



TEST REPORT

31-10460/1/T

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

Type designation V6 PELLET MICRO 8

Customer: MCE Małopolskie Centrum Ekologiczne
S. Migdałek, P. Kozłowski s.c.
Klecza Dolna 15a
34-124 Klecza Górna
POLAND

Manufacturer: GREŃ sp.j.
ul. Górnośląska 5
43-200 Pszczyna
POLAND

Employee responsible:

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Distribution list: 1 copy to the Engineering Test Institute (SZU)
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The tests were performed based on these documents:

- Order B-68992 of 2020-02-10 (Order reg. no. B-68992 delivered on 2020-02-10)
- Contract B-68992/31

I. Description of product tested

The Hot-water boiler for solid fuel (wood pellets - C1) with automatic fuel supply, V6 PELLET MICRO 8 is intended for heating of residential, industrial buildings and similar buildings. The boiler unit consists of a water backed combustion chamber and the heat exchanger with a burner mounted in the combustion chamber. Pellets are stored in an integrated hopper and fed into the burner via an auger screw which drops the fuel from the top of the auger into the burner. Combustion air is drawn through the air holes in the burner by the exhaust fan which maintains a constant under-pressure in the combustion chamber.

Further detailed descriptions of individual assembly groups are provided in the enclosed technical documentation to Task 31-10460.

II. Sample tested

Boiler output versions that are the subject of the proceedings:

(table 1)

Boiler output version	Heat output	Sample number	Place of testing
V6 PELLET MICRO 8	8 kW	0211.17.17611.000	SZU, Hudcova 424/56b, Brno

The visual inspection, tests and verification were carried out by Ing. Michal Havlů, Test Engineer, at the test station of SZU in Brno, in 09/2017.

The tests were carried out with the use of validly calibrated measuring and test equipment.



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	022331	05/2018	see KL 6051-KL-H0184-16
3.	Induction flow meter	022389-C/1	10/2017	see KL 6015-KL-P0446-13
4.	Temperature measurement set	022399-D/8	11/2017	see KL 140074
5.	Thermometer, Moisture meter	116258	12/2018	see KL 10280/2015
6.	Barometer	112541	01/2019	see KL 6013-KL-K0001-14
7.	Draught gauge	MaR11-Tah	06/2019	see KL 6013-KL-C0423-17
8.	Electronic stop watch	990760	11/2017	see KL 2955E-12
9.	Gravimat SHC 501	022328	04/2018	see KL 150046-150050
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	04/2018	see KL Q 0254/2012
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. Methods, results of tests and verifications

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	+
2.	Surface temperature test (T 001*)	ČSN EN 303-5:2013 Art. 5.12, 5.16.4, 4.3.6	Pages 6 - 7	+
3.	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 8 - 10	+
4.	Electrical consumption (T 071*)	ČSN EN 303-5:2013 Art. 5.8.5 ČSN EN 15456 Art. 5	Page 11	+
5.	Combustion efficiency test – emissions (T 001*)	ČSN EN 303-5:2013 Art. 5.7.3, 5.7.4, 5.9, 5.10.4	Pages 12 - 13	+
6.	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 14 - 15	+
		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 16 - 17	+
		ČSN EN 303-5:2013 Annex C, Deviation from Germany, C.5.1, C.5.2	Page 18	+
		ČSN EN 303-5:2013 Annex C C.6 Deviation from Switzerland	Pages 19 - 20	+
		ČSN EN 303-5:2013 Annex C C.8 Deviation from Italy	-	0
7.	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 21 - 23	+

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: V6 PELLET MICRO 8

Measuring equipment used: Chapter III - Measuring and test equipment

Test results:

Requirement	Requirement specification	Test evaluation	Note
Pressure test for boilers of sheet or sheet metal of non-ferrous metal	ČSN EN 303-5:2013 Art. 5.4		
Tests to be carried out before production 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	<div style="text-align: center;">+</div> <div style="text-align: center;">+</div> <div style="text-align: center;">+</div> <div style="text-align: center;">+</div> <div style="text-align: center;">+</div>	Enclosed technical documentation.
Test during production 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	+	

Testing date: 2017-09-24

Ambient conditions:	22.9 °C	35.0 %	99.46 kPa
	temperature	relative humidity	barometric pressure

Maximum working pressure [bar]	Prescribed testing pressure [bar]	Preset testing pressure [bar]	Test medium	Test time [min]
3	6	6	water	30

Test evaluation:

No leakages or visible permanent deformations appeared during the test.



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: V6 PELLET MICRO 8

Measuring equipment used: Chapter III - Measuring and test equipment

Test results:

Requirement	Requirement specification	Test evaluation	Note
Surface temperature 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"> – 35 K for metals and similar materials; – 45 K for porcelain and similar materials; – 60 K for plastics and similar materials. 	ČSN EN 303-5:2013 Art. 4.3.6	+	
Resistance to thermal conductance 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: V6 PELLET MICRO 8

Average temperatures of boiler walls, doors and covers (°C):		
Boiler type	V6 PELLET MICRO 8	
Fuel type	Wood Pellets - C1	
Heat output	Nominal	Minimum
Testing date	2017-09-24	2017-09-24
ambient temperature (°C)	22.9	23.1
humidity (%)	35.0	35.0
air pressure (kPa)	99.46	99.59
Front wall	29.0	24.0
Rear wall	29.0	24.0
Right wall	29.0	24.0
Left wall	29.0	30.0
Upper wall	32.0	28.0
Lower wall	35.0	28.0
Temperatures of control elements (°C):		
El. control panel (plastic)	32.0	
Safety temperature limiter - STB (plastic)	33.0	

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: V6 PELLET MICRO 8
Measuring equipment used: Chapter III - Measuring and test equipment

Test results:

Average measured and calculated values (solid fuels):

Test:	I.	II.
Boiler type:	V6 PELLET MICRO 8	
Testing date:	2017-09-24	2017-09-24
Output tested:	Nominal	Minimum
Fuel type:	Wood pellets - C1	
Combustion period, (automatic) stoking	Minimally 6 hours	
Nominal heat output (specified by manufacturer) [kW]	8	8
Flue gas temperature [°C]	110.9	85.0
Fuel mass added [kg/h]	1.900	0.555
Inlet water temperature [°C]	60.0	62.0
Outlet water temperature [°C]	78.3	76.0
Cooling water temperature [°C]	0.0	0.0
Cooling water flow rate [m3/h]	0.3800	0.1360
Draught [Pa]	15.0	10.0
Ambient temperature [°C]	22.9	23.1
Relative air humidity [%]	35.0	35.0
Barometric pressure [kPa]	99.46	99.59

Analysis of combustion products:

Test (period of burning) :	I.	II.
Oxygen O ₂ [%]	6.80	13.50
Carbon dioxide CO ₂ [%]	13.20	7.00
Carbon monoxide CO [ppm]	55	65
Higher hydrocarbons THC/OGC [ppm]	3	3
Nitrogen oxides NO _x [ppm]	85	55
Sulphur oxides SO ₂ [ppm]	0	0



Auxiliary combustion values (solid fuels):

Test (period of burning) :		I.	II.
Stoichiometric oxygen volume	[m ³ /kg]	0.936	0.936
Stoichiometric air volume	[m ³ /kg]	4.455	4.455
Stoichiometric volume of dry combustion products	[m ³ /kg]	4.388	4.388
Maximum content of CO ₂	[%]	19.79	19.79
Stoichiometric air multiple	[-]	1.47	2.77
Volume of dry combustion products. actual	[m ³ /kg]	6.578	12.398
Content of H ₂ O in combustion air	[m ³ /kg]	0.065	0.124
Content of H ₂ O in combustion products	[m ³ /kg]	0.824	0.883
Flue gas mass flow	[kg/s]	0.00507	0.00254

Calculated values - thermal overview

Test (period of burning) :		I.	II.
Loss of sensible heat of combustion products	[%]	5.3	6.5
Loss of gas underburning	[%]	0.0	0.1
Loss of mechanical underburning	[%]	0.0	0.0
Loss of heat transfer into environment	[%]	2.8	3.5
Total loss	[%]	8.1	10.0
Efficiency – indirect method	[%]	91.9	90.0
Fuel mass added - actual	[kg/h]	1.907	0.557
Heat input	[kW]	9.0	2.6
Heat output	[kW]	8.2	2.4
Uncertainty of determining heat output	[kW]	0.3	0.1
Efficiency – direct method	[%]	90.8	89.8
Output / nominal output	[%]	102.3	29.6

At nominal and minimum 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]	18.51	0.22
Lower heating value	Q_j	[MJ/kg]	17.02	0.22
All water in original condition	W_t^r	[% by weight]	7.15	0.01
Ash	A	[% by weight]	0.33	0.02
Carbon	C	[% by weight]	46.97	0.24
Hydrogen	H	[% by weight]	6.04	0.20
Nitrogen	N	[% by weight]	0.05	0.14
Sulphur	S	[% by weight]	0.007	0.004
Chlorine	Cl	[% by weight]	0.014	0.003
Oxygen – calculation for 100%	O	[% by weight]	39.44	
Conversion factor f_{emis} for emissions in [mg/m ³] to [mg/MJ]	f_{emis}	[-]	0.26176	

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.



Accredited test
number:

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

Test method: ČSN EN 303-5:2013 Art. 5.8.5

Sample tested: V6 PELLET MICRO 8

Measuring equipment used: Chapter III - Measuring and test equipment

Test results:

Requirement	Requirement specification	Test evaluation	Note
Electrical consumption During the tests, the electrical consumption shall be determined according to EN 15456. The values for maximum consumption, for stand by, 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	+	

Test results:

V6 PELLET MICRO 8	
Maximum electrical input	370 W
Electrical input at nominal heat output	70 W
Electrical input at minimum heat output	60 W
Electrical input for STAND BY mode	4 W
Maximum electrical input for ignition system	300 W
Maximum electrical input for fuel supply (fuel line)	60 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: V6 PELLET MICRO 8

Measuring equipment used: Chapter III - Measuring and test equipment

Requirement	Requirement specification	Test evaluation	Note
Emission limits 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/m³ at 10% O₂								
		kW	Class	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.

^a Referred to dry exit flue gas, 0 °C, 1013 mbar.

^b 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/m³ at 10 % O₂.



Measurement results: V6 PELLET MICRO 8 - Wood pellets - C1

Boiler output	Average values									
	Measured values						Converted values O ₂ =10%			
	O ₂ [%]	CO ₂ [%]	CO [ppm]	OGC/THC [ppm]	NO _x [ppm]	Dust [mg/m ³]	CO [mg/m ³]	OGC/THC [mg/m ³]	NO _x [mg/m ³]	Dust [mg/m ³]
Nominal	6.80	13.20	55	3	85	26	53	4	135	20
Minimum	13.50	7.00	65	3	55	15	119	7	166	22

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

Test evaluation:

V6 PELLET MICRO 8 - Wood pellets - C1 meets at nominal and minimum 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**

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

Sample tested: V6 PELLET MICRO 8

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		ČSN EN 303-5:2013 Annex C, Deviation from Austria, C.2.2	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 Pn) %		
>200 kW	89 %		
a) automatically loaded			+
up to 10 kW	80 %		
>10 to 200 kW	(72.3 + 7.7 log Pn) %		
>200 kW	90 %		
NOTE Pn is the nominal heat output (Qn in this standard)			

Requirement		Requirement specification	Test evaluation		
Emission limits		ČSN EN 303-5:2013 Annex C, Deviation from Austria, C.2.3			
Small burners used for solid fuels automatically loaded					
Parameter	Emission limits mg-MJ				
	Wood Pellets Room heaters		Wood Pellets Central heaters	Other wooden fuels	Other standardised biogenous fuels
CO	500 ^a		250 ^a	250 ^a	500 ^a
NO _x	100		100	100	300
OGC/THC	30		20	30	20
Dust	25	20	30	35	
			+		

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

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



Measurement results: V6 PELLET MICRO 8 - Wood pellets - C1

Boiler output	Minimum efficiency	Measured efficiency
Nominal	80.0	90.8
Minimum		89.8

Test evaluation:

The measured efficiency of V6 PELLET MICRO 8 - Wood pellets - C1 is **higher** than required.

Measurement results: V6 PELLET MICRO 8 - Wood pellets - C1

Boiler output	Average values								
	Measured values					Converted values O ₂ =0%			
	O ₂ [%]	CO [ppm]	NO _x [ppm]	OGC/THC [ppm]	Dust [mg/m ³]	CO [mg/MJ]	NO _x [mg/MJ]	OGC/THC [mg/MJ]	Dust [mg/MJ]
Nominal	6.80	55	85	3	26	26	67	2	10
Minimum	13.50	65	55	3	15	59	82	4	11

Test evaluation:

The measured emission values for V6 PELLET MICRO 8 - 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**

Requirement:

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

Sample tested:

V6 PELLET MICRO 8

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

Requirement	Requirement specification	Test evaluation
Boiler Efficiency	ČSN EN 303-5:2013 Annex C, Deviation from Denmark, C.4.1	Wood Pellets - C1
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.		
Minimum efficiency (67 + 6 log Q_n) %		+
For boilers above 300 kW, the requirement corresponding to 300 kW shall be used.		

Requirement					Requirement specification	Test evaluation
Emission limits						
According to the Danish EPA Statutory Order no. 1432 of 11-12-2007, only Class 3 (or higher) is acceptable for Denmark.					ČSN EN 303-5:2013 Annex C, Deviation from Denmark, C.4.2	Wood Pellets - C1
Stoking	Fuel	Nominal heat output	Emission limit values ^a			
			CO	OGC/THC		Dust
			mg-m ³ at 10% O ₂			
	kW	Class				
		3				
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			
^a Referring to dry exit flue gas. 0 °C. 1 013 mbar.						

^a Referring to dry exit flue gas, 0 °C, 1 013 mbar.



Measurement results: V6 PELLET MICRO 8 - Wood pellets - C1

Boiler output	Minimum efficiency	Measured efficiency
Nominal	72.4	90.8
Minimum		89.8

Test evaluation:

Measured efficiency for V6 PELLET MICRO 8 - Wood pellets - C1 is **higher** than required.

Measurement results: V6 PELLET MICRO 8 - Wood pellets - C1

Boiler output	Average emission values						
	Measured values				Converted values O ₂ =10%		
	O ₂ [%]	CO [ppm]	OGC/THC [ppm]	Dust [mg/m ³]	CO [mg/m ³]	OGC/THC [mg/m ³]	Dust [mg/m ³]
Nominal	6.80	55	3	26	53	4	20
Minimum	13.50	65	3	15	119	7	22

Test evaluation:

The measured emission values for V6 PELLET MICRO 8 - 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**

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

Sample tested: V6 PELLET MICRO 8

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

Requirement					Requirement specification	Test evaluation
Emission limits						
Table 7 – Emission limits					ČSN EN 303-5:2013 Annex C, Deviation from Germany, C.5.1, C.5.2	
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 ³	CO g/m ³		
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: V6 PELLET MICRO 8 - Wood pellets - C1

Boiler output	Average emission values				
	Measured values			Converted values O ₂ =13%	
	O ₂ [%]	CO [ppm]	Dust [mg/m ³]	CO [g/m ³]	Dust [g/m ³]
Nominal	6.80	55	26	0.039	0.015
Minimum	13.50	65	15	0.087	0.016

Test evaluation:

The measured emission values for V6 PELLET MICRO 8 - 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**

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

Sample tested: V6 PELLET MICRO 8

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 C.6 Deviation from Switzerland	
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	Particular requirements (emission limits) ^a for carbon monoxide (CO) and particulate matter (dust)			Wood Pellets - C1
	CO (mg·m ⁻³)	Dust (mg·m ⁻³)		
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		+
^a 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: V6 PELLET MICRO 8 - Wood pellets - C1

Boiler output	Average emission values				
	Measured values			Converted values O ₂ =13%	
	O ₂ [%]	CO [ppm]	Dust [mg/m ³]	CO [mg/m ³]	Dust [mg/m ³]
Nominal	6.80	55	26	39	15
Minimum	13.50	65	15	87	16

Test evaluation:

The measured emission values for V6 PELLET MICRO 8 - 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: V6 PELLET MICRO 8

Measuring equipment used: Chapter III - Measuring and test equipment

Test results:

Requirement	Requirement specification	Test evaluation	Note
<p>Function check of the temperature controller and safety temperature limiter at the boiler</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 Q_N 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 $(40 \pm 5) \%$ 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>Function test for the rapidly disconnectable firing system</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 Q_N 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 Q_N 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>Safety test of consequences of fuel overload and effect of a blockage of the fuel supply</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>The requirements specified in 4.3.4 shall be satisfied.</p>	<p>ČSN EN 303-5:2013 Art. 5.16.2</p>	<p>+</p>	



Requirement	Requirement specification	Test evaluation	Note
Loss of combustion air supply The safety of the heating boiler shall be checked at maximum heat input under the following conditions: <ul style="list-style-type: none"> – failure of combustion air fan; – failure to close of the adjustable combustion air supply. 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. Test of combustion air supply loss	ČSN EN 303-5:2013 Art. 5.16.3	+	

Note:

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

Measurement results:

Temperature controller		
Temperature	[°C]	Note:
Pre-set	90.0	Temperature set on the operating thermostat regulator
Shutdown	91.0	Fan and stoking switched off (suppression mode)
Restoration of operation	85.0	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	103.0	Temperature set on the temperature limiter
Shutdown	104.0	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 Havlů Date: 09/2017, 02/2020

Signed: 

Reviewed by: Ing. Stanislav Buchta Date: 07/2019, 02/2020

Signed: 



V. A list of other referenced documents

- 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 - Electrical power consumption for heat generators - System boundaries - Measurements
- ČSN ISO 80000-1:2011 – Quantities and units – Part 1: General

Test Report compiled by: Ing. Michal Havlů

Test Report approved by:

Mr. Milan Holomek

Head of Heat and Environment-Friendly Equipment
Test Station



-End of text-



TEST REPORT

31-10460/2/T

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

Type designation V6 PELLET MICRO 12

Customer: MCE Małopolskie Centrum Ekologiczne
S. Migdałek, P. Kozłowski s.c.
Klecza Dolna 15a
34-124 Klecza Górna
POLAND

Manufacturer: GREŃ sp.j.
ul. Górnośląska 5
43-200 Pszczyna
POLAND

Employee responsible:

Report issue date: 2020-02-28

Distribution list: 1 copy to the Engineering Test Institute (SZU)
1 copy to the Customer

This report may be copied in its entirety without written consent of the Engineering Test Institute.
The results of tests and verifications only apply to the products tested as received or presented.
The testing laboratory is not responsible for the data provided by the customer in the report.



The tests were performed based on these documents:

- Order B-68992 of 2020-02-10 (Order reg. no. B-68992 delivered on 2020-02-10)
- Contract B-68992/31

I. Description of product tested

The Hot-water boiler for solid fuel (wood pellets - C1) with automatic fuel supply, V6 PELLET MICRO 12 is intended for heating of residential, industrial buildings and similar buildings. The boiler unit consists of a water backed combustion chamber and the heat exchanger with a burner mounted in the combustion chamber. Pellets are stored in an integrated hopper and fed into the burner via an auger screw which drops the fuel from the top of the auger into the burner. Combustion air is drawn through the air holes in the burner by the exhaust fan which maintains a constant under-pressure in the combustion chamber.

Further detailed descriptions of individual assembly groups are provided in the enclosed technical documentation to Task 31-10460.

II. Sample tested

Boiler output versions that are the subject of the proceedings:

(table 1)

Boiler output version	Heat output	Sample number	Place of testing
V6 PELLET MICRO 12	12 kW	0211.17.17611.000	SZU, Hudcova 424/56b, Brno

The visual inspection, tests and verification were carried out by Ing. Michal Havlů, Test Engineer at the test station of SZU in Brno, in 09/2017.

The tests were carried out with the use of validly calibrated measuring and test equipment.



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	022331	05/2018	see KL 6051-KL-H0184-16
3.	Induction flow meter	022389-C/1	10/2017	see KL 6015-KL-P0446-13
4.	Temperature measurement set	022399-D/8	11/2017	see KL 140074
5.	Thermometer, Moisture meter	116258	12/2018	see KL 10280/2015
6.	Barometer	112541	01/2019	see KL 6013-KL-K0001-14
7.	Draught gauge	MaR11-Tah	06/2019	see KL 6013-KL-C0423-17
8.	Electronic stop watch	990760	11/2017	see KL 2955E-12
9.	Gravimat SHC 501	022328	04/2018	see KL 150046-150050
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	04/2018	see KL Q 0254/2012
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. Methods, results of tests and verifications

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	+
2.	Surface temperature test (T 001*)	ČSN EN 303-5:2013 Art. 5.12, 5.16.4, 4.3.6	Pages 6 - 7	+
3.	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 8 - 10	+
4.	Electrical consumption (T 071*)	ČSN EN 303-5:2013 Art. 5.8.5 ČSN EN 15456 Art. 5	Page 11	+
5.	Combustion efficiency test – emissions (T 001*)	ČSN EN 303-5:2013 Art. 5.7.3, 5.7.4, 5.9, 5.10.4	Pages 12 - 13	+
6.	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 14 - 15	+
		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 16 - 17	+
		ČSN EN 303-5:2013 Annex C, Deviation from Germany, C.5.1, C.5.2	Page 18	+
		ČSN EN 303-5:2013 Annex C C.6 Deviation from Switzerland	Pages 19 - 20	+
		ČSN EN 303-5:2013 Annex C C.8 Deviation from Italy	-	0
7.	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 21 - 23	+

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:

V6 PELLET MICRO 12

Measuring equipment used:

Chapter III - Measuring and test equipment

Test results:

Requirement	Requirement specification	Test evaluation	Note
Pressure test for boilers of sheet or sheet metal of non-ferrous metal	ČSN EN 303-5:2013 Art. 5.4		
Tests to be carried out before production 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	<div style="text-align: center;">+</div> <div style="text-align: center;">+</div> <div style="text-align: center;">+</div> <div style="text-align: center;">+</div> <div style="text-align: center;">+</div>	Enclosed technical documentation.
Test during production 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	+	

Testing date:

2017-09-25

Ambient conditions:

23.0 °C

32.0 %

99.32 kPa

temperature

relative humidity

barometric pressure

Maximum working pressure [bar]	Prescribed testing pressure [bar]	Preset testing pressure [bar]	Test medium	Test time [min]
3	6	6	water	30

Test evaluation:

No leakages or visible permanent deformations appeared during the test.



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: V6 PELLET MICRO 12

Measuring equipment used: Chapter III - Measuring and test equipment

Test results:

Requirement	Requirement specification	Test evaluation	Note
Surface temperature 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"> - 35 K for metals and similar materials; - 45 K for porcelain and similar materials; - 60 K for plastics and similar materials. 	ČSN EN 303-5:2013 Art. 4.3.6	+	
Resistance to thermal conductance 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: V6 PELLET MICRO 12

Average temperatures of boiler walls, doors and covers (°C):		
Boiler type	V6 PELLET MICRO 12	
Fuel type	Wood Pellets - C1	
Heat output	Nominal	Minimum
Testing date	2017-09-25	2017-09-24
ambient temperature (°C)	23.0	23.1
humidity (%)	32.0	35.0
air pressure (kPa)	99.32	99.59
Front wall	31.0	24.0
Rear wall	32.0	24.0
Right wall	30.0	24.0
Left wall	30.0	30.0
Upper wall	33.0	28.0
Lower wall	36.0	28.0
Temperatures of control elements (°C):		
El. control panel (plastic)	32.0	
Safety temperature limiter - STB (plastic)	33.0	

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: V6 PELLET MICRO 12

Measuring equipment used: Chapter III - Measuring and test equipment

Test results:

Average measured and calculated values (solid fuels):

Test:	I.	II.
Boiler type:	V6 PELLET MICRO 12	
Testing date:	2017-09-25	2017-09-24
Output tested:	Nominal	Minimum
Fuel type:	Wood pellets - C1	
Combustion period, (automatic) stoking	Minimally 6 hours	
Nominal heat output (specified by manufacturer) [kW]	12	12
Flue gas temperature [°C]	120.1	85.0
Fuel mass added [kg/h]	2.850	0.555
Inlet water temperature [°C]	58.4	62.0
Outlet water temperature [°C]	79.0	76.0
Cooling water temperature [°C]	0.0	0.0
Cooling water flow rate [m ³ /h]	0.5100	0.1360
Draught [Pa]	15.0	10.0
Ambient temperature [°C]	23.0	23.1
Relative air humidity [%]	32.0	35.0
Barometric pressure [kPa]	99.32	99.59

Analysis of combustion products:

Test (period of burning) :	I.	II.
Oxygen O ₂ [%]	6.40	13.50
Carbon dioxide CO ₂ [%]	13.50	7.00
Carbon monoxide CO [ppm]	75	65
Higher hydrocarbons THC/OGC [ppm]	2	3
Nitrogen oxides NO _x [ppm]	87	55
Sulphur oxides SO ₂ [ppm]	0	0



Auxiliary combustion values (solid fuels):

Test (period of burning) :		I.	II.
Stoichiometric oxygen volume	[m ³ /kg]	0.936	0.936
Stoichiometric air volume	[m ³ /kg]	4.455	4.455
Stoichiometric volume of dry combustion products	[m ³ /kg]	4.388	4.388
Maximum content of CO ₂	[%]	19.79	19.79
Stoichiometric air multiple	[-]	1.43	2.77
Volume of dry combustion products. actual	[m ³ /kg]	6.431	12.398
Content of H ₂ O in combustion air	[m ³ /kg]	0.058	0.124
Content of H ₂ O in combustion products	[m ³ /kg]	0.817	0.883
Flue gas mass flow	[kg/s]	0.00745	0.00265

Calculated values - thermal overview

Test (period of burning) :		I.	II.
Loss of sensible heat of combustion products	[%]	5.7	6.5
Loss of gas underburning	[%]	0.0	0.1
Loss of mechanical underburning	[%]	0.0	0.0
Loss of heat transfer into environment	[%]	2.4	3.5
Total loss	[%]	8.1	10.0
Efficiency – indirect method	[%]	91.9	90.0
Fuel mass added - actual	[kg/h]	2.860	0.557
Heat input	[kW]	13.5	2.6
Heat output	[kW]	12.2	2.4
Uncertainty of determining heat output	[kW]	0.5	0.1
Efficiency – direct method	[%]	90.3	89.8
Output / nominal output	[%]	101.8	29.6

At nominal and minimum 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]	18.51	0.22
Lower heating value	Q_j	[MJ/kg]	17.02	0.22
All water in original condition	W_t^r	[% by weight]	7.15	0.01
Ash	A	[% by weight]	0.33	0.02
Carbon	C	[% by weight]	46.97	0.24
Hydrogen	H	[% by weight]	6.04	0.20
Nitrogen	N	[% by weight]	0.05	0.14
Sulphur	S	[% by weight]	0.007	0.004
Chlorine	Cl	[% by weight]	0.014	0.003
Oxygen – calculation for 100%	O	[% by weight]	39.44	
Conversion factor f_{emis} for emissions in [mg/m ³] to [mg/MJ]	f_{emis}	[-]	0.26176	

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.



Accredited test
number:

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

Test method: ČSN EN 303-5:2013 Art. 5.8.5

Sample tested: V6 PELLET MICRO 12

Measuring equipment used: Chapter III - Measuring and test equipment

Test results:

Requirement	Requirement specification	Test evaluation	Note
Electrical consumption During the tests, the electrical consumption shall be determined according to EN 15456. The values for maximum consumption, for stand by, 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	+	

Test results:

V6 PELLET MICRO 12	
Maximum electrical input	370 W
Electrical input at nominal heat output	130 W
Electrical input at minimum heat output	100 W
Electrical input for STAND BY mode	4 W
Maximum electrical input for ignition system	300 W
Maximum electrical input for fuel supply (fuel line)	60 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:

V6 PELLET MICRO 12

Measuring equipment used:

Chapter III - Measuring and test equipment

Requirement	Requirement specification	Test evaluation	Note
Emission limits 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 ³ at 10% O ₂								
		kW	Class	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.

^a Referred to dry exit flue gas, 0 °C, 1013 mbar.

^b 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/m³ at 10 % O₂.



Measurement results: V6 PELLET MICRO 12 - Wood pellets - C1

Boiler output	Average values									
	Measured values						Converted values O ₂ =10%			
	O ₂ [%]	CO ₂ [%]	CO [ppm]	OGC/THC [ppm]	NO _x [ppm]	Dust [mg/m ³]	CO [mg/m ³]	OGC/THC [mg/m ³]	NO _x [mg/m ³]	Dust [mg/m ³]
Nominal	6.40	13.50	75	2	87	27	71	2	135	20
Minimum	13.50	7.00	65	3	55	15	119	7	166	22

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

Test evaluation:

V6 PELLET MICRO 12 - Wood pellets - C1 meets at nominal and minimum 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**

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

Sample tested: V6 PELLET MICRO 12

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		ČSN EN 303-5:2013 Annex C, Deviation from Austria, C.2.2	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 %		
a) automatically loaded			
up to 10 kW	80 %		+
>10 to 200 kW	(72.3 + 7.7 log P _n) %		
>200 kW	90 %		
NOTE <i>P_n is the nominal heat output (Q_n in this standard)</i>			

Requirement	Requirement specification	Test evaluation
Emission limits	ČSN EN 303-5:2013 Annex C, Deviation from Austria, C.2.3	Wood Pellets - C1
Small burners used for solid fuels automatically loaded		
Emission limits mg-MJ		+
Parameter		
Wood Pellets Room heaters		
Wood Pellets Central heaters		
Other wooden fuels		
Other standardised biogenous fuels		
CO	500 ^a	250 ^a
NO _x	100	100
OGC/THC	30	30
Dust	25	35

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



Measurement results: V6 PELLET MICRO 12 - Wood pellets - C1

Boiler output	Minimum efficiency	Measured efficiency
Nominal	80.6	90.3
Minimum		89.8

Test evaluation:

The measured efficiency of V6 PELLET MICRO 12 - Wood pellets - C1 is **higher** than required.

Measurement results: V6 PELLET MICRO 12 - Wood pellets - C1

Boiler output	Average values								
	Measured values					Converted values O ₂ =0%			
	O ₂ [%]	CO [ppm]	NO _x [ppm]	OGC/THC [ppm]	Dust [mg/m ³]	CO [mg/MJ]	NO _x [mg/MJ]	OGC/THC [mg/MJ]	Dust [mg/MJ]
Nominal	6.40	75	87	2	27	35	66	1	10
Minimum	13.50	65	55	3	15	59	82	4	11

Test evaluation:

The measured emission values for V6 PELLET MICRO 12 - 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**

Requirement:

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

Sample tested:

V6 PELLET MICRO 12

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

Requirement	Requirement specification	Test evaluation
Boiler Efficiency	ČSN EN 303-5:2013 Annex C, Deviation from Denmark, C.4.1	Wood Pellets - C1
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.		
Minimum efficiency (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						
According to the Danish EPA Statutory Order no. 1432 of 11-12-2007, only Class 3 (or higher) is acceptable for Denmark.					ČSN EN 303-5:2013 Annex C, Deviation from Denmark , C.4.2	Wood Pellets - C1
Stoking	Fuel	Nominal heat output	Emission limit values ^a			
			CO	OGC/THC		Dust
			mg-m ³ at 10% O ₂			
	kW	Class 3				
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			
						+

^a Referring to dry exit flue gas, 0 °C, 1 013 mbar.

^a Referring to dry exit flue gas, 0 °C, 1 013 mbar.



Measurement results: V6 PELLET MICRO 12 - Wood pellets - C1

Boiler output	Minimum efficiency	Measured efficiency
Nominal	73.5	90.3
Minimum		89.8

Test evaluation:

Measured efficiency for V6 PELLET MICRO 12 - Wood pellets - C1 is **higher** than required.

Measurement results: V6 PELLET MICRO 12 - Wood pellets - C1

Boiler output	Average emission values						
	Measured values				Converted values O ₂ =10%		
	O ₂ [%]	CO [ppm]	OGC/THC [ppm]	Dust [mg/m ³]	CO [mg/m ³]	OGC/THC [mg/m ³]	Dust [mg/m ³]
Nominal	6.40	75	2	27	71	2	20
Minimum	13.50	65	3	15	119	7	22

Test evaluation:

The measured emission values for V6 PELLET MICRO 12 - 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**

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

Sample tested: V6 PELLET MICRO 12

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

Requirement					Requirement specification	Test evaluation
Emission limits						
Table 7 – Emission limits					ČSN EN 303-5:2013 Annex C, Deviation from Germany, C.5.1, C.5.2	
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 ³	CO g/m ³		
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: V6 PELLET MICRO 12 - Wood pellets - C1

Boiler output	Average emission values				
	Measured values			Converted values O ₂ =13%	
	O ₂ [%]	CO [ppm]	Dust [mg/m ³]	CO [g/m ³]	Dust [g/m ³]
Nominal	6.40	75	27	0.051	0.015
Minimum	13.50	65	15	0.087	0.016

Test evaluation:

The measured emission values for V6 PELLET MICRO 12 - 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**

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

Sample tested: V6 PELLET MICRO 12

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 C.6 Deviation from Switzerland	
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	Particular requirements (emission limits) ^a for carbon monoxide (CO) and particulate matter (dust)			Wood Pellets - C1
	CO (mg·m ⁻³)	Dust (mg·m ⁻³)		
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		+
^a 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: V6 PELLET MICRO 12 - Wood pellets - C1

Boiler output	Average emission values				
	Measured values			Converted values O ₂ =13%	
	O ₂ [%]	CO [ppm]	Dust [mg/m ³]	CO [mg/m ³]	Dust [mg/m ³]
Nominal	6.40	75	27	51	15
Minimum	13.50	65	15	87	16

Test evaluation:

The measured emission values for V6 PELLET MICRO 12 - 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: V6 PELLET MICRO 12

Measuring equipment used: Chapter III - Measuring and test equipment

Test results:

Requirement	Requirement specification	Test evaluation	Note
<p>Function check of the temperature controller and safety temperature limiter at the boiler</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 Q_N 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 $(40 \pm 5) \%$ 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>Function test for the rapidly disconnectable firing system</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 Q_N 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 Q_N 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>Safety test of consequences of fuel overload and effect of a blockage of the fuel supply</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>The requirements specified in 4.3.4 shall be satisfied.</p>	<p>ČSN EN 303-5:2013 Art. 5.16.2</p>	<p>+</p>	



Requirement	Requirement specification	Test evaluation	Note
Loss of combustion air supply The safety of the heating boiler shall be checked at maximum heat input under the following conditions: <ul style="list-style-type: none"> – failure of combustion air fan; – failure to close of the adjustable combustion air supply. 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. Test of combustion air supply loss	ČSN EN 303-5:2013 Art. 5.16.3	+	

Note:

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

Measurement results:

Temperature controller		
Temperature	[°C]	Note:
Pre-set	90.0	Temperature set on the operating thermostat regulator
Shutdown	91.0	Fan and stoking switched off (suppression mode)
Restoration of operation	85.0	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	103.0	Temperature set on the temperature limiter
Shutdown	104.0	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 Havlů Date: 09/2017, 02/2020

Signed: 

Reviewed by: Ing. Stanislav Buchta Date: 07/2019, 02/2020

Signed: 



V. A list of other referenced documents

- 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 - Electrical power consumption for heat generators - System boundaries - Measurements
- ČSN ISO 80000-1:2011 – Quantities and units – Part 1: General

Test Report compiled by: Ing. Michal Havlů

Test Report approved by:

Mr. Milan Holomek
Head of Heat and Environment-Friendly Equipment
Test Station



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