



**Testing Laboratory 1045.1**  
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ČSN EN ISO/IEC 17025:2005  
**Strojírenský zkušební ústav, s.p. Testing Laboratory, Hudcova 424/56b, 621 00 Brno**  
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## TEST REPORT

### 39-13820/T

**Product:** Hot water boiler for solid fuel (wood pellets – C1)  
with automatic fuel supply

**Type designation:** HEAD PELL

**Versions:** HEAD PELL 16, HEAD PELL 32

**Customer:** P.P.H.U. Kotłostal I S.C.  
Zakład Produkcji Kotłów C.O.  
Tomaszew, ul. Podmiejska 10  
63-300 Pleszew  
POLAND

**Manufacturer:** P.P.H.U. Kotłostal I S.C.  
Zakład Produkcji Kotłów C.O.  
Tomaszew, ul. Podmiejska 10  
63-300 Pleszew  
POLAND

**Employee responsible:** Mr. Milan Holomek

**Report issue date:** 2019-02-06

**Distribution list:** 1 copy to the Engineering Test Institute  
1 copy to the Customer



The tests were performed based on these documents:

- Order B-64028 dated 2018-11-09 (received on 2018-11-13)
- Contract B-64028/39

## **I. Product description, intended use and mode of application**

The hot-water boilers for solid fuel (wood pellets – C1) with automatic fuel supply, HEAD PELL, are intended for heating of houses and similar buildings. The boiler is designed for burning of wood pellets – C1.

The body of boiler is from welded steel sheets. The boiler body is composed of combustion and convection parts. The furnace is cuboid-shaped, with burner inside and the ash pan beneath. The boiler body is thermally insulated with mineral wool.

Further detailed descriptions of individual assembly groups are provided in the enclosed technical documentation to Task 39-13820.

## **II. Sample tested**

- Number of samples: 2
- Date of submission 2019-01-14  
or collection:
- Reg. number: -
- Serial number: prototype1, prototype2

Boiler output versions that are the subject of the proceedings:

Boiler output version	Heat output	Place of testing
HEAD PELL 16	16 kW	SZÚ Brno
HEAD PELL 32	32 kW	

Visual inspection, testing and verification were carried out by Ing. Michal Havlů and Ing. Vladimír Foit in 01/2019.

The tests were performed with the measurement and test equipment with valid calibration.



### III. Measuring and test equipment

No.	Description	Inventory number	Calibration valid until	Accuracy
1.	Combustion product analyser, Horiba, type ENDA-680P	022394	calibration prior to each measurement	see CRM 190/16 see CRM 103000414644
2.	Weighing machine	022342	02/2019	see 6051-KL-H0334-17
3.	Induction flow meter	022389-C/1	10/2021	see 6015-KL-P0696-17
4.	Temperature measurement set	022399-D/8	11/2020	see KL-T-0162-17
5.	Thermometer, Moisture meter	116258	11/2021	see KL 10595/2018
6.	Barometer	111985	04/2019	see KL 6013-KL-K0005-14
7.	Draught gauge	MaR11-Tah	06/2019	see KL 6013-KL-C0423-17
8.	Electronic stop watch	990760	11/2022	see KL 3434E-17
9.	Gravimat SHC 501	022328	05/2021	see KL-P-0084-18
10.	Analytic weighing machine Sartorius	021682	05/2019	see KL 19/KA-17
11.	Electronic thermometer	116557	03/2019	see KL 160066
12.	Electrometer	022389-A/4	05/2025	see KL 039/15/E
13.	Induction water meter	116320	04/2024	see KL Q 0191/2018
14.	Weighing machine	022151	02/2019	see 6051-KL-H0120-17
15.	Weighing machine	022211	02/2019	see 6051-KL-H0333-17
16.	Tape measure	ME 477	10/2022	see KL 8800/2017



#### IV. Results of tests and evaluation

No.	Requirement	Technical standard, regulation applied	Source materials	Test evaluation
1.	Pressurized component tightness and strength test (T 001*)	ČSN EN 303-5:2013 Art. 5.4, 5.4.1, 5.4.2	Page 5	+
3.	Surface temperature test (T 001*)	ČSN EN 303-5:2013 Art. 5.12, 5.16.4, 4.3.6	Pages 6 - 8	+
4.	Test of heat output, input and efficiency (T 001*) Test of combustion product temperature (T 001*)	ČSN EN 303-5:2013 Art. 4.4.2, 4.4.3, 5.7, 5.8, 5.10 ČSN EN 303-5:2013 Art. 4.4.3	Pages 9 - 13	+
5.	Electrical consumption (T 071*)	ČSN EN 303-5:2013 Art. 5.8.5 ČSN EN 15456 Art. 5	Page 14	+
6.	Combustion efficiency test - emissions (T 001*)	ČSN EN 303-5:2013 Art. 5.7.3, 5.7.4, 5.9, 5.10.4	Pages 15 - 16	+
7.	Test of heat output, input and efficiency (T 001*)  Combustion efficiency test - emissions (T 001*)	ČSN EN 303-5:2013 Annex C, Deviation from Austria, C.2.2, C.2.3	Pages 17 - 18	+
		ČSN EN 303-5:2013 Annex C, C.3 Deviation from Croatia	-	0
		ČSN EN 303-5:2013 Annex C, Deviation from Denmark, C.4.1, C.4.2	Pages 19 - 20	+
		ČSN EN 303-5:2013 Annex C, Deviation from Germany, C.5.1, C.5.2	Pages 21 - 22	+
		ČSN EN 303-5:2013 Annex C C.6 Deviation from Switzerland	Pages 23 - 24	+
		ČSN EN 303-5:2013 Annex C C.8 Deviation from Italy	-	0
8.	Test of control, regulation and safety elements (T 001*) Combustion efficiency test - emissions (T 001*)	ČSN EN 303-5:2013 Art. 5.13, 5.14, 5.16.2, 5.16.3 ČSN EN 303-5:2013 Art. 5.9, 5.10.4	Pages 25 - 28	+

Evaluation:

- + Requirement fulfilled
- Requirement not fulfilled
- 0 Not applicable



Accredited test  
number:

**T 001\*** Test title: **Pressurized component tightness and strength test**

Test method:

ČSN EN 303-5:2013 Art. 5.4, 5.4.1, 5.4.2

Sample tested:

HEAD PELL 16, HEAD PELL 32

Measuring equipment used:

Chapter III - Measuring and test equipment

**Test results:**

Requirement	Requirement specification	Test evaluation	Note
<b>Pressure test for boilers of sheet or sheet metal of non-ferrous metal</b>	ČSN EN 303-5:2013 Art. 5.4		
<b>Tests to be carried out before production</b> The type test pressure is $2 \times PS$ using hydraulic pressure where $PS$ is the maximum permissible operating pressure. The test period shall be at least 10 min and if it is to apply to a range of boilers, the test shall be carried out on at least 3 boiler sizes (smallest, medium, and largest size). No leakage or noticeable permanent deformation shall occur during the test.  A record shall be made of the test, including the following details: - exact description of the boiler tested by stating the drawing number; - test pressure in bar and duration of the test; - test result; - place and date of the test, including the names of persons carrying out the test. The test report shall be signed by, as a minimum, the works tester responsible and one witness.	ČSN EN 303-5:2013 Art. 5.4.1	+       + + + + +	Enclosed technical documentation.
<b>Test during production</b> Each boiler shall be tested during the production and the test pressure shall be at least $1.43 \times PS$ .	ČSN EN 303-5:2013 Art. 5.4.2	+	

**Measurement results:** HEAD PELL 16  
HEAD PELL 32

Boiler Type	HEAD PELL 16	HEAD PELL 32
Testing pressure [bar]	6.0	6.0
Maximal operation pressure [bar]	3.0	3.0
Ambient temperature (°C)	28.3	20.8
Humidity (%)	42.7	26.5
Air pressure (kPa)	98.77	97.04
Time [min]	30	30
Test medium	water	water
Date	2019-01-15	2019-01-14



Accredited test  
number:

**T 001\*** Test title: **Surface temperature test**

Test method:

ČSN EN 303-5:2013 Art. 5.12, 5.16.4, 4.3.6

Sample tested:

HEAD PELL 16, HEAD PELL 32

Measuring equipment used:

Chapter III - Measuring and test equipment

**Test results:**

Requirement	Requirement specification	Test evaluation	Note
<b>Surface temperature</b> The mean surface temperature shall be measured at nominal heat output. In order to do this, a minimum of 5 points on each boiler surface shall be measured. Under the same conditions, the critical temperatures (e.g. boiler doors, operating levers) shall be measured.	ČSN EN 303-5:2013 Art. 5.12	+	
The surface temperature on the outside of the boiler (including the bottom and doors but not including the flue gas outlet and maintenance openings of natural draft boilers) shall not exceed the room temperature by more than 60 K when tested in accordance with 5.12. The requirement for the bottom is not applicable for instances when the manufacturer declares that the boiler is to be installed on a non-combustible base. When tested in accordance with 5.12, the surface temperature of operating levers and all parts which shall be touched by hand during operation of the boiler shall not exceed the room temperature by more than the following values: <ul style="list-style-type: none"> <li>- 35 K for metals and similar materials;</li> <li>- 45 K for porcelain and similar materials;</li> <li>- 60 K for plastics and similar materials.</li> </ul>	ČSN EN 303-5:2013 Art. 4.3.6	+	
<b>Resistance to thermal conductance</b> Temperature measurement shall be performed on the surface of the stoking device at the place next to the fuel line but within a maximum distance which shall be less than 1 m against the feeding direction from the inner wall of the combustion chamber. For boilers with integrated hopper, the temperature measurement shall be performed on the surface of the stoking device at the place next to the integrated hopper but within a maximum distance which shall be less than 1 m against the feeding direction from the inner wall of the combustion chamber. In addition, the highest surface temperature of the hopper shall be measured.	ČSN EN 303-5:2013 Art. 5.16.4	+	



**Measurement results:** HEAD PELL 16

Average temperatures of boiler walls, doors and covers (°C):		
Boiler type	HEAD PELL 16	
Fuel type	Wood Pellets - C1	
Heat output	Nominal	Minimal
Testing date	2019-01-15	2019-01-15
ambient temperature (°C)	28.3	28.7
humidity (%)	42.7	33.0
air pressure (kPa)	98.77	98.74
Front wall	36.3	32.3
Rear wall	35.1	36.5
Right wall	43.2	39.3
Left wall	39.7	36.3
Upper wall	45.7	39.8
Lower wall	35.0	35.0
Temperatures of control elements (°C):		
El. control panel - plastic	27.0	
Main switch - plastic	29.0	
STB - plastic	22.0	
Upper handle – plastic	25.0	
Middle handle – plastic	28.0	
Lower handle – plastic	26.0	
Temperature of fuel chamber and stoking elements (°C):		
Temperature of fuel chamber – metal	24.0	
Temperature of feeder – metal	39.0	

**Measurement uncertainty:** 2 °C for temperatures within the range of (0 ÷ 200) °C

"The above-specified extended measurement uncertainties are calculated as a factor of the measurement uncertainty and the extension coefficient,  $k=2$ , corresponding to the coverage certainty of 95% as regards standard classification. The uncertainties do not reflect the impact of sample taking and lack of homogeneity. The standard uncertainty was determined in accordance with Document EA 4-02."

**Test evaluation:** The specified temperature rise values have not been exceeded.



**Measurement results:** HEAD PELL 32

Average temperatures of boiler walls, doors and covers (°C):		
Boiler type	HEAD PELL 32	
Fuel type	Wood Pellets - C1	
Heat output	Nominal	Minimal
Testing date	2019-01-14	2019-01-14
ambient temperature (°C)	20.8	20.7
humidity (%)	26.5	27.4
air pressure (kPa)	97.04	98.12
Front wall	35.0	32.0
Rear wall	40.3	30.8
Right wall	34.0	34.0
Left wall	35.0	31.5
Upper wall	35.4	34.0
Lower wall	33.4	32.0
Temperatures of control elements (°C):		
El. control panel - plastic	27.0	
Main switch - plastic	29.0	
STB - plastic	22.0	
Upper handle – plastic	25.0	
Middle handle – plastic	28.0	
Lower handle – plastic	26.0	
Temperature of fuel chamber and stoking elements (°C):		
Temperature of fuel chamber – metal	24.0	
Temperature of feeder – metal	39.0	

**Measurement uncertainty:** 2 °C for temperatures within the range of (0 ÷ 200) °C

"The above-specified extended measurement uncertainties are calculated as a factor of the measurement uncertainty and the extension coefficient,  $k=2$ , corresponding to the coverage certainty of 95% as regards standard classification. The uncertainties do not reflect the impact of sample taking and lack of homogeneity. The standard uncertainty was determined in accordance with Document EA 4-02."

**Test evaluation:** The specified temperature rise values have not been exceeded.





Accredited test number: **T 001\*** Test title: **Test of heat output, input and efficiency  
Test of combustion product temperature**

Test method: ČSN EN 303-5:2013 Art. 4.4.2, 4.4.3, 5.7 to 5.10

Sample tested: HEAD PELL 16

Measuring equipment used: Chapter III - Measuring and test equipment

**Test results:**

**Average measured and calculated values (solid fuels):**

Test:	I.	II.
Boiler type:	HEAD PELL 16	
Output tested:	Nominal	Minimal
Testing date:	2019-01-15	2019-01-15
Fuel type:	<b>Wood Pellets - C1</b>	
Combustion period, (automatic) stoking	Minimally 6 hours	
Nominal heat output (specified by manufacturer) [ kW ]	16	16
Flue gas temperature [ °C ]	151.8	94.1
Fuel mass added [ kg/hour ]	3.590	1.090
Inlet water temperature [ °C ]	59.2	65.8
Outlet water temperature [ °C ]	80.6	79.3
Cooling water temperature [ °C ]	17.3	16.7
Cooling water flow rate [ m3/hour ]	0.6353	0.3022
Draught [ Pa ]	10.5	11.7
Ambient temperature [ °C ]	28.3	28.7
Relative air humidity [ % ]	42.7	33.0
Barometric pressure [ kPa ]	98.77	98.74

**Analysis of combustion products:**

Test (period of burning) :	I.	II.
Oxygen, O <sub>2</sub> [ % ]	5.01	11.62
Carbon dioxide CO <sub>2</sub> [ % ]	14.81	8.66
Carbon monoxide CO [ ppm ]	86	152
Higher hydrocarbons THC-OGC [ ppm ]	2	2
Nitrogen oxides NOx [ ppm ]	105	55
Sulphur oxides SO <sub>2</sub> [ ppm ]	3	3



**Auxiliary combustion values (solid fuels):**

Test (period of burning) :		I.	II.
Stoichiometric oxygen volume	[ m <sup>3</sup> /kg ]	0.946	0.953
Stoichiometric air volume	[ m <sup>3</sup> /kg ]	4.503	4.539
Stoichiometric volume of dry combustion products	[ m <sup>3</sup> /kg ]	4.421	4.457
Maximum content of CO <sub>2</sub>	[ % ]	19.51	19.52
Stoichiometric air multiple	[ - ]	1.31	2.21
Volume of dry combustion products, actual	[ m <sup>3</sup> /kg ]	5.821	10.028
Content of H <sub>2</sub> O in combustion air	[ m <sup>3</sup> /kg ]	0.099	0.134
Content of H <sub>2</sub> O in combustion products	[ m <sup>3</sup> /kg ]	0.884	0.919
Flue gas mass flow	[ kg/s ]	0.00869	0.00429

**Calculated values - thermal overview:**

Test (period of burning) :		I.	II.
Loss of sensible heat of combustion products	[ % ]	6.68	5.61
Loss of gas underburning	[ % ]	0.04	0.12
Loss of mechanical underburning	[ % ]	1.07	0.28
Loss of heat transfer into environment	[ % ]	2.13	4.83
Total loss	[ % ]	9.9	10.8
Efficiency - indirect method	[ % ]	90.1	89.2
Fuel mass added - actual	[ kg/hour ]	3.622	1.095
Heat input	[ kW ]	0.032	0.005
<b>Heat output</b>	<b>[ kW ]</b>	<b>17.3</b>	<b>5.2</b>
Uncertainty of determining heat output	[ kW ]	15.54	4.66
<b>Efficiency - direct method</b>	<b>[ % ]</b>	<b>89.7</b>	<b>89.0</b>
Output - nominal output	[ % ]	97.1	29.1

At nominal and minimal output, when burning **Wood Pellets - C1**, the boiler efficiency meets the requirements applicable to **Class 5** as per ČSN EN 303-5:2013, Fig. 1.

The measured heat output is within the  $\pm 8\%$  tolerance;  
Boiler Class 5;

**Test evaluation:**

At nominal output, combustion product temperature is less than 160 K above the ambient temperature;  
When burning Wood Pellets - C1, the period of burning is more than 6 hours;  
The minimum heat output is less than 30% of nominal heat output.



Accredited test number: **T 001\*** Test title: **Test of heat output, input and efficiency  
Test of combustion product temperature**

Test method: ČSN EN 303-5:2013 Art. 4.4.2, 4.4.3, 5.7 to 5.10

Sample tested: HEAD PELL 32

Measuring equipment used: Chapter III - Measuring and test equipment

**Test results:**

**Average measured and calculated values (solid fuels):**

Test:	I.	II.
Boiler type:	HEAD PELL 32	
Output tested:	Nominal	Minimal
Testing date:	2019-01-14	2019-01-14
Fuel type:	<b>Wood Pellets - C1</b>	
Combustion period, (automatic) stoking	Minimally 6 hours	
Nominal heat output (specified by manufacturer) [ kW ]	32	32
Flue gas temperature [ °C ]	175.0	93.5
Fuel mass added [ kg/hour ]	7.698	2.230
Inlet water temperature [ °C ]	52.6	64.4
Outlet water temperature [ °C ]	73.1	77.6
Cooling water temperature [ °C ]	8.8	10.0
Cooling water flow rate [ m3/hour ]	1.3712	0.6169
Draught [ Pa ]	14.0	13.3
Ambient temperature [ °C ]	20.8	20.7
Relative air humidity [ % ]	26.5	27.4
Barometric pressure [ kPa ]	97.04	98.12

**Analysis of combustion products:**

Test (period of burning) :	I.	II.
Oxygen, O <sub>2</sub> [ % ]	4.58	12.49
Carbon dioxide CO <sub>2</sub> [ % ]	14.40	7.71
Carbon monoxide CO [ppm]	100	178
Higher hydrocarbons THC-OGC [ppm]	3	3
Nitrogen oxides NO <sub>x</sub> [ppm]	107	54
Sulphur oxides SO <sub>2</sub> [ppm]	0	0



**Auxiliary combustion values (solid fuels):**

Test (period of burning) :		I.	II.
Stoichiometric oxygen volume	[ m3/kg ]	0.947	0.947
Stoichiometric air volume	[ m3/kg ]	4.508	4.508
Stoichiometric volume of dry combustion products	[ m3/kg ]	4.424	4.424
Maximum content of CO <sub>2</sub>	[ % ]	19.47	19.47
Stoichiometric air multiple	[ - ]	1.27	2.44
Volume of dry combustion products, actual	[ m3/kg ]	5.979	11.151
Content of H <sub>2</sub> O in combustion air	[ m3/kg ]	0.039	0.076
Content of H <sub>2</sub> O in combustion products	[ m3/kg ]	0.836	0.873
Flue gas mass flow	[ kg/s ]	0.0188	0.0096

**Calculated values - thermal overview:**

Test (period of burning) :		I.	II.
Loss of sensible heat of combustion products	[ % ]	8.7	7.0
Loss of gas underburning	[ % ]	0.0	0.2
Loss of mechanical underburning	[ % ]	0.1	0.1
Loss of heat transfer into environment	[ % ]	1.7	4.4
Total loss	[ % ]	10.5	11.6
Efficiency - indirect method	[ % ]	89.5	88.4
Fuel mass added - actual	[ kg/hour ]	7.712	2.234
Heat input	[ kW ]	36.2	10.5
<b>Heat output</b>	<b>[ kW ]</b>	<b>32.3</b>	<b>9.2</b>
Uncertainty of determining heat output	[ kW ]	1.4	0.4
<b>Efficiency – direct method</b>	<b>[ % ]</b>	<b>89.2</b>	<b>88.1</b>
Output - nominal output	[ % ]	101.0	28.9

At nominal and minimal output, when burning **Wood Pellets - C1**, the boiler efficiency meets the requirements applicable to **Class 5** as per ČSN EN 303-5:2013, Fig. 1.

**Test evaluation:**

The measured heat output is within the  $\pm 8\%$  tolerance;

Boiler Class 5;

At nominal output, combustion product temperature is less than 160 K above the ambient temperature;

When burning Wood Pellets - C1, the period of burning is more than 6 hours;

The minimum heat output is less than 30% of nominal heat output.



**Fuel analysis:**

Fuel type	Wood Pellets - C1			
Analytical indicator	Symbol	Unit	Value	Uncertainty
Higher heating value	$Q_s$	[ MJ/kg ]	18.47	0.22
Lower heating value	$Q_i$	[ MJ/kg ]	16.91	0.22
All water in original condition	$W_t^r$	[ % by weight ]	7.44	0.06
Ash	A	[ % by weight ]	0.15	0.02
Carbon	C	[ % by weight ]	46.59	0.24
Hydrogen	H	[ % by weight ]	6.35	0.20
Nitrogen	N	[ % by weight ]	0.13	0.14
Sulphur	S	[ % by weight ]	0.024	0.001
Chlorine	Cl	[ % by weight ]	0.008	0.001
Oxygen – calculation for 100%	O	[ % by weight ]	39.31	
Conversion factor $f_{emis}$ for emissions in [mg/m <sup>3</sup> ] to [mg/MJ]	$f_{emis}$	[ - ]	0.26213	

Note: Sample in original condition

**Measurement uncertainty:** Specified in Measurement results

"The above-specified extended measurement uncertainties are calculated as a factor of the measurement uncertainty and the extension coefficient,  $k=2$ , corresponding to the coverage certainty of 95% for standard classification. The uncertainties do not reflect the impact of sample taking and lack of homogeneity. The standard uncertainty was determined in accordance with Document EA 4-02".



Accredited test  
number:

**T 071\*** Test title: **Electrical consumption**

Test method:

ČSN EN 303-5:2013 Art. 5.8.5, ČSN EN 15456 Art. 5

Sample tested:

HEAD PELL 16, HEAD PELL 32

Measuring equipment used:

Chapter III - Measuring and test equipment

**Test results:**

Requirement	Requirement specification	Test evaluation	Note
<b>Electrical consumption</b> During the tests, the electrical consumption shall be determined according to EN 15456. The values for maximum consumption, for standby, nominal heat output and minimum heat output shall be stated in the test report. For boilers with automatic feeding systems (fuel line), the electrical consumption of the boiler and the fuel line shall be determined and stated separately. The average electrical power consumption during stand by shall be measured for a minimum duration of 10 min and shall be stated in watts. In cases where control operations influence the intrinsic energy consumption, a longer duration might be necessary.	ČSN EN 303-5:2013 Art. 5.8.5, ČSN EN 15456 Art. 5	+	

**Measurement results:**

Electrical consumption	HEAD PELL 16
Maximum electrical input	450 W
Electrical input at nominal heat output	39 W
Electrical input at minimum heat output	17 W
Electrical input for STAND BY mode	4 W
Maximum electrical input for ignition system	300 W

Note: Testing date and ambient conditions - see Test No. T 001\* (Test of heat output, input and efficiency)

Electrical consumption	HEAD PELL 32
Maximum electrical input	450 W
Electrical input at nominal heat output	47 W
Electrical input at minimum heat output	19 W
Electrical input for STAND BY mode	4 W
Maximum electrical input for ignition system	300 W

Note: Testing date and ambient conditions - see Test No. T 001\* (Test of heat output, input and efficiency)



Accredited test  
number:

**T 001\*** Test title: **Combustion efficiency test - emissions**

Test method:

ČSN EN 303-5:2013 Art. 5.7.3, 5.7.4, 5.9, 5.10.4

Sample tested:

HEAD PELL 16, HEAD PELL 32

Measuring equipment used:

Chapter III - Measuring and test equipment

Requirement	Requirement specification	Test evaluation	Note
<b>Emission limits</b> Combustion shall be of low-emission. This requirement shall be satisfied if the emission values shown in Table 6 are not exceeded when operating at nominal heat output or, in the case of boilers with heat output range, when operating at nominal heat output and minimum heat output, in accordance with 5.7, 5.9 and 5.10.	ČSN EN 303-5:2013 Art. 4.4.7	+	

Table 6

Stoking	Fuel	Nominal heat output	Emission limits								
			CO			OGC/THC		Dust			
			mg-m <sup>3</sup> at 10% O <sub>2</sub>								
			kW	Class	Class	Class	Class	Class	Class	Class	Class
			3	4	5	3	4	5	3	4	5
Manual	Biogenic	≤ 50	5000	1200	700	150	50	30	150	75	60
		> 50 ≤ 150	2500			100					
		> 150 ≤ 500	1200			100					
	Fossil	≤ 50	5000			150			125		
		> 50 ≤ 150	2500			100					
		> 150 ≤ 500	1200			100					
Automatic	Biogenic	≤ 50	3000	1000	500	100	30	20	150	60	40
		> 50 ≤ 150	2500			80					
		> 150 ≤ 500	1200			80					
	Fossil	≤ 50	3000			100			125		
		> 50 ≤ 150	2500			80					
		> 150 ≤ 500	1200			80					

NOTE 1: The dust values in this Table are based on the experience of the gravimetric filter method. The method used needs to be referred to in the test report. The particulate matter emission measured according to this European Standard does not include condensable organic compounds which may form additional particulate matter when the flue gas is mixed with ambient air. The values are therefore not directly comparable with values measured by dilution tunnel methods. Neither can they be directly translated into ambient air particulate concentrations.

NOTE 2: Additional test methods and emission limits which apply in some countries are given in the A-Deviations in Annex C.

<sup>a</sup> Referred to dry exit flue gas, 0 °C, 1013 mbar.

<sup>b</sup> Boilers of class 3 for type E-fuels according to 1.2.1 or e-fuels according to 1.2.3 in this Table and marked with the classification E-fuels and e-fuels do not need to fulfil the requirements for the dust emissions. The actual value shall be stated in the technical documentation and shall not exceed 200 mg-m<sup>3</sup> at 10 % O<sub>2</sub>.



**Measurement results:** HEAD PELL 16 - Wood Pellets - C1

Boiler output	Average values									
	Measured values						Converted values O <sub>2</sub> =10%			
	O <sub>2</sub> [%]	CO <sub>2</sub> [%]	CO [ppm]	OGC/THC [ppm]	NO <sub>x</sub> [ppm]	Dust [mg/m <sup>3</sup> ]	CO [mg/m <sup>3</sup> ]	OGC/THC [mg/m <sup>3</sup> ]	NO <sub>x</sub> [mg/m <sup>3</sup> ]	Dust [mg/m <sup>3</sup> ]
Nominal	5.01	14.81	86	2	105	34	74	3	148	23
Minimal	11.62	8.66	152	2	55	5	222	3	132	6

Note: Testing date and ambient conditions - see Test No. T 001\* (Test of heat output, input and efficiency)

**Test evaluation:**

HEAD PELL 16 (Wood Pellets - C1) meets at nominal and minimal output the emission requirements for **Class 5**, as per ČSN EN 303-5:2013 Table 6.

**Measurement results:** HEAD PELL 32 - Wood Pellets - C1

Boiler output	Average values									
	Measured values						Converted values O <sub>2</sub> =10%			
	O <sub>2</sub> [%]	CO <sub>2</sub> [%]	CO [ppm]	OGC/THC [ppm]	NO <sub>x</sub> [ppm]	Dust [mg/m <sup>3</sup> ]	CO [mg/m <sup>3</sup> ]	OGC/THC [mg/m <sup>3</sup> ]	NO <sub>x</sub> [mg/m <sup>3</sup> ]	Dust [mg/m <sup>3</sup> ]
Nominal	4.58	14.40	100	3	107	37	84	3	147	24
Minimal	12.49	7.71	178	3	54	25	287	6	142	32

Note: Testing date and ambient conditions - see Test No. T 001\* (Test of heat output, input and efficiency)

**Test evaluation:**

HEAD PELL 32 (Wood Pellets - C1) meets at nominal and minimal output the emission requirements for **Class 5**, as per ČSN EN 303-5:2013 Table 6.





Accredited test number: **T 001\*** Test title: **Test of heat output input and efficiency  
Combustion efficiency test - emissions**

Test method: **ČSN EN 303-5:2013 Annex C,  
Deviation from Austria, C.2.2, C.2.3**

Sample tested: **HEAD PELL 16, HEAD PELL 32**

**Test results:** Evaluation of the test results stated in this Test Report only.

Requirement	Requirement specification	Test evaluation
Boiler efficiency for nominal heat output and minimum heat output		Wood Pellets - C1
Boiler	Minimum efficiency	
Heating boilers for solid fuels	75 %	+
a) manually loaded		
up to 10 kW	79 %	
>10 to 200 kW	$(71.3 + 7.7 \log P_n) \%$	
>200 kW	89 %	
b) automatically loaded		
up to 10 kW	80 %	
>10 to 200 kW	$(72.3 + 7.7 \log P_n) \%$	
>200 kW	90 %	+
NOTE: $P_n$ is the nominal heat output ( $Q_n$ in this standard)		
ČSN EN 303-5:2013 Annex C, Deviation from Austria, C.2.2		

Requirement	Requirement specification	Test evaluation
<b>Emission limits</b>	ČSN EN 303-5:2013 Annex C, Deviation from Austria, C.2.3	Wood Pellets - C1
<b>Small burners used for solid fuels automatically loaded</b>		
Parameter		
CO		500 <sup>a</sup>
NO <sub>x</sub>		100
OGC/THC		30
Dust		25

<sup>a</sup> The limit value can be exceeded by 50 % during partial load operation at 30 % of nominal heat output.



**Measurement results:** HEAD PELL 16 - Wood Pellets - C1

Boiler output	Minimum efficiency	Measured efficiency
Nominal	81.6	89.7
Minimal		89.0

**Test evaluation:**

The measured efficiency of HEAD PELL 16 (Wood Pellets - C1) is **higher** than required.

**Measurement results:** HEAD PELL 16 - Wood Pellets - C1

Boiler output	Average values								
	Measured values					Converted values O <sub>2</sub> =0%			
	O <sub>2</sub> [%]	CO [ppm]	NO <sub>x</sub> [ppm]	OGC/THC [ppm]	Dust [mg/m3]	CO [mg/MJ]	NO <sub>x</sub> [mg/MJ]	OGC/THC [mg/MJ]	Dust [mg/MJ]
Nominal	5.01	86	105	2	34	36	73	1	11
Minimal	11.62	152	55	2	5	110	65	2	3

**Test evaluation:**

The measured emission values for HEAD PELL 16 (Wood Pellets - C1) **do not exceed** the specified values.

**Measurement results:** HEAD PELL 32 - Wood Pellets - C1

Boiler output	Minimum efficiency	Measured efficiency
Nominal	83.9	89.2
Minimal		88.1

**Test evaluation:**

The measured efficiency of HEAD PELL 32 (Wood Pellets - C1) is **higher** than required.

**Measurement results:** HEAD PELL 32 - Wood Pellets - C1

Boiler output	Average values								
	Measured values					Converted values O <sub>2</sub> =0%			
	O <sub>2</sub> [%]	CO [ppm]	NO <sub>x</sub> [ppm]	OGC/THC [ppm]	Dust [mg/m3]	CO [mg/MJ]	NO <sub>x</sub> [mg/MJ]	OGC/THC [mg/MJ]	Dust [mg/MJ]
Nominal	4.58	100	107	3	37	42	73	2	12
Minimal	12.49	178	54	3	25	143	71	3	16

**Test evaluation:**

The measured emission values for HEAD PELL 32 (Wood Pellets - C1) **do not exceed** the specified values.



Accredited test  
number:

T 001\*

Test title:

**Test of heat output, input and efficiency  
Combustion efficiency test - emissions**

Test method:

ČSN EN 303-5:2013 Annex C,  
Deviation from Denmark, C.4.1, C.4.2

Sample tested:

HEAD PELL 16, HEAD PELL 32

**Test results:** Evaluation of the test results stated in this Test Report only.

Requirement	Requirement specification	Test evaluation
<b>Boiler Efficiency</b>		
According to the Danish Construction Code BR08, Clause 8.5.1.4, Sub-clause 7, boilers for coal, coke, bio fuel or biomass shall have an efficiency equivalent to Class 3 in EN 303-5.	ČSN EN 303-5:2013 Annex C, Deviation from Denmark, C.4.1	Wood Pellets - C1
<b>Minimum efficiency</b> (67 + 6 log Qn) %		
For boilers above 300 kW, the requirement corresponding to 300 kW shall be used.		
		+

Requirement						Requirement specification	Test evaluation
Emission limits						ČSN EN 303-5:2013 Annex C, Deviation from Denmark, C.4.2	Wood Pellets - C1
According to the Danish EPA Statutory Order no. 1432 of 11-12-2007, only Class 3 (or higher) is acceptable for Denmark.							
Stoking	Fuel	Nominal heat output	Emission limit values <sup>a</sup>				
			CO	OGC/ THC	Dust		
		kW	mg·m <sup>-3</sup> at 10% O <sub>2</sub>				
			Class				
Manual	Biogenic	≤ 50	5000	150	150		
		> 50 to 150	2500	100			
		> 150 to 300	1200				
	Fossil	≤ 50	5000	150	125		
		> 50 to 150	2500	100			
		> 150 to 300	1200				
Automatic	Biogenic	≤ 50	3000	80	150		
		> 50 to 150	2500				
		> 150 to 300	1200				
	Fossil	≤ 50	3000	100	125		
		> 50 to 150	2500	80			
		> 150 to 300	1200				

<sup>a</sup> Referring to dry exit flue gas, 0 °C, 1 013 mbar.

<sup>a</sup> Referring to dry exit flue gas, 0 °C, 1 013 mbar.



**Measurement results:** HEAD PELL 16 - Wood Pellets - C1

Boiler output	Minimum efficiency	Measured efficiency
Nominal	74.2	89.7
Minimal		89.0

**Test evaluation:**

Measured efficiency for HEAD PELL 16 (Wood Pellets - C1) is **higher** than required.

**Measurement results:** HEAD PELL 16 - Wood Pellets - C1

Boiler output	Average emission values						
	Measured values				Converted values O <sub>2</sub> =10%		
	O <sub>2</sub> [%]	CO [ppm]	OGC/THC [ppm]	Dust [mg/m <sup>3</sup> ]	CO [mg/m <sup>3</sup> ]	OGC/THC [mg/m <sup>3</sup> ]	Dust [mg/m <sup>3</sup> ]
Nominal	5.01	86	2	34	74	3	23
Minimal	11.62	152	2	5	222	3	6

**Test evaluation:**

The measured emission values HEAD PELL 16 (Wood Pellets - C1) **do not exceed** the specified values.

**Measurement results:** HEAD PELL 32 - Wood Pellets - C1

Boiler output	Minimum efficiency	Measured efficiency
Nominal	76.0	89.2
Minimal		88.1

**Test evaluation:**

Measured efficiency for HEAD PELL 32 (Wood Pellets - C1) is **higher** than required.

**Measurement results:** HEAD PELL 32 - Wood Pellets - C1

Boiler output	Average emission values						
	Measured values				Converted values O <sub>2</sub> =10%		
	O <sub>2</sub> [%]	CO [ppm]	OGC/THC [ppm]	Dust [mg/m <sup>3</sup> ]	CO [mg/m <sup>3</sup> ]	OGC/THC [mg/m <sup>3</sup> ]	Dust [mg/m <sup>3</sup> ]
Nominal	4.58	100	3	37	84	3	24
Minimal	12.49	178	3	25	287	6	32

**Test evaluation:**

The measured emission values HEAD PELL 32 (Wood Pellets - C1) **do not exceed** the specified values.



Accredited test number: **T 001\*** Test title: **Test of heat output, input and efficiency  
Combustion efficiency test - emissions**

Test method: **ČSN EN 303-5:2013 Annex C,  
Deviation from Germany, C.5.1, C.5.2**

Sample tested: **HEAD PELL 16, HEAD PELL 32**

**Test results:** Evaluation of the test results stated in this Test Report only.

Requirement					Requirement specification	Test evaluation
Emission limits					ČSN EN 303-5:2013 Annex C, Deviation from Germany, C.5.1, C.5.2	Wood Pellets - C1
Table 7 – Emission limits The emission limits are regulated in Chapter 2, paragraphs 4, 5 and Annex 2 of the German Immission Control Ordinance "Erste Verordnung zur Durchführung des Bundes-Immissionsschutzgesetzes (Verordnung über kleine und mittlere Feuerungsanlagen - 1. BImSchV)". Boilers operated with solid fuels shall only be installed, possess the quality and be put into operation if they fulfil the following specifications of the 1. BImSchV:						
	Fuel acc. to §3 (1)	Nominal output range kW	Dust g/m <sup>3</sup>	CO g/m <sup>3</sup>		
Stage 2: Appliances, which will be installed after 31.12.2014	Numbers 1 to 5a	≥ 4	0.02	0.4		
	Numbers 6 to 7	≥ 30 ≤ 500	0.02	0.4		
		> 500	0.02	0.3		
	Numbers 8 to 13	≥ 4 < 100	0.02	0.4		
NOTE: Differing from sentence 1 for firing systems (appliances) which will exclusively be fired by fuels according §3 article 1 Number 4 in the form of split logs, the limits according Stage 2 apply for firing systems (appliances) if they are installed after 31.12.2016.						

**Measurement results:** HEAD PELL 16 - Wood Pellets - C1

Boiler output	Average emission values				
	Measured values			Converted values O <sub>2</sub> =13%	
	O <sub>2</sub> [%]	CO [ppm]	Dust [mg/m <sup>3</sup> ]	CO [g/m <sup>3</sup> ]	Dust [g/m <sup>3</sup> ]
Nominal	5.01	86	34	0.054	0.017
Minimal	11.62	152	5	0.162	0.004

**Test evaluation:**

The measured emission values for HEAD PELL 16 (Wood Pellets - C1) **do not exceed** the specified values.



**Measurement results:** HEAD PELL 32 - Wood Pellets - C1

Boiler output	Average emission values				
	Measured values			Converted values O <sub>2</sub> =13%	
	O <sub>2</sub> [%]	CO [ppm]	Dust [mg/m <sup>3</sup> ]	CO [g/m <sup>3</sup> ]	Dust [g/m <sup>3</sup> ]
Nominal	4.58	100	37	0.061	0.018
Minimal	12.49	178	25	0.209	0.023

**Test evaluation:**

The measured emission values for HEAD PELL 32 (Wood Pellets - C1) **do not exceed** the specified values.



Accredited test  
number:

T 001\*

Test title:

**Test of heat output, input and efficiency  
Combustion efficiency test - emissions**

Test method:

ČSN EN 303-5:2013 Annex C  
C.6 Deviation from Switzerland

Sample tested:

HEAD PELL 16, HEAD PELL 32

**Test results:** Evaluation of the test results stated in this Test Report only.

Requirement		Requirement specification	Test evaluation	
<b>Emission limits</b>		ČSN EN 303-5:2013 Annex C C.6 Deviation from Switzerland	Wood Pellets - C1	
Clause 4.4.7, Table 7 The emission limits are regulated in Annex 4 of the Swiss Ordinance on Air Pollution Control ([OAPC] SR 814.318.142.1) of 1985-12-16 (as at 2010-07-15). Boilers operated with woody biomass shall only be put on the market if they fulfil the following specifications of the OAPC: – declarations of conformity (Figure 20 OAPC); – Figures 1, 212, 23 Annex 4 OAPC; – Figures 31, 32 Annex 5 OAPC. Emissions for boilers operated with coal or wood fuels shall not exceed the following limits:				
Type of installation	<b>Particular requirements (emission limits)<sup>a</sup> for carbon monoxide (CO) and particulate matter (dust)</b>			
	CO (mg·m <sup>-3</sup> )			Dust (mg·m <sup>-3</sup> )
Boilers for log wood and boilers for coal, manual stoking	800			50
Boilers for chipped wood and boilers for coal, automatic stoking	400		60	
Boilers for Wood Pellets, automatic stoking	300	40	+	
<sup>a</sup> Referred to oxygen basis: – for boilers for natural state wood 13 % volume; – for boilers for coal 7 % volume.				
The sulphur content of coal, coal briquettes and coke shall not exceed 3 %. Boilers operated with non-woody biomass shall comply with the following specifications of the OAPC: – Figures 741, 742, 743 Annex 2 OAPC; – Figures 81, 82 Annex 3 OAPC. According to Figure 743, Annex 2 OPAC, non-woody biomass, such as biogenic waste and products from agriculture, may only be burnt in boilers with a heat input of at least 70 kW. Such units need an approval and shall meet stronger emission limits according to Figure 742, Annex 2 OAPC.			0	



**Measurement results:** HEAD PELL 16 - Wood Pellets - C1

Boiler output	Average emission values				
	Measured values			Converted values O <sub>2</sub> =13%	
	O <sub>2</sub> [%]	CO [ppm]	Dust [mg/m <sup>3</sup> ]	CO [mg/m <sup>3</sup> ]	Dust [mg/m <sup>3</sup> ]
Nominal	5.01	86	34	54	17
Minimal	11.62	152	5	162	4

**Test evaluation:**

The measured emission values for HEAD PELL 16 (Wood Pellets - C1) **do not exceed** the specified values.

**Measurement results:** HEAD PELL 32 - Wood Pellets - C1

Boiler output	Average emission values				
	Measured values			Converted values O <sub>2</sub> =13%	
	O <sub>2</sub> [%]	CO [ppm]	Dust [mg/m <sup>3</sup> ]	CO [mg/m <sup>3</sup> ]	Dust [mg/m <sup>3</sup> ]
Nominal	4.58	100	37	61	18
Minimal	12.49	178	25	209	23

**Test evaluation:**

The measured emission values for HEAD PELL 32 (Wood Pellets - C1) **do not exceed** the specified values.





Accredited test number: **T 001\*** Test title: **Function test of control, regulation and safety elements  
Combustion efficiency test - emissions**

Test method: ČSN EN 303-5:2013 Art. 5.13, 5.14, 5.16.1, 5.16.2, 5.16.3  
ČSN EN 303-5:2013 Art. 5.9, 5.10.4

Sample tested: HEAD PELL 16, HEAD PELL 32

Measuring equipment used: Chapter III - Measuring and test equipment

**Test results:**

Requirement	Requirement specification	Test evaluation	Note
<p><b>Function check of the temperature controller and safety temperature limiter at the boiler</b></p> <p>The water-side flow rate shall comply with that specified for the nominal heat output test. The flow temperature of 75 °C shall not be exceeded at the start of the test °C.</p> <p>Adjust the firing so that it corresponds to the nominal heat output <math>Q_N</math> of the boiler. A steady state condition shall be reached and the outlet pressure at the flue gas section shall be according to the nominal heat output setting. For manual stoked boilers, the boiler shall be refuelled after reaching steady state with a full batch before starting the test.</p> <p>The dissipated output shall be reduced to <math>(40 \pm 5) \%</math> of the nominal heat output of the boiler, circulating pump running in continuous operation; temperature controller adjusted to maximum set value.</p> <p>When the temperature controller is operating normally, the measured flow temperature shall not exceed 100 °C; the safety temperature cut out or limiter or the device for dissipating excess heat shall not trigger.</p> <p>Repeat the test with the temperature controller out of function. This time, check if the safety temperature limiter-detector switches off the firing system at the highest value specified by the boiler manufacturers and if all hazardous operation states are avoided (see 4.1).</p>	<p>ČSN EN 303-5:2013 Art. 5.13</p>	<p>+</p>	



Requirement	Requirement specification	Test evaluation	Note
<p><b>Function test for the rapidly disconnectable firing system</b></p> <p>– Sudden absence of heat dissipation</p> <p>The water-side flow rate shall comply with that specified for the nominal output test. The flow temperature of 75 °C shall not be exceeded at the start of the test.</p> <p>Adjust the firing so that it corresponds to the nominal heat output <math>Q_N</math> of the boiler, a steady state condition is reached and the outlet pressure at the flue spigot is according to the rated heat output.</p> <p>The heat consumption is set to 0; water circulation in the boiler is permitted; temperature controller is adjusted to manufacture recommended maximum set value.</p> <p>Check if the safety temperature limiter or the temperature controller switches off the firing system and all hazardous operation states are avoided.</p> <p>– Loss of the electrical power supply</p> <p>The water-side flow rate shall comply with that specified for the nominal heat output test. The flow temperature of 75 °C shall not be exceeded at the start of the test.</p> <p>Adjust the firing so that it corresponds to the nominal heat output <math>Q_N</math> of the boiler, a steady state condition is reached and the outlet pressure at the flue gas section is according to the rated heat output.</p> <p>The electrical power supply including the circulation is cut off, check that no hazardous operation conditions occur.</p> <p>For the evaluation of the temperatures and the CO-concentrations, only mean values at a maximum average time of one minute shall be considered.</p>	<p>ČSN EN 303-5:2013 Art. 5.14</p>	<p>+</p>	
<p><b>Safety test of consequences of fuel overload and effect of a blockage of the fuel supply</b></p> <p>The safety of the boiler shall be checked at continuous operation of the boiler with the fuel feed rate of the stoking device set at possible maximum capacity, taking into account failures according to the risk analyses and the electrical safety. If other fuel feed rates lower than the maximum are categorised as critical by the risk analysis, these shall also be tested.</p> <p>The functionality of the safety device for the shut-down of the fuel shall occur by prevention of the ignition after release of fuel if no or insufficient combustion in the combustion chamber occurs.</p> <p>The test for blocked fuel line shall be achieved by deactivating the stoking device.</p> <p><b>The requirements specified in 4.3.4 shall be satisfied.</b></p>	<p>ČSN EN 303-5:2013 Art. 5.16.2</p>	<p>+</p>	



Requirement	Requirement specification	Test evaluation	Note
<b>Loss of combustion air supply</b> The safety of the heating boiler shall be checked at maximum heat input under the following conditions: <ul style="list-style-type: none"> <li>- failure of combustion air fan;</li> <li>- failure to close of the adjustable combustion air supply.</li> </ul> In each case, only one failure shall be simulated. The CO concentrations in the boiler shall not exceed 5 % volume. The measurement of CO concentration shall be carried out in the flue gas measuring section. <b>Test of combustion air supply loss.</b>	ČSN EN 303-5:2013 Art. 5.16.3	+	

Note:

- + Compliant
- Non-compliant
- 0 Not applicable
- x Not assessed

**Measurement results:** HEAD PELL 16

Temperature controller		
Temperature	[°C]	Note:
Pre-set	85	Temperature set on the operating thermostat regulator
Shutdown	86	Fan and stoking switched off (suppression mode)
Restoration of operation	78	Fan and stoking restored

Note: Testing date and ambient conditions - see Test No. T 001\* (Test of heat output, input and efficiency)

Temperature limiter (manual restoration of temperature) STB		
Temperature	[°C]	Note:
Pre-set	95	Temperature set on the temperature limiter
Shutdown	93	Fan and stoking switched off
Restoration of operation	The boiler irreversibly switched off. In order to restore operation, a manual intervention required, after the temperature drops under the limiter switching temperature	

Note: Testing date and ambient conditions - see Test No. T 001\* (Test of heat output, input and efficiency)

**Test evaluation:**

Proper functioning of safety elements has been verified.



**Measurement results:** HEAD PELL 32

Temperature controller		
Temperature	[°C]	Note:
Pre-set	85	Temperature set on the operating thermostat regulator
Shutdown	86	Fan and stoking switched off (suppression mode)
Restoration of operation	78	Fan and stoking restored

Note: Testing date and ambient conditions - see Test No. T 001\* (Test of heat output, input and efficiency)

Temperature limiter (manual restoration of temperature) STB		
Temperature	[°C]	Note:
Pre-set	95	Temperature set on the temperature limiter
Shutdown	93	Fan and stoking switched off
Restoration of operation	The boiler irreversibly switched off. In order to restore operation, a manual intervention required, after the temperature drops under the limiter switching temperature	

Note: Testing date and ambient conditions - see Test No. T 001\* (Test of heat output, input and efficiency)

**Test evaluation:**

Proper functioning of safety elements has been verified.

Tested by: Ing. Michal Haviř

Date: 01/2019

Signed: 

Reviewed by: Ing. Stanislav Buchta

Date: 02/2019

Signed: 



The test methods in this Report were applied without deviations, additions or exceptions.

**V. A list of other referenced documents**

- Order B-64028 dated 2018-11-09 (received on 2018-11-13)
- Contract B-64028/39
- ČSN EN 303-5:2013 - Heating boilers - Part 5: Heating boilers for solid fuels, manually and automatically stoked, nominal heat output of up to 500 kW - Terminology, requirements, testing and marking
- ČSN EN 15456 - Heating boilers - Electrical power consumption for heat generators - System boundaries – Measurements

Test Report compiled by:

Ing. Michal Havlů

Person responsible for correctness of the Report:

**Milan Holomek**

Head of Heat and Environment-Friendly Equipment Test Station



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