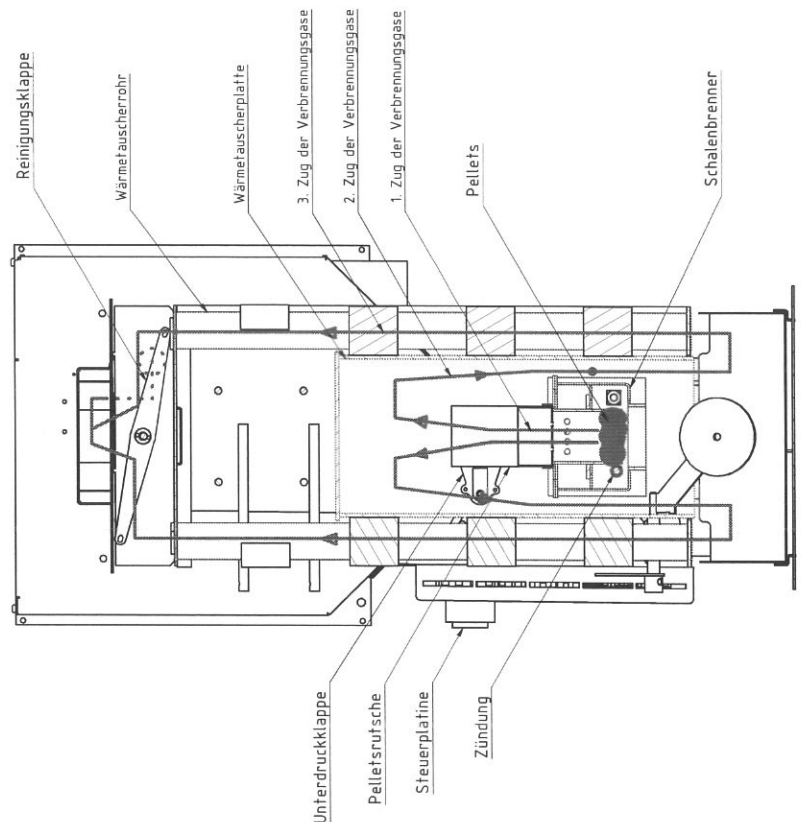
Geprüft nach.....	EN 14785
Wirkungsgrad	> 95 %
Leistung	14,9 kW
Gewicht	158 kg
Rauchrohranschluss	Durchmesser 80 mm
Stromverbrauch - Standby	7 Watt
Stromverbrauch - mittlere Leistung	38 Watt
Anschluss Absicherung	16 Ampere
Thermische Ablaufsicherung	nicht erforderlich
Wasserinhalt	29 Liter
Pellet - Vorratsbehälter	30 kg
Isolierung	Melaminharz 60 - 80mm
Brennraumtür	Sichtfenster aus Glas
Verkleidung	offen

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Schnittansicht B



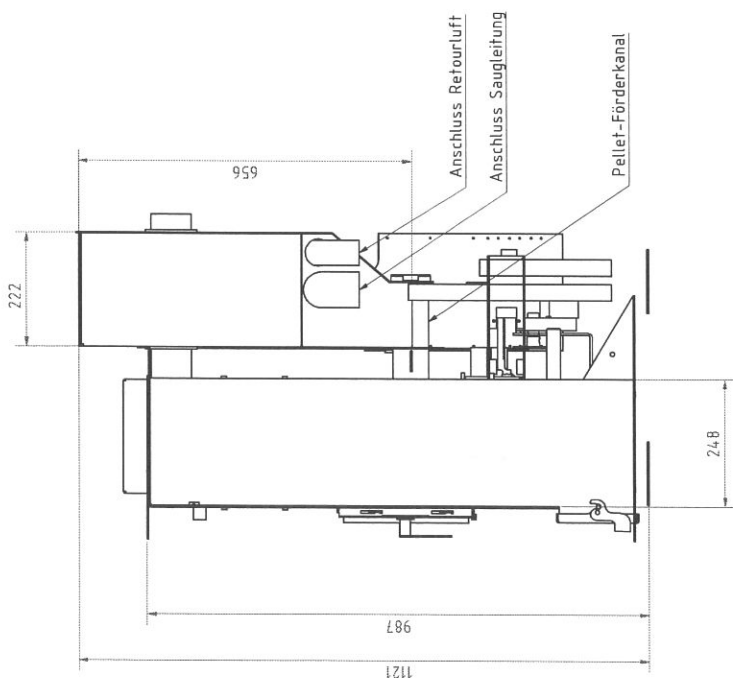
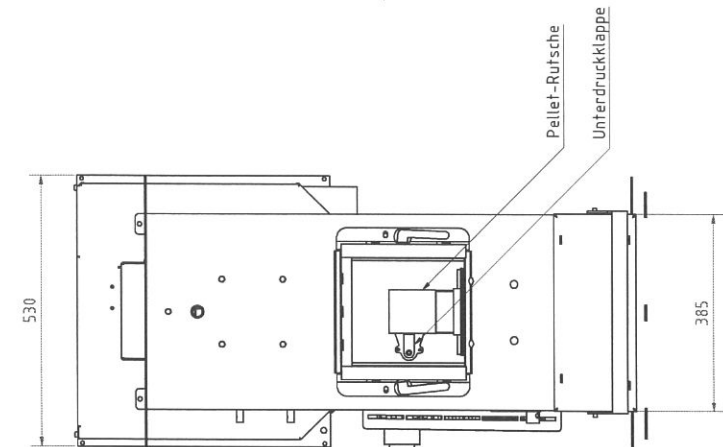
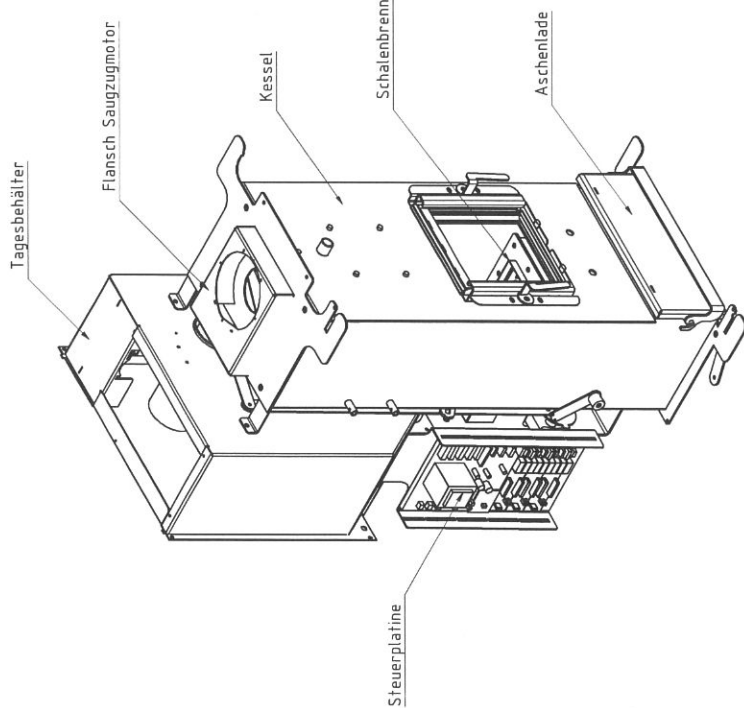
Schnittansicht A



Pelletsofen: Typenbezeichnung HP-02 / Einwurffheizung / 3-zügiger Wärmetauscher
 Nennwärmeleistung: 14,9 kW
 Maximal zulässiger Betriebsdruck: 3 Bar
 Prüfdruck des Wasserkreislaufes: 6 Bar
 Schweißnahtformen: Kehl- und Stumpfnaht
 Werkstoff: S 235 JR G2
 Maximal zulässige Betriebstemperatur des Wasserkreislaufes: 80°C

Toleranzen nach DIN 7168 mittel		Funktions- und Prüfm. Maßstab: Projektion Drit 6	
Kanten	Gewicht ca.	Hilfsmasse ()	Werkstoff
Benennung HP 02 Wohnraum (nach EN 14785)		Kesselschnitt mit Rauchgasführung	
Baugruppenzeichnung		Zeichnungsnummer	
Datei		alte Zeich-Nr.	
Zustimmung		gezeichnet am	
Datum		Blatt von	
Name		A2	
Gezeichnet: 20.03.2009 Rehl Paul		1	
Normalisiert		A	
Norm		A2	
Gezeichnet		A	
Gezeichnet		A	

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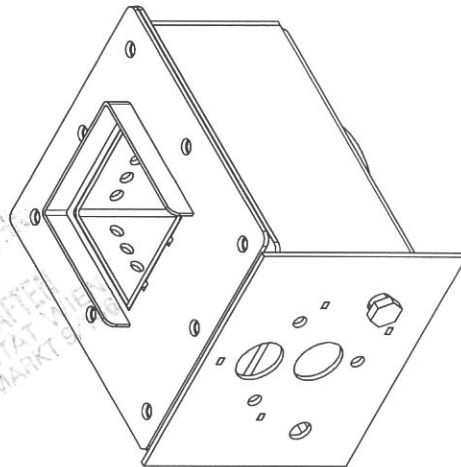
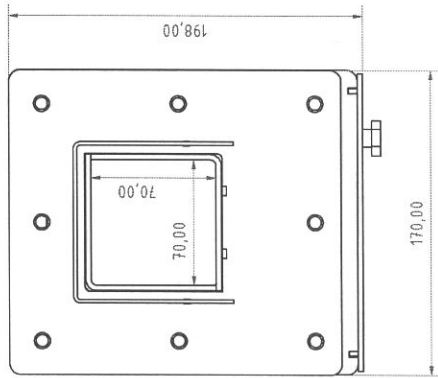
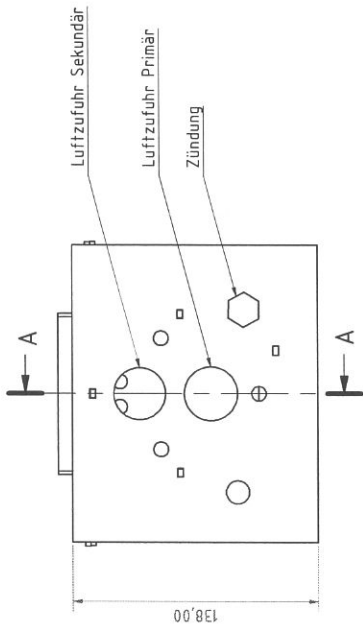
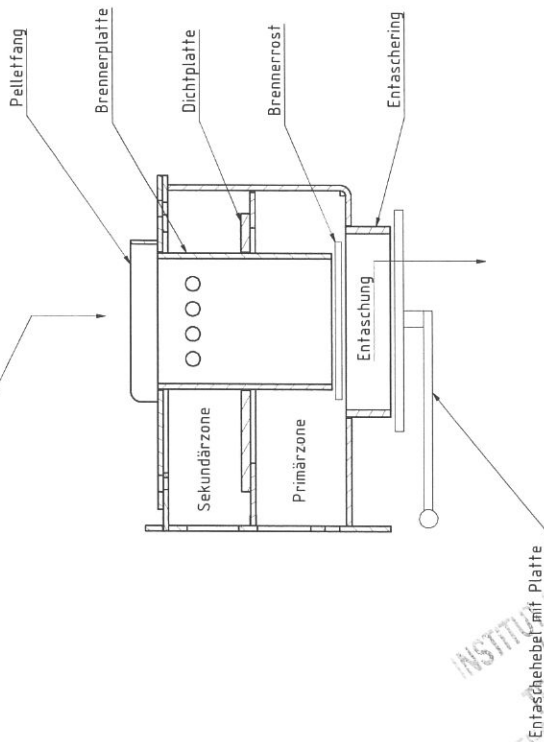


Pelletsofen: Typenbezeichnung HP-02 / Einwurfbrenner / 3-zügiger Wärmetauscher
 Nennwärmeleistung: 14,9 kW
 Maximal zulässiger Betriebsdruck: 3 Bar
 Prüfdruck des Wasserkreislaufes: 6 Bar
 Schweißnahtformen: Kehl- und Stumpfnaht
 Werkstoff – Stahl, wandstärke 3 / 4 / 5mm, Qualität – S 235 JRG2
 Maximal zulässige Betriebstemperatur des Wasserkreislaufes: 80°C

Toleranzen nach DIN 7168 mittel		Funktions- und Prüfm.		Maßstab:	
Kanten	Gewicht ca.	Hilfsmasse ()	Werkstoff	Projektion DIN 6	Oberfläche
HAPERO		Benennung		HP 02 - Wohnraum (nach EN 14785)	
Datum		Kesselabmessungen		Zeichnungsnummer	
Gezeichnet: 19.03.2009 Rend.Pawl		Baugruppe		alle Zöhg-Nr.	
Normal:		Dokumentiert		geprüft am	
Norm:		Dokumentiert		A2	
Dokumentiert		Dokumentiert		3	

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A-A (1 : 2)



Pelletstufen: Typenbezeichnung HP-02 / Einwurfbrenner / 3-zügiger Wärmetauscher
 Nennwärmeleistung: 14,9 kW
 Maximal zulässiger Betriebsdruck: 3 Bar
 Prüfdruck des Wasserkreislaufes: 6 Bar
 Schweißnahtformen: Keh- und Stupnaht
 Werkstoff - Stahl, Wandstärke 3 / 4 / 5mm, Qualität - S 235 JRG2
 Maximal zulässige Betriebstemperatur des Wasserkreislaufes: 80°C

Toleranzen nach DIN 7168 mittel		Funktions- und Prüfm.		Maßstab:	
Kanten	Gewicht ca.	Hilfsmasse ()	Werkstoff	Projektion DIN 6	Oberfläche
HAPERO HERNIMANN & PARTNER AG					
Datum	Name	Benennung			
Gezeichnet: 19.03.2009	Rehl, Paul	HP 02 Wohnraum (nach EN 14785)			
Normalisiert:		Schalenbrenner			
Zeichnungsnummer		Zeichnungsnummer			
Baugruppenzeichnung		alle Zeich-Nr.			
Datum	Name	gezeichnet am			
3		2			
1		A2			

Balance - Wohnraum

Type: HP 02 / W

Hersteller: Hapero Energietechnik GmbH (AUSTRIA)

Manufacturer: <http://www.hapero.com>



office@hapero.com

Seriennummer: 04.12.00035.2010 41A

Serialnumber:



KENNUNG



Automatischer Holzpelletsessel:

Automatic wood pellet boiler,

Automatisk træpillefyr, Chaudière automatique à granulés de bois,

Wärmeleistung:

Nominal output,

Varmeydelse, Puissance nominale, Potenza nominale,

4,3 - 14,9 kW

14-51 BTU

Kesselklasse:

Boiler class,

Kedelklasse, Chaudière de classe, Classe caldaia,

3

Max. Betriebsdruck:

Maximum operating pressure,

Max driftryk, Pression de service maximum, Pressione massima ammessa,

3 bar

Max. Kesseltemperatur:

Maximum boiler temperature,

Max kedeltryk, Température maximale de chaudière, Massima temperatura di caldaia,

85° C

185° F

Wasserinhalt:

Water capacity,

Vandinhold, Contenance en eau, Contenuto d'acqua,

32 Liter

Stromanschluss:

Electricity supply,

Strømtilslutning, Raccordement électrique, Allacciamento elettrico,

230 V / 1400 W

50 Hz / >= 13 A

Vor Inbetriebnahme des Pelletsessels ist die Bedienungsanleitung vollinhaltlich zur Kenntnis zu nehmen.

Before commencement of operation the manual should be read over carefully.

Før igangsætning af kedlen skal monteringsvejledning læses og overholdes.

Prière de lire attentivement la notice technique d'utilisation avant la mise en service.

Leggere attentamente il libretto di istruzioni prima della messa in funzione della caldaia

Balance - Wohnraum

Type: HP 02 / W

Hersteller: Hapero Energietechnik GmbH (AUSTRIA)

Manufacturer: <http://www.hapero.com>



office@hapero.com

Seriennummer: 04.12.00033.2010 41A

Serialnumber:



KENNUNG



Automatischer Holzpelletsessel:

Automatic wood pellet boiler,

Automatisk træpillefyr, Chaudière automatique à granulés de bois,

Wärmeleistung:

Nominal output,

Varmeydelse, Puissance nominale, Potenza nominale,

4,3 - 14,9 kW

14-51 BTU

Kesselklasse:

Boiler class,

Kedelklasse, Chaudière de classe, Classe caldaia,

3

Max. Betriebsdruck:

Maximum operating pressure,

Max driftryk, Pression de service maximum, Pressione massima ammessa,

3 bar

Max. Kesseltemperatur:

Maximum boiler temperature,

Max kedeltryk, Température maximale de chaudière, Massima temperatura di caldaia,

85° C

185° F

Wasserinhalt:

Water capacity,

Vandinhold, Contenance en eau, Contenuto d'acqua,

32 Liter

Stromanschluss:

Electricity supply,

Strømtilslutning, Raccordement électrique, Allacciamento elettrico,

230 V / 1400 W

50 Hz / >= 13 A

Vor Inbetriebnahme des Pelletsessels ist die Bedienungsanleitung vollinhaltlich zur Kenntnis zu nehmen.

Before commencement of operation the manual should be read over carefully.

Før igangsætning af kedlen skal monteringsvejledning læses og overholdes.

Prière de lire attentivement la notice technique d'utilisation avant la mise en service.

Leggere attentamente il libretto di istruzioni prima della messa in funzione della caldaia

Balance - Wohnraum

Type: HP 02 / W

Hersteller: Hapero Energietechnik GmbH (AUSTRIA)

Manufacturer: <http://www.hapero.com>



office@hapero.com

Seriennummer: 04.12.00036.2010 41A

Serialnumber:



KENNUNG



Automatischer Holzpelletsessel:

Automatic wood pellet boiler,

Automatisk træpillefyr, Chaudière automatique à granulés de bois,

Wärmeleistung:

Nominal output,

Varmeydelse, Puissance nominale, Potenza nominale,

4,3 - 14,9 kW

14-51 BTU

Kesselklasse:

Boiler class,

Kedelklasse, Chaudière de classe, Classe caldaia,

3

Max. Betriebsdruck:

Maximum operating pressure,

Max driftryk, Pression de service maximum, Pressione massima ammessa,

3 bar

Max. Kesseltemperatur:

Maximum boiler temperature,

Max kedeltryk, Température maximale de chaudière, Massima temperatura di caldaia,

85° C

185° F

Wasserinhalt:

Water capacity,

Vandinhold, Contenance en eau, Contenuto d'acqua,

32 Liter

Stromanschluss:

Electricity supply,

Strømtilslutning, Raccordement électrique, Allacciamento elettrico,

230 V / 1400 W

50 Hz / >= 13 A

Vor Inbetriebnahme des Pelletsessels ist die Bedienungsanleitung vollinhaltlich zur Kenntnis zu nehmen.

Before commencement of operation the manual should be read over carefully.

Før igangsætning af kedlen skal monteringsvejledning læses og overholdes.

Prière de lire attentivement la notice technique d'utilisation avant la mise en service.

Leggere attentamente il libretto di istruzioni prima della messa in funzione della caldaia

Balance - Wohnraum

Type: HP 02 / W

Hersteller: Hapero Energietechnik GmbH (AUSTRIA)

Manufacturer: <http://www.hapero.com>



office@hapero.com

Seriennummer: 04.12.00034.2010 41A

Serialnumber:



KENNUNG



Automatischer Holzpelletsessel:

Automatic wood pellet boiler,

Automatisk træpillefyr, Chaudière automatique à granulés de bois,

Wärmeleistung:

Nominal output,

Varmeydelse, Puissance nominale, Potenza nominale,

4,3 - 14,9 kW

14-51 BTU

Kesselklasse:

Boiler class,

Kedelklasse, Chaudière de classe, Classe caldaia,

3

Max. Betriebsdruck:

Maximum operating pressure,

Max driftryk, Pression de service maximum, Pressione massima ammessa,

3 bar

Max. Kesseltemperatur:

Maximum boiler temperature,

Max kedeltryk, Température maximale de chaudière, Massima temperatura di caldaia,

85° C

185° F

Wasserinhalt:

Water capacity,

Vandinhold, Contenance en eau, Contenuto d'acqua,

32 Liter

Stromanschluss:

Electricity supply,

Strømtilslutning, Raccordement électrique, Allacciamento elettrico,

230 V / 1400 W

50 Hz / >= 13 A

Vor Inbetriebnahme des Pelletsessels ist die Bedienungsanleitung vollinhaltlich zur Kenntnis zu nehmen.

Before commencement of operation the manual should be read over carefully.

Før igangsætning af kedlen skal monteringsvejledning læses og overholdes.

Prière de lire attentivement la notice technique d'utilisation avant la mise en service.

Leggere attentamente il libretto di istruzioni prima della messa in funzione della caldaia