L 1045.1

TEST REPORT
32-10676/1/T

Product:	Hot water boilers for solid fuel (wood pellets – C1) with automatic fuel supply
Type designation:	Compact Pellet
Versions:	Compact Pellet 10, Compact Pellet 20, Compact Pellet 30
Customer:	GTH ECO Sp. z o. o. ul. Miodowa 665 34-382 Wieprz Poland
Manufacturer:	GTH ECO Sp. z o. o. ul. Miodowa 665 34-382 Wieprz Poland
Person responsible for review and evaluation:	Ing. Stanislav Buchta
Report issue date:	2021-09-24
Distribution list:	1 copy to the Engineering Test Institute 1 copy to the Customer

The tests were performed based on these documents:

- Order B-73915 dated 2021-08-09 (received on 2021-08-13)
- Contract B-73915/32 dated 2021-09-22

I. Product description, intended use and mode of application

The hot-water boilers **Compact Pellet** for solid fuel (wood pellets – C1) with automatic fuel supply, is intended for heating of residential, industrial buildings and similar buildings. Boiler consists of an exchanger, a container and an automatic ash removal system. Pellet fuel in the hopper goes by gravity to the feeder. The feeder consists of a pellet feeding spiral and a supply motor (geared motor).

Pellets are forced by a spiral from which the flexible tube goes to the burner, which is an integral part of the heat exchanger.

Three-pass system - the combustion chamber is the first line. Then the exhaust gases pass through the smoke tubes of the 2nd line to the return chamber. The third line consists of smoke tubes with a simple shape, which lead the flue gases to the flue chamber, from where they are discharged through the flue to the chimney system.

Ash pan - The ash generated during the combustion process is discharged into a special drawer inside the combustion chamber or into the automatic ash removal system.

Further detailed descriptions of individual assembly groups are provided in the enclosed technical documentation to Tasks 32-10676 and 31-10536.

II. Sample tested

Boiler output versions that are the subject of the proceedings:

(table 1)

Boiler output version	Heat output	Fuel	Place of testing
Compact Pellet 10	10 kW	Wood pellets – C1	BTI GUMKOWSKI Sp. z o.o. Sp. k. Obornicka 71 62-002 Suchy Las POLAND
Compact Pellet 20	20 kW		
Compact Pellet 30	28 kW		

Visual inspection, testing and evaluation were carried out by Ing. Pavel Fojtů, Test Engineer, at the test station of BTI GUMKOWSKI Sp. z o.o. Sp. k., Obornicka 71, 62-002 Suchy Las, POLAND, in 09/2020.

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	02/2021	see 6051-KL-H0334-19
3.	Induction flow meter	022435/F2	12/2021	see 6015-KL-P0894-17
4.	Temperature measurement set	022399-D/8	11/2020	see KL-T-0116-18
5.	Thermometer, Moisture meter	022435/T2	01/2023	see 6036-KL-V0009-18
6.	Barometer	022435/P2	01/2022	see 25/2020
7.	Draught gauge	118510	06/2021	see 6013-KL-C0479-19
8.	Electronic stop watch	990760	11/2022	see 3434E-17
9.	Gravimat SHC 501	022328	04/2022	see KL 150046-150050
10.	Analytic weighing machine Sartorius	021682	05/2021	see KL 19/KA-19
11.	Electronic thermometer	116557	03/2021	see KL 160066
12.	Electrometer	022435/E1	01/2028	see 001/18/E
13.	Induction water meter	022416/14/F1	06/2024	see 6015-KL-P0036-20
14.	Induction water meter	022435/F2	12/2021	6015-KL-P0894-17
15.	Weighing machine	022151	02/2021	see 6051-KL-H0120-19
16.	Weighing machine	022211	02/2021	see 6051-KL-H0333-19
17.	Tape measure	ME 450	03/2022	see KL 1908/2017
18.	Flue gas side soundness testing equipment	022388	11/2021	see KL 5012-KL-P1831-17
19.	Differential pressure gauge	022389-C/10	02/2022	see KL-P-0050-20

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	+
2.	**Test of hydraulic pressure drop (T 001*)**	ČSN EN 303-5:2013 Art. 5.11	Page 6	+
3.	**Surface temperature test (T 001*)**	ČSN EN 303-5:2013 Art. 5.12, 5.16.4, 4.3.6	Pages 7 - 10	+
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 11 - 17	+
5.	**Electrical consumption (T 071*)**	ČSN EN 303-5:2013 Art. 5.8.5 ČSN EN 15456 Art. 5	Pages 18 - 19	+
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 20 - 21	+
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 22 - 25	+
		ČSN EN 303-5:2013 Annex C, C.3 Deviation from Croatia	Page 26	0
		ČSN EN 303-5:2013 Annex C, Deviation from Denmark , C.4.1, C.4.2	Pages 27 - 30	+
		ČSN EN 303-5:2013 Annex C, Deviation from Germany, C.5.1, C.5.2	Pages 31 - 32	+
		ČSN EN 303-5:2013 Annex C C.6 Deviation from Switzerland	Pages 33 - 34	+
		ČSN EN 303-5:2013 Annex C C.8 Deviation from Italy	Page 35	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 36 - 39	+

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: Compact Pellet 10, Compact Pellet 20, Compact Pellet 30

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 × *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.
Test during production Each boiler shall be tested during the production and the test pressure shall be at least 1.43 × *PS*.	ČSN EN 303-5:2013 Art. 5.4.2	+	

Testing date: 2020-09-17

Ambient conditions:

26.1 °C	42.2 %	100.39 kPa
temperature	relative humidity	barometric pressure

Maximum working pressure [MPa]	Prescribed testing pressure [MPa]	Preset testing pressure [MPa]	Test medium	Test time [min]
0.3	0.6	0.6	water	60

Test evaluation: No leakages or visible permanent deformations appeared during the test.

Accredited test number: **T 001*** Test title: **Test of hydraulic pressure drop**

Test method:	ČSN EN 303-5:2013 Art. 5.11
Sample tested:	Compact Pellet 10, Compact Pellet 20, Compact Pellet 30
Measuring equipment used:	Chapter III - Measuring and test equipment

Evaluation results:

Requirement	Requirement specification	Evaluation	Note
Determination of the waterside resistance The water side resistance (measured in mbar) shall be determined for the flow which is equivalent to the rated output of the boiler at a temperature difference of Δt = 10 K and 20 K between the flow and return.	ČSN EN 303-5:2013 Art. 5.11	+	

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

Measurement results: Compact Pellet 10

no.	Q	ΔP
[-]	[$m^3 \cdot h^{-1}$]	[mbar]
differences of 20 K	0.430	0.18
differences of 10 K	0.860	0.56

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

Measurement results: Compact Pellet 20

no.	Q	ΔP
[-]	[$m^3 \cdot h^{-1}$]	[mbar]
differences of 20 K	0.860	0.56
differences of 10 K	1.720	1.81

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

Measurement results: Compact Pellet 30

no.	Q	ΔP
[-]	[$m^3 \cdot h^{-1}$]	[mbar]
differences of 20 K	1.204	2.96
differences of 10 K	2.408	10.96

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: **Surface temperature test**

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

Sample tested: Compact Pellet 10, Compact Pellet 20, Compact Pellet 30

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: - 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: Compact Pellet 10

Average temperatures of boiler walls, doors and covers (^{0}C):		
Boiler type	Compact Pellet 10	
Fuel type	Wood Pellets - C1	
Heat output	Nominal	Minimal
Testing date	2020-09-09	2020-09-10
ambient temperature (°C) humidity (%) air pressure (kPa)	25.1 63.5 100.98	25.1 53.0 100.66
Front wall	39.6	37.2
Rear wall	33.7	31.0
Right wall	29.9	27.5
Left wall	30.1	28.3
Upper wall	34.0	30.8
Lower wall	49.8	38.3
Temperatures of control elements (^{0}C):		
El. control panel (plastic)	29.0	
Lower door handle (plastic)	34.0	
Safety thermostat - STB (plastic)	36.0	
Hopper handle (plastic)	28.0	
Fuel feeder (metal)	31.0	

Measurement uncertainty: 2 ^{0}C for temperatures within the range of (0 ÷ 200) ^{0}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: Compact Pellet 20

Average temperatures of boiler walls, doors and covers (^{0}C):		
Boiler type	Compact Pellet 20	
Fuel type	Wood Pellets - C1	
Heat output	Nominal	Minimal
Testing date	2020-09-07	2020-09-08
ambient temperature (°C) humidity (%) air pressure (kPa)	24.3 53.2 100.90	24.2 53.3 101.02
Front wall	53.3	46.6
Rear wall	37.9	36.0
Right wall	33.6	32.0
Left wall	31.6	30.9
Upper wall	34.1	31.5
Lower wall	49.2	39.8
Temperatures of control elements (^{0}C):		
El. control panel (plastic)	31.0	
Lower door handle (plastic)	31.0	
Safety thermostat - STB (plastic)	36.0	
Hopper handle (plastic)	32.0	
Fuel feeder (metal)	35.0	

Measurement uncertainty: 2 ^{0}C for temperatures within the range of (0 ÷ 200) ^{0}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: Compact Pellet 30

Average temperatures of boiler walls, doors and covers (^{0}C):		
Boiler type	Compact Pellet 30	
Fuel type	Wood Pellets - C1	
Heat output	Nominal	Minimal
Testing date	2020-09-17	2020-09-15
ambient temperature (°C) humidity (%) air pressure (kPa)	26.1 42.2 100.39	27.7 56.1 100.90
Front wall	35.9	37.1
Rear wall	36.8	32.6
Right wall	33.5	31.0
Left wall	34.3	31.5
Upper wall	38.2	35.0
Lower wall	48.8	38.2
Temperatures of control elements (^{0}C):		
El. control panel (plastic)	30.0	
Lower door handle (plastic)	33.0	
Safety thermostat - STB (plastic)	35.0	
Hopper handle (plastic)	32.0	
Fuel feeder (metal)	34.0	

Measurement uncertainty: 2 ^{0}C for temperatures within the range of (0 ÷ 200) ^{0}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: Compact Pellet 10, Compact Pellet 20, Compact Pellet 30

Measuring equipment used: Chapter III - Measuring and test equipment

Test results:

Average measured and calculated values (solid fuels):

Test:		I.	II.
Boiler type:		Compact Pellet 10	
Testing date:		2020-09-09	2020-09-10
Output tested:		Nominal	Minimum
Fuel type:		**Wood pellets - C1**	
Combustion period, (automatic) stoking		Minimally 6 hours	
Nominal heat output (specified by manufacturer)	[kW]	10	10
Flue gas temperature	[°C]	81.1	59.4
Fuel mass added	[kg/h]	2.175	0.702
Inlet water temperature	[°C]	53.2	64.3
Outlet water temperature	[°C]	72.4	73.9
Water flow rate	[m3/h]	0.4245	0.2524
Draught	[Pa]	8.0	4.0
Ambient temperature	[°C]	25.1	25.1
Relative air humidity	[%]	63.5	53.0
Barometric pressure	[kPa]	100.98	100.66

Analysis of combustion products:

Test (period of burning) :		I.	II.
Oxygen O_2	[%]	7.95	12.95
Carbon dioxide CO_2	[%]	12.46	7.48
Carbon monoxide CO	[ppm]	46	139
Higher hydrocarbons THC/OGC	[ppm]	2	3
Nitrogen oxides NOx	[ppm]	84	47
Sulfur oxides SO_2	[ppm]	< 1	< 1

Auxiliary combustion values (solid fuels):

Test (period of burning) :		I.	II.
Stoichiometric oxygen volume	[m^3/kg]	0.928	0.938
Stoichiometric air volume	[m^3/kg]	4.421	4.466
Stoichiometric volume of dry combustion products	[m^3/kg]	4.342	4.386
Maximum content of CO_2	[%]	19.54	19.55
Stoichiometric air multiple	[-]	1.60	2.58
Volume of dry combustion products. actual	[m^3/kg]	6.808	11.443
Content of H_2O in combustion air	[m^3/kg]	0.144	0.197
Content of H_2O in combustion products	[m^3/kg]	0.927	0.979
Flue gas mass flow	[kg/s]	0.00605	0.00312

Calculated values - thermal overview

Test (period of burning) :		I.	II.
Loss of sensible heat of combustion products	[%]	3.5	3.4
Loss of gas underburning	[%]	0.0	0.1
Loss of mechanical underburning	[%]	1.1	0.2
Loss of heat transfer into environment	[%]	2.7	6.7
Total loss	[%]	7.4	10.4
Efficiency – indirect method	[%]	92.6	89.6
Fuel mass added - actual	[kg/h]	2.193	0.704
Heat input	[kW]	10.3	3.3
Heat output	**[kW]**	**9.5**	**2.9**
Uncertainty of determining heat output	[kW]	0.4	0.1
Efficiency – direct method	**[%]**	**92.1**	**89.1**
Output / nominal output	[%]	94.7	29.4

At nominal 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 ± 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.

Test results:

Average measured and calculated values (solid fuels):

Test:		I.	II.
Boiler type:		Compact Pellet 20	
Testing date:		2020-09-07	2020-09-08
Output tested:		Nominal	Minimum
Fuel type:		**Wood pellets - C1**	
Combustion period, (automatic) stoking		Minimally 6 hours	
Nominal heat output (specified by manufacturer)	[kW]	20	20
Flue gas temperature	[°C]	97.7	69.2
Fuel mass added	[kg/h]	4.360	1.367
Inlet water temperature	[°C]	53.7	64.4
Outlet water temperature	[°C]	72.5	74.3
Water flow rate	[m3/h]	0.8651	0.5055
Draught	[Pa]	25.0	10.0
Ambient temperature	[°C]	24.3	24.2
Relative air humidity	[%]	53.2	53.3
Barometric pressure	[kPa]	100.90	101.02

Analysis of combustion products:

Test (period of burning) :		I.	II.
Oxygen O_2	[%]	4.97	11.40
Carbon dioxide CO_2	[%]	15.43	9.00
Carbon monoxide CO	[ppm]	132	104
Higher hydrocarbons THC/OGC	[ppm]	4	2
Nitrogen oxides NOx	[ppm]	99	58
Sulfur oxides SO_2	[ppm]	< 1	< 1

Auxiliary combustion values (solid fuels):

Test (period of burning) :		I.	II.
Stoichiometric oxygen volume	[m^3/kg]	0.903	0.938
Stoichiometric air volume	[m^3/kg]	4.301	4.465
Stoichiometric volume of dry combustion products	[m^3/kg]	4.222	4.385
Maximum content of CO_2	[%]	19.50	19.55
Stoichiometric air multiple	[-]	1.30	2.16
Volume of dry combustion products. actual	[m^3/kg]	5.331	9.519
Content of H_2O in combustion air	[m^3/kg]	0.091	0.157
Content of H_2O in combustion products	[m^3/kg]	0.874	0.940
Flue gas mass flow	[kg/s]	0.00988	0.00512

Calculated values - thermal overview

Test (period of burning) :		I.	II.
Loss of sensible heat of combustion products	[%]	3.7	3.8
Loss of gas underburning	[%]	0.1	0.1
Loss of mechanical underburning	[%]	3.8	0.2
Loss of heat transfer into environment	[%]	2.0	4.2
Total loss	[%]	9.5	8.2
Efficiency – indirect method	[%]	90.5	91.8
Fuel mass added - actual	[kg/h]	4.457	1.372
Heat input	[kW]	20.9	6.4
Heat output	**[kW]**	**18.8**	**5.9**
Uncertainty of determining heat output	[kW]	0.8	0.3
Efficiency – direct method	**[%]**	**90.2**	**91.4**
Output / nominal output	[%]	94.2	29.4

At nominal 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 ± 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.

Test results:

Average measured and calculated values (solid fuels):

Test:		I.	II.
Boiler type:		Compact Pellet 30	
Testing date:		2020-09-17	2020-09-15
Output tested:		Nominal	Minimum
Fuel type:		**Wood pellets - C1**	
Combustion period, (automatic) stoking		Minimally 6 hours	
Nominal heat output (specified by manufacturer)	[kW]	28	28
Flue gas temperature	[°C]	117.6	69.4
Fuel mass added	[kg/h]	6.090	1.890
Inlet water temperature	[°C]	52.8	63.8
Outlet water temperature	[°C]	71.7	73.1
Water flow rate	[m3/h]	1.1929	0.7469
Draught	[Pa]	30.0	8.0
Ambient temperature	[°C]	26.1	27.7
Relative air humidity	[%]	42.2	56.1
Barometric pressure	[kPa]	100.39	100.90

Analysis of combustion products:

Test (period of burning) :		I.	II.
Oxygen O_2	[%]	7.04	11.10
Carbon dioxide CO_2	[%]	13.44	9.35
Carbon monoxide CO	[ppm]	79	74
Higher hydrocarbons THC/OGC	[ppm]	2	3
Nitrogen oxides NOx	[ppm]	92	56
Sulfur oxides SO_2	[ppm]	< 1	< 1

Auxiliary combustion values (solid fuels):

Test (period of burning) :		I.	II.
Stoichiometric oxygen volume	[m^3/kg]	0.914	0.938
Stoichiometric air volume	[m^3/kg]	4.354	4.468
Stoichiometric volume of dry combustion products	[m^3/kg]	4.274	4.388
Maximum content of CO_2	[%]	19.51	19.55
Stoichiometric air multiple	[-]	1.49	2.10
Volume of dry combustion products. actual	[m^3/kg]	6.205	9.165
Content of H_2O in combustion air	[m^3/kg]	0.094	0.197
Content of H_2O in combustion products	[m^3/kg]	0.877	0.980
Flue gas mass flow	[kg/s]	0.01567	0.00686

Calculated values - thermal overview

Test (period of burning) :		I.	II.
Loss of sensible heat of combustion products	[%]	5.3	3.4
Loss of gas underburning	[%]	0.0	0.1
Loss of mechanical underburning	[%]	2.6	0.1
Loss of heat transfer into environment	[%]	1.8	4.2
Total loss	[%]	9.8	7.8
Efficiency – indirect method	[%]	90.2	92.2
Fuel mass added - actual	[kg/h]	6.188	1.896
Heat input	[kW]	29.0	8.9
Heat output	**[kW]**	**26.0**	**8.2**
Uncertainty of determining heat output	[kW]	1.1	0.3
Efficiency – direct method	**[%]**	**89.8**	**91.8**
Output / nominal output	[%]	93.0	29.1

At nominal 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 ± 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]	18.43	0.22
Lower heating value	Q_j	[MJ/kg]	16.87	0.22
All water in original condition	W^r_t	[% by weight]	7.37	0.01
Ash	A	[% by weight]	0.24	0.02
Carbon	C	[% by weight]	46.43	0.24
Hydrogen	H	[% by weight]	6.23	0.20
Nitrogen	N	[% by weight]	0.05	0.14
Sulphur	S	[% by weight]	0.023	0.001
Chlorine	Cl	[% by weight]	0.012	0.001
Oxygen – calculation for 100%	O	[% by weight]	39.04	
Conversion factor f_{emis} for emissions in [mg/m3] to [mg/MJ]	f_{emis}	[-]	0.26071	

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: Compact Pellet 10, Compact Pellet 20, Compact Pellet 30

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:

Compact Pellet 10	
Maximum electrical input	333 W
Electrical input at nominal heat output	48 W
Electrical input at minimum heat output	42 W
Electrical input for STAND BY mode	3 W
Maximum electrical input for ignition system	245 W
Maximum electrical input for fuel supply (fuel line)	53 W

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

Test results:

Compact Pellet 20	
Maximum electrical input	349 W
Electrical input at nominal heat output	68 W
Electrical input at minimum heat output	42 W
Electrical input for STAND BY mode	3 W
Maximum electrical input for ignition system	245 W
Maximum electrical input for fuel supply (fuel line)	53 W

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

Test results:

Compact Pellet 30	
Maximum electrical input	326 W
Electrical input at nominal heat output	57 W
Electrical input at minimum heat output	52 W
Electrical input for STAND BY mode	3 W
Maximum electrical input for ignition system	245 W
Maximum electrical input for fuel supply (fuel line)	53 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: Compact Pellet 10, Compact Pellet 20, Compact Pellet 30

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% O_2								
		kW	Class 3	Class 4	Class 5	Class 3	Class 4	Class 5	Class 3	Class 4	Class 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: Compact Pellet 10 - 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	7.95	12.46	46	2	84	22	48	3	145	19
Minimum	12.95	7.48	139	3	47	9	237	7	131	13

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

Test evaluation:
Compact Pellet 10 - Wood pellets - C1 meets at nominal and minimum output the emission requirements for **Class 5,** as per ČSN EN 303-5:2013 Table 6.

Measurement results: Compact Pellet 20 - 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	4.97	15.43	132	4	99	19	113	4	140	13
Minimum	11.40	9.00	104	2	58	14	148	4	136	16

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

Test evaluation:
Compact Pellet 20 - Wood pellets - C1 meets at nominal and minimum output the emission requirements for **Class 5,** as per ČSN EN 303-5:2013 Table 6.

Measurement results: Compact Pellet 30 - 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	7.04	13.44	79	2	92	20	78	3	149	15
Minimum	11.10	9.35	74	3	56	13	103	5	128	15

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

Test evaluation:
Compact Pellet 30 - 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: Compact Pellet 10, Compact Pellet 20, Compact Pellet 30

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	Wood Pellets – C1
Small burners used for solid fuels automatically loaded						
Parameter	Emission limits mg-MJ					
	Wooden Wood Pellets Room heaters	**Wooden Wood Pellets Central heaters**	Other wooden fuels	Other standard-ised 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.						

Measurement results: Compact Pellet 10 - Wood pellets - C1

Boiler output	Minimum efficiency	Measured efficiency
Nominal	80.0	92.1
Minimum		89.1

Test evaluation:

The measured efficiency of Compact Pellet 10 - Wood pellets - C1 is **higher** than required.

Measurement results: Compact Pellet 10 - 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	7.95	46	84	2	22	24	71	1	9
Minimum	12.95	139	47	3	9	118	65	4	6

Test evaluation:

The measured emission values for Compact Pellet 10 - Wood pellets - C1 **do not exceed** the specified values.

Measurement results: Compact Pellet 20 - Wood pellets - C1

Boiler output	Minimum efficiency	Measured efficiency
Nominal	82.3	90.2
Minimum		91.4

Test evaluation:

The measured efficiency of Compact Pellet 20 - Wood pellets - C1 is **higher** than required.

Measurement results: Compact Pellet 20 - 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	4.97	132	99	4	19	54	67	2	6
Minimum	11.40	104	58	2	14	74	67	2	8

Test evaluation:

The measured emission values for Compact Pellet 20 - Wood pellets - C1 **do not exceed** the specified values.

Measurement results: Compact Pellet 30 - Wood pellets - C1

Boiler output	Minimum efficiency	Measured efficiency
Nominal	83.4	89.8
Minimum		91.8

Test evaluation:

The measured efficiency of Compact Pellet 30 - Wood pellets - C1 is **higher** than required.

Measurement results: Compact Pellet 30 - 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	7.04	79	92	2	20	38	72	1	7
Minimum	11.10	74	56	3	13	51	63	2	7

Test evaluation:

The measured emission values for Compact Pellet 30 - Wood pellets - C1 **do not exceed** the specified values.

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

Requirement: ČSN EN 303-5:2013 Annex C, C.3 Deviation from Croatia

Sample tested: Compact Pellet 10, Compact Pellet 20, Compact Pellet 30

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

Requirement		**Specification of requirement**	**Test evaluation**
Maximum heat losses by combustion products		ČSN EN 303-5:2013 Annex C, C.3 Deviation from Croatia	
Nominal heat output, kW	**Heat losses, %**		
100 – 1000 kW	17 %		0
Emission limits for solid fuels[a]			
Nominal heat output, kW	**CO mg/m3** at 7 % O_2 for coal at 11 % O_2 for wood and biomass		
100 – 1000 kW	1000 mg/m3		0
[a] Emissions are referred to dry exit flue gas, 0 °C, 1013,3 mbar.			

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: Compact Pellet 10, Compact Pellet 20, Compact Pellet 30

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							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.						ČSN EN 303-5:2013 Annex C, Deviation from Denmark , C.4.2	
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**		**150**		+
		> 50 to 150	2500	80			
		> 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.

Measurement results: Compact Pellet 10 - Wood pellets - C1

Boiler output	Minimum efficiency	Measured efficiency
Nominal	73.0	92.1
Minimum		89.1

Test evaluation:

Measured efficiency for Compact Pellet 10 - Wood pellets - C1 is **higher** than required.

Measurement results: Compact Pellet 10 - 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	7.95	46	2	22	48	3	19
Minimum	12.95	139	3	9	237	7	13

Test evaluation:

The measured emission values for Compact Pellet 10 - Wood pellets - C1 **do not exceed** the specified values.

Measurement results: Compact Pellet 20 - Wood pellets - C1

Boiler output	Minimum efficiency	Measured efficiency
Nominal	74.8	90.2
Minimum		91.4

Test evaluation:

Measured efficiency for Compact Pellet 20 - Wood pellets - C1 is **higher** than required.

Measurement results: Compact Pellet 20 - 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	4.97	132	4	19	113	4	13
Minimum	11.40	104	2	14	148	4	16

Test evaluation:

The measured emission values for Compact Pellet 20 - Wood pellets - C1 **do not exceed** the specified values.

Measurement results: Compact Pellet 30 - Wood pellets - C1

Boiler output	Minimum efficiency	Measured efficiency
Nominal	75.7	89.8
Minimum		91.8

Test evaluation:

Measured efficiency for Compact Pellet 30 - Wood pellets - C1 is **higher** than required.

Measurement results: Compact Pellet 30 - 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	7.04	79	2	20	78	3	15
Minimum	11.10	74	3	13	103	5	15

Test evaluation:

The measured emission values for Compact Pellet 30 - 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: Compact Pellet 10, Compact Pellet 20, Compact Pellet 30

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

<table>
<tr><th colspan="6">Requirement</th><th>Requirement specification</th><th>Test evaluation</th></tr>
<tr><td colspan="6">Emission limits</td><td rowspan="10">ČSN EN 303-5:2013
Annex C,
Deviation from Germany, C.5.1, C.5.2</td><td rowspan="2">Wood Pellets – C1</td></tr>
<tr><td colspan="6">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:</td></tr>
<tr><td></td><td>Fuel acc. to §3 (1)</td><td>Nominal output range kW</td><td>Dust g/m³</td><td>CO g/m³</td><td></td></tr>
<tr><td rowspan="4">Stage 2: Appliances, which will be installed after 31.12.2014</td><td>Numbers 1 to 5a</td><td>≥ 4</td><td>0.02</td><td>0.4</td><td>+</td></tr>
<tr><td rowspan="2">Numbers 6 to 7</td><td>≥ 30 ≤ 500</td><td>0.02</td><td>0.4</td><td rowspan="3"></td></tr>
<tr><td>> 500</td><td>0.02</td><td>0.3</td></tr>
<tr><td>Numbers 8 to 13</td><td>≥ 4 < 100</td><td>0.02</td><td>0.4</td></tr>
<tr><td colspan="6">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.</td></tr>
</table>

Measurement results: Compact Pellet 10 - 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	7.95	46	22	0.035	0.014
Minimum	12.95	139	9	0.172	0.009

Test evaluation:

The measured emission values for Compact Pellet 10 - Wood pellets - C1 **do not exceed** the specified values.

Measurement results: Compact Pellet 20 - 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	4.97	132	19	0.082	0.009
Minimum	11.40	104	14	0.108	0.012

Test evaluation:

The measured emission values for Compact Pellet 20 - Wood pellets - C1 **do not exceed** the specified values.

Measurement results: Compact Pellet 30 - 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	7.04	79	20	0.056	0.011
Minimum	11.10	74	13	0.075	0.011

Test evaluation:

The measured emission values for Compact Pellet 30 - 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: Compact Pellet 10, Compact Pellet 20, Compact Pellet 30

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

<table>
<tr><th colspan="3">Requirement</th><th>Requirement specification</th><th>Test evaluation</th></tr>
<tr><td colspan="3">Emission limits
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:</td><td rowspan="6">ČSN EN 303-5:2013
Annex C
C.6 Deviation from Switzerland</td><td rowspan="5">Wood Pellets - C1</td></tr>
<tr><td rowspan="2">Type of installation</td><td colspan="2">Particular requirements (emission limits)[a] for carbon monoxide (CO) and particulate matter (dust)</td></tr>
<tr><td>CO (mg-m^3)</td><td>Dust (mg-m^3)</td></tr>
<tr><td>Boilers for log wood and boilers for coal, manual stoking</td><td>800</td><td>50</td></tr>
<tr><td>Boilers for chipped wood and boilers for coal, automatic stoking</td><td>400</td><td>60</td></tr>
<tr><td>Boilers for Wood Pellets, automatic stoking</td><td>300</td><td>40</td><td>+</td></tr>
<tr><td colspan="5">[a] Referred to oxygen basis:
– for boilers for natural state wood 13 % volume;
– for boilers for coal 7 % volume.</td></tr>
<tr><td colspan="4">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.</td><td>0</td></tr>
</table>

Measurement results: Compact Pellet 10 - 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	7.95	46	22	35	14
Minimum	12.95	139	9	172	9

Test evaluation:

The measured emission values for Compact Pellet 10 - Wood pellets - C1 **do not exceed** the specified values.

Measurement results: Compact Pellet 20 - 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	4.97	132	19	82	9
Minimum	11.40	104	14	108	12

Test evaluation:

The measured emission values for Compact Pellet 20 - Wood pellets - C1 **do not exceed** the specified values.

Measurement results: Compact Pellet 30 - 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	7.04	79	20	56	11
Minimum	11.10	74	13	75	11

Test evaluation:

The measured emission values for Compact Pellet 30 - 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.8 Deviations for Italy

Sample tested: Compact Pellet 10, Compact Pellet 20, Compact Pellet 30

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

Requirement	**Specification of requirement**		**Test evaluation**
Italian emission limits for heating plants fuelled with biomass solid fuels	Emissions refer to an 11% O_2		Wood Pellets - C1
Plant nominal thermal output (MW)	>0,035 ÷ <0,15 (>35kW÷<150kW)	>0,15 ÷ <1 (>150kW÷<1000kW)	
Total Particulate Matter	200mg-Nm^3	100mg-Nm^3	0
Total Organic Carbon (COT) Carbon Monoxide (CO)		- 350 mg-Nm^3	
Nitrogen Dioxide (expressed as NO_2)		500 mg-Nm^3	
Sulphur Dioxide (expressed as SO_2)		200mg-Nm^3	
Italian emission limits for heating plants fuelled with non-biomass solid fuels			
	Emissions refer to an 6% O_2		
Nominal Thermal output (MW)	>0.35 (350kW)		
Total Particulate Matter	50 mg-Nm3		0

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:	Compact Pellet 10, Compact Pellet 20, Compact Pellet 30
Measuring equipment used:	Chapter III - Measuring and test equipment

Test results:

Requirement	Requirement specification	Test evaluation	Note
Function check of the temperature controller and safety temperature limiter at the boiler 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. 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. The dissipated output shall be reduced to (40 ± 5) % of the nominal heat output of the boiler, circulating pump running in continuous operation; temperature controller adjusted to maximum set value. 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. 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).	ČSN EN 303-5:2013 Art. 5.13	+	

Requirement	Requirement specification	Test evaluation	Note
Function test for the rapidly disconnectable firing system – Sudden absence of heat dissipation 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. 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. The heat consumption is set to 0; water circulation in the boiler is permitted; temperature controller is adjusted to manufacture recommended maximum set value. Check if the safety temperature limiter or the temperature controller switches off the firing system and all hazardous operation states are avoided. - Loss of the electrical power supply 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. 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. The electrical power supply including the circulation is cut off, check that no hazardous operation conditions occur. For the evaluation of the temperatures and the CO-concentrations, only mean values at a maximum average time of one minute shall be considered.	ČSN EN 303-5:2013 Art. 5.14	+	
Safety test of consequences of fuel overload and effect of a blockage of the fuel supply 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. 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. The test for blocked fuel line shall be achieved by deactivating the stoking device. **The requirements specified in 4.3.4 shall be satisfied.**	ČSN EN 303-5:2013 Art. 5.16.2	+	

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: – 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	85	Temperature set on the operating thermo-stat regulator
Regulation	84	Fan and stoking start modulation
Maximal temperature	95	The highest reached temperature
Restoration of operation	80	Fan and stoking restored

Temperature limiter (manual restoration of temperature) STB		
Temperature	**[°C]**	**Note:**
Pre-set	100	Temperature set on the temperature limiter
Shutdown	100	Fan and stoking switched off
Maximal temperature	101	The highest reached temperature
Restoration of operation	The boiler irreversibly switched off. In order to restore opera-tion, a manual intervention required, after the temperature drops under the limiter switching temperature	

Tested by: Ing. Pavel Fojtů Date: 09/2020 Signed:

Reviewed by: Ing. Stanislav Buchta Date: 09/2021 Signed:

V. List of source materials

The tests were performed based on

- Order B-73915 dated 2021-08-09 (received on 2021-08-13)
- Contract B-73915/32 dated 2021-09-22
- 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
- ČSN ISO 80000-1:2011 - Quantities and units – Part 1: General

Test report compiled by: Ing. Pavel Fojtů

The persons named below are accountable for the accuracy of the above-specified data:

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