Strojírenský zkušební ústav, s.p.
(Engineering Test Institute, Public Enterprise)
Hudcova 424/56b, 621 00 Brno, Czech Republic

TEST REPORT
39-9917

Product:	Hot-water boilers burning wood pellets with automatic fuel supply
Type designation:	EG PELLET 10 EG PELLET 15 EG PELLET 40
Customer:	Zaklad Slusarski "GREN" sp.j ul. Miarki 1B, 43-200 Pszczyna, Poland
Manufacturer:	Zaklad Slusarski "GREN" sp.j ul. Miarki 1B, 43-200 Pszczyna, Poland
Person responsible for review and evaluation:	Ing. Stanislav Buchta
Report issue date:	2013-08-02
Distribution list:	1 copy to the Engineering Test Institute 1 copy to the Customer

The tests have been conducted based on Order B-46835 of 2013-06-11, Contract B-46835/39 of 2013-06-27, and Amendment to the Contract of 2013-07-22.

I. Product description, intended use and mode of application

The hot-water boilers burning wood pellets with automatic fuel supply, type EG PELLET 10, EG PELLET 15, EG PELLET 40 (GB PELLET 10, GB PELLET 15, GB PELLET 40), are intended for heating of residential houses and similar buildings. The boilers are designed for burning of wood pellets.

The boiler assembly comprises the boiler body, boiler burner, feed screw and the fuel chamber of various construction designs (see the enclosed technical documentation). A rotary separator is fitted between the feed screw of the burner and any of the various types of the fuel chamber. The boiler body is equipped with automatic mechanism for cleaning of combustion product passages. The boiler body is a steel-sheet weldment, cylindrical in shape. The panel with control, regulation and safety elements is in the top part of the boiler. The boiler body is thermally insulated with mineral felt.
Further detailed descriptions of individual assembly groups are provided in the enclosed technical documentation to Task 39-9917.

II. Sample tested

The new measurement was realised based on new eletronic settings (combustion air) for minimal heat output for boilers EG PELLET 10, EG PELLET 15, EG PELLET 40 (GB PELLET 10, GB PELLET 15, GB PELLET 40).

Boiler output versions that are the subject of the proceedings:

Boiler output version	EKV No.	Place of testing
EG PELLET 10	0211.13.15137.000	SZU Brno
EG PELLET 15	0211.13.15137.000	
EG PELLET 40	0211.13.15138.000	

Visual inspection, testing and evaluation were carried out by Ing. Michal Havlů, Test Engineer, at the test station of SZU in Brno, in 07/2013. 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 680 P	92-0004	Calibration prior to each measurement	see CRM 103000237769 see CRM 103000237770
2.	Weighing machine	02-2290	10/2015	see Calibration Sheet 6051-KL-H-0651-10
3.	Water meter, NW 20	02-1575	03/2015	see Calibration Sheet AKL-P/006/2009
4.	Data collection system	02-2241	12/2013	see Calibration Sheet 110002
5.	Moisture meter, thermometer	11-6258	11/2015	see Calibration Sheet 7630F/09
6.	Barometer	11-2541	11/2013	see Calibration Sheet 613-KL-K011-08
7.	Draught gauge	11-7275	01/2015	see Calibration Sheet 0144F/11
8.	Stop watch	99-0760	10/2015	see Calibration Sheet 2850E-07
9.	Calorimeter, IKA, type C 5000	02-2236	03/2015	± 0.12 MJ/kg
10.	Elemental analyser, Perkin Elmer, type 2400 CHNS	02-2107	03/2015	± 0.2 % rel.
11.	Gravimat, SHC 501	02-2328	12/2013	see Calibration Sheet 090177 (8,9), 090180
12.	Laboratory weighing machine	02-1458	06/2015	see Calibration Sheet 6051-KL-H376-09
13.	Weighing machine, Ohaus MB 45	02-2274	06/2015	see Calibration Sheet 6051-KL-H374-09
14.	Manometer	11-1985	02/2014	see Calibration Sheet 090162
15.	Prandtl tube, 0.3 m	ME 484	11/2015	see Calibration Sheet 5012-KL-RS090-09
16.	Psychrometer H 4220	92-0005	12/2013	see Calibration Sheet 090176

IV. Results of tests and evaluation

No.	Requirement	Technical standard, regulation applied	Source materi-als	Evaluation	
				Test	Evalua-tion
1.	**Surface temperature test (1003*)**	ČSN EN 303-5:2013 Art. 5.12, 5.16.4, 4.3.6	Pages 5 - 7	+	
2.	**Test of heat output, input and efficiency(1004.1*)** **Test of combustion prod-uct temperature (1004.2*)**	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 - 13	+	
3.	**Combustion efficiency test – emissions (1005.1*)**	ČSN EN 303-5:2013 Art. 4.4.7, 5.7.3, 5.7.4, 5.9, 5.10.4	Pages 14 - 15	+	
4.	**Test of heat output, input and efficiency (1004.1*)** **Combustion efficiency test – emissions (1005.1*)**	ČSN EN 303-5:2013 Annex C, Deviation from Austria, C.2.2, C.2.3	Pages 16 - 17	+	
		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 18 - 19	+	
		ČSN EN 303-5:2013 Annex C, Deviation from Germany, C.5.1, C.5.2	Pages 20 - 21	+	
		ČSN EN 303-5:2013 Annex C C.6 Deviation from Switzerland	Pages 22 - 23	+	
		ČSN EN 303-5:2013 Annex C C.8 Deviation from Italy	-	0	

Note:
No.:
(**) Not a test

Evaluation:
+ Requirement fulfilled
- Requirement not fulfilled
x Not assessed
0 Not applicable

Accredited test number: **1003*** Test title: **Surface temperature test**

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

Sample tested: EG PELLET 10, EG PELLET 15, EG PELLET 40

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:
EG PELLET 10, EG PELLET 15

Average temperatures of boiler walls, doors and covers (^{0}C):	
Fuel type	Pellets – C1
Front wall	31.4
Rear wall	32.3
Right wall	30.8
Left wall	34.0
Upper wall	32.2
Lower wall (a base was used, non-combustible material)	34.3
Temperatures of control elements (^{0}C):	
Ash-pan door handle - metal	35
El. control panel – plastic	30
Temperature of fuel chamber and stoking elements (^{0}C):	
Inner face of fuel chamber	33
Temperature of fuel line tube (screw feeder - flange)	54

Measurement results:
EG PELLET 40

Average temperatures of boiler walls, doors and covers (^{0}C):	
Fuel type	Pellets – C1
Front wall	27.6
Rear wall	30.1
Right wall	24.5
Left wall	30.4
Upper wall	29.6
Lower wall (a base was used, non-combustible material)	49.7
Temperatures of control elements (^{0}C):	
Ash-pan door handle - metal	35
El. control panel – plastic	30
Temperature of fuel chamber and stoking elements (^{0}C):	
Inner face of fuel chamber	33
Temperature of fuel line tube (screw feeder - flange)	54

Measurement uncertainty: 2 ^{0}C for temperatures within the range of (0 ÷ 250)^{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.

Tested by: Ing. Michal Havlů Date: 07/2013 Signed:

Reviewed by: Ing. Stanislav Buchta Date: 07/2013 Signed:

Accredited test number:	**1004.1*** **1004.2***	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:	EG PELLET 10, EG PELLET 15, , EG PELLET 40,
Measuring equipment used:	Chapter III - Measuring and test equipment

Test results:

Average measured and calculated values (solid fuels):

Test:		I.
Boiler type:		EG PELLET 10
Output tested:		Minimum
Fuel type:		**Pellets - C1**
Combustion period, (manual/automatic) stoking		Minimally 6 hours
Nominal heat output (specified by manufacturer)	[kW]	10
Flue gas temperature	[°C]	64.5
Fuel mass added	[kg/hour]	0.68
Flow temperature	[°C]	80.0
Return temperature	[°C]	72.7
Temperature of the entering cold water	[°C]	21.1
Cooling water flow rate	[m3/hour]	0.0366
Draught	[Pa]	7
Ambient temperature	[°C]	29
Relative air humidity	[%]	32.1
Barometric pressure	[kPa]	99.3

Fuel analysis:

Test (period of burning) :		I.
Oxygen, O_2	[%]	11.77
Carbon dioxide CO_2	[%]	9.08
Carbon monoxide CO	[ppm]	196
Higher hydrocarbons THC/OGC	[ppm]	9
Nitrogen oxides NOx	[ppm]	62

Test results:

Auxiliary combustion values (solid fuels):

Test (period of burning) :		I.
Stoichiometric oxygen volume	[m^3/kg]	0.877
Stoichiometric air volume	[m^3/kg]	4.176
Stoichiometric volume of dry combustion products	[m^3/kg]	4.178
Maximum content of CO_2	[%]	20.99
Stoichiometric air multiple	[-]	2.27
Volume of dry combustion products, actual	[m^3/kg]	9.646
Content of H_2O in combustion air	[m^3/kg]	0.125
Content of H_2O in combustion products	[m^3/kg]	0.756

Calculated values - thermal overview

Test (period of burning) :		I.
Loss of sensible heat of combustion products	[%]	2.8
Loss of gas underburning	[%]	0.2
Loss of mechanical underburning	[%]	0.4
Loss of heat transfer into environment	[%]	6.1
Total loss	[%]	9.4
Heat input	[kW]	3.3
Heat output	**[kW]**	**3.0**
Uncertainty of determining heat output	[kW]	0.1
Efficiency – direct method	**[%]**	**90.3**
Output / nominal output	[%]	29.8

At minimal heat output, when burning **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;
When burning wood pellets, the period of burning is more than 6 hours;
The minimum heat output is less than 30% of nominal heat output.

Average measured and calculated values (solid fuels):

Test:		I.
Boiler type:		EG PELLET 15
Output tested:		Minimum
Fuel type:		**Pellets - C1**
Combustion period, (manual/automatic) stoking		Minimally 6 hours
Nominal heat output (specified by manufacturer)	[kW]	10
Flue gas temperature	[°C]	64.5
Fuel mass added	[kg/hour]	0.68
Flow temperature	[°C]	80.0
Return temperature	[°C]	72.7
Temperature of the entering cold water	[°C]	21.1
Cooling water flow rate	[m3/hour]	0.0366
Draught	[Pa]	7
Ambient temperature	[°C]	29
Relative air humidity	[%]	32.1
Barometric pressure	[kPa]	99.3

Fuel analysis:

Test (period of burning) :		I.
Oxygen, O_2	[%]	11.77
Carbon dioxide CO_2	[%]	9.08
Carbon monoxide CO	[ppm]	196
Higher hydrocarbons THC/OGC	[ppm]	9
Nitrogen oxides NOx	[ppm]	62

Auxiliary combustion values (solid fuels):

Test (period of burning) :		I.
Stoichiometric oxygen volume	[m^3/kg]	0.877
Stoichiometric air volume	[m^3/kg]	4.176
Stoichiometric volume of dry combustion products	[m^3/kg]	4.178
Maximum content of CO_2	[%]	20.99
Stoichiometric air multiple	[-]	2.27
Volume of dry combustion products, actual	[m^3/kg]	9.646
Content of H_2O in combustion air	[m^3/kg]	0.125
Content of H_2O in combustion products	[m^3/kg]	0.756

Calculated values - thermal overview

Test (period of burning) :		I.
Loss of sensible heat of combustion products	[%]	2.8
Loss of gas underburning	[%]	0.2
Loss of mechanical underburning	[%]	0.4
Loss of heat transfer into environment	[%]	6.1
Total loss	[%]	9.4
Heat input	[kW]	3.3
Heat output	**[kW]**	**3.0**
Uncertainty of determining heat output	[kW]	0.1
Efficiency – direct method	**[%]**	**90.3**
Output / nominal output	[%]	19.8

At minimal heat output, when burning **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;
When burning wood pellets, 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.
Boiler type:		EG PELLET 40
Output tested:		Minimum
Fuel type:		**Pellets - C1**
Combustion period, (manual/automatic) stoking		Minimally 6 hours
Nominal heat output (specified by manufacturer)	[kW]	40
Flue gas temperature	[°C]	79.0
Fuel mass added	[kg/hour]	2.470
Flow temperature	[°C]	76.3
Return temperature	[°C]	57.6
Temperature of the entering cold water	[°C]	19.1
Cooling water flow rate	[m3/hour]	0.1640
Draught	[Pa]	7
Ambient temperature	[°C]	26.0
Relative air humidity	[%]	40.6
Barometric pressure	[kPa]	98.9

Fuel analysis:

Test (period of burning) :		I.
Oxygen, O_2	[%]	10.42
Carbon dioxide CO_2	[%]	10.18
Carbon monoxide CO	[ppm]	286
Higher hydrocarbons THC/OGC	[ppm]	8
Nitrogen oxides NOx	[ppm]	91

Auxiliary combustion values (solid fuels):

Test (period of burning) :		I.
Stoichiometric oxygen volume	[m^3/kg]	0.877
Stoichiometric air volume	[m^3/kg]	4.176
Stoichiometric volume of dry combustion products	[m^3/kg]	4.178
Maximum content of CO_2	[%]	20.99
Stoichiometric air multiple	[-]	1.98
Volume of dry combustion products, actual	[m^3/kg]	8.594
Content of H_2O in combustion air	[m^3/kg]	0.115
Content of H_2O in combustion products	[m^3/kg]	0.746

Calculated values - thermal overview

Test (period of burning) :		I.
Loss of sensible heat of combustion products	[%]	3.8
Loss of gas underburning	[%]	0.2
Loss of mechanical underburning	[%]	0.4
Loss of heat transfer into environment	[%]	1.8
Total loss	[%]	6.1
Heat input	[kW]	12.0
Heat output	**[kW]**	**11.3**
Uncertainty of determining heat output	[kW]	0.5
Efficiency – direct method	**[%]**	**93.4**
Output / nominal output	[%]	28.1

At minimal heat output, when burning **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;
When burning wood pellets, 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	Pellets – C1			
Analytical indicator	Symbol	Unit	Value	Uncertainty
Heat of combustion	Q_s	[MJ/kg]	19.71	0.14
Caloric value	Q_j	[MJ/kg]	18.14	0.14
All water in original condition	W^r_t	[% by weight]	5.16	0.01
Ash	A	[% by weight]	0.46	0.02
Carbon	C	[% by weight]	49.07	0.25
Hydrogen	H	[% by weight]	6.63	0.10
Nitrogen	N	[% by weight]	0.16	0.10
Sulphur	S	[% by weight]	0.011	0.001
Chlorine	Cl	[% by weight]	0.015	0.002
Oxygen – calculation for 100%	O	[% by weight]	38.49	
Conversion factor f_{emis} for emissions in [mg/m^3] to [mg/MJ]	f_{emis}	[-]	0.26077	

Note: Sample in original condition

Measurement uncertainty: Specified in Measurement results

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

Tested by: Ing. Michal Havlů Date: 07/2013 Signed:

Reviewed by: Ing. Stanislav Buchta Date: 07/2013 Signed:

Accredited test number: **1005.1*** Test title: **Combustion efficiency test - emissions**

Test method: ČSN EN 303-5:2013
Art. 4.4.7, 5.7.3, 5.7.4, 5.9, 5.10.4

Sample tested: EG PELLET 10, EG PELLET 15, EG PELLET 40

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: EG PELLET 10 – 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]
Minimum	11.77	9.08	196	9	62	11	292	17	152	13

Test evaluation:

EG PELLET 10 (Pellets - C1) meets at minimum heat output the emission requirements for **Class 5,** as per ČSN EN 303-5:2013 Table 6.

Measurement results: EG PELLET 15 – 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]
Minimum	11.77	9.08	196	9	62	11	292	17	152	13

Test evaluation:

EG PELLET 15 (Pellets - C1) meets at minimum heat output the emission requirements for **Class 5,** as per ČSN EN 303-5:2013 Table 6.

Measurement results: EG PELLET 40 – 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]
Minimum	10.42	10.18	286	8	91	27	371	14	193	28

Test evaluation:

EG PELLET 40 (Pellets - C1) meets at minimum heat output the emission requirements for **Class 5,** as per ČSN EN 303-5:2013 Table 6.

Tested by: Ing. Michal Havlů Date: 07/2013 Signed:

Reviewed by: Ing. Stanislav Buchta Date: 07/2013 Signed:

Accredited test number:	**1004.1*** **1005.1***	Test title:	**Test of heat capacity, input and efficiency** **Combustion efficiency test - emissions**

Test method:	ČSN EN 303-5:2013 Annex C, Deviation from Austria, C.2.2, C.2.3
Sample tested:	EG PELLET 10, EG PELLET 15, EG PELLET 40
Measuring equipment used:	Chapter III - Measuring and test equipment

Test results:

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	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	Pellets – C1
Small burners used for solid fuels automatically loaded						
Parameter	Emission limits mg/MJ					
	Wooden pellets Room heaters	**Wooden pellets Central heaters**	Other wooden fuels	Other stand-ardised biogenous fuels		
CO	500[a]	**250**[a]	250[a]	500[a]		+
NO_x	150	**150**	150	300		
OGC/THC	30	**30**	30	30		
Dust	50	**40**	50	60		

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

Measurement results: EG PELLET 10 – Pellets - C1

Boiler output	**Minimum efficiency**	**Measured efficiency**
Minimum	80.0	90.3

Measurement results: EG PELLET 15 – Pellets - C1

Boiler output	Minimum efficiency	Measured efficiency
Minimum	81.4	90.3

Measurement results: EG PELLET 40 – Pellets - C1

Boiler output	Minimum efficiency	Measured efficiency
Minimum	84.6	93.4

Test evaluation:

The measured efficiency of EG PELLET 10, EG PELLET 15, EG PELLET 40, (Pellets - C1) is **higher** than required.

Measurement results: EG PELLET 10 – 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]
Minimum	11.77	196	62	9	11	133	69	8	6

Measurement results: EG PELLET 15 – 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]
Minimum	11.77	196	62	9	11	133	69	8	6

Measurement results: EG PELLET 40 – Pellets - C1

Boiler output	Average values								
	Measured values					Converted valuesO_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]
Minimum	10.42	286	91	8	27	169	88	6	13

Test evaluation:

The measured emission values for EG PELLET 10, EG PELLET 15, EG PELLET 40 (Pellets - C1) **do not exceed** the specified values.

Tested by: Ing. Michal Havlů Date: 07/2013 Signed:

Reviewed by: Ing. Stanislav Buchta Date: 07/2013 Signed:

Accredited test number:	**1004.1*** **1005.1***	Test title:	**Test of heat output, input and efficiency** **Combustion efficiency test - emissions**

Test method:	ČSN EN 303-5:2013 Annex C, Deviation from Denmark, C.4.1, C.4.2
Sample tested:	EG PELLET 10, EG PELLET 15, EG PELLET 40
Measuring equipment used:	Chapter III - Measuring and test equipment

Test results:

Requirement		Requirement specification	Test evaluation
Boiler Efficiency		ČSN EN 303-5:2013 Annex C, Deviation from Denmark , C.4.1	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.							
Stoking	**Fuel**	**Nominal heat output**	**Emission limit values** [a]			ČSN EN 303-5:2013 Annex C, Deviation from Denmark , C.4.2	Pellets – C1
			CO	**OGC/ THC**	**Dust**		
			mg/m³ 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.							

Measurement results: EG PELLET 10 – Pellets - C1

Boiler output	Minimum efficiency	Measured efficiency
Minimum	74.1	90.3

Measurement results: EG PELLET 15 – Pellets - C1

Boiler output	Minimum efficiency	Measured efficiency
Minimum	74.1	90.3

Measurement results: EG PELLET 40 – Pellets - C1

Boiler output	Minimum efficiency	Measured efficiency
Minimum	76.6	93.4

Test evaluation:

Measured efficiency for EG PELLET 10, EG PELLET 15, EG PELLET 40, (Pellets - C1) is **higher** than required.

Measurement results: EG PELLET 10 – 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]
Minimum	11.77	196	9	11	292	17	13

Measurement results: EG PELLET 15 – 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]
Minimum	11.77	196	9	11	292	17	13

Measurement results: EG PELLET 40 – 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]
Minimum	10.42	286	8	27	371	14	28

Test evaluation:

The measured emission values for EG PELLET 10, EG PELLET 15, EG PELLET 40, (Pellets - C1) **do not exceed** the specified values.

Tested by: Ing. Michal Havlů Date: 07/2013 Signed:

Reviewed by: Ing. Stanislav Buchta Date: 07/2013 Signed:

Accredited test number:	**1004.1*** **1005.1***	Test title:	**Test of heat output, input and efficiency** **Combustion efficiency test - emissions**

Test method:	ČSN EN 303-5:2013 Annex C, Deviation from Germany, C.5.1, C.5.2
Sample tested:	EG PELLET 10, EG PELLET 15, EG PELLET 40
Measuring equipment used:	Chapter III - Measuring and test equipment

Test results:

<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="12">ČSN EN 303-5:2013
Annex C,
Deviation from Germany, C.5.1</td><td rowspan="2">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="8">Stage 1: Appliances, which will be installed after 22.3.2010</td><td rowspan="2">Numbers 1 to 3a</td><td>≥ 4 ≤ 500</td><td>0.09</td><td>1.0</td><td rowspan="10"></td></tr>
<tr><td>> 500</td><td>0.09</td><td>0.5</td></tr>
<tr><td rowspan="2">Numbers 4 to 5</td><td>≥ 4 ≤ 500</td><td>0.10</td><td>1.0</td></tr>
<tr><td>> 500</td><td>0.10</td><td>0.5</td></tr>
<tr><td rowspan="2">Number 5a</td><td>≥ 4 ≤ 500</td><td>0.06</td><td>0.5</td><td>+</td></tr>
<tr><td>> 500</td><td>0.06</td><td>0.5</td><td rowspan="4"></td></tr>
<tr><td rowspan="3">Numbers 6 to 7</td><td>≥ 30 ≤ 100</td><td>0.10</td><td>0.8</td></tr>
<tr><td>> 100 ≤ 500</td><td>0.10</td><td>0.5</td></tr>
<tr><td>> 500</td><td>0.10</td><td>0.3</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 rowspan="4"></td></tr>
<tr><td rowspan="2">Numbers 6 to 7</td><td>≥ 30 ≤ 500</td><td>0.02</td><td>0.4</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="8">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: EG PELLET 10 – 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]
Minimum	11.77	196	11	0.212	0.009

Measurement results: EG PELLET 15 – 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]
Minimum	11.77	196	11	0.212	0.009

Measurement results: EG PELLET 40 – 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]
Minimum	10.42	286	27	0.270	0.020

Test evaluation:

The measured emission values for EG PELLET 10, EG PELLET 15, EG EG PELLET 40, (Pellets - C1) **do not exceed** the specified values.

Tested by: Ing. Michal Havlů Date: 07/2013 Signed:

Reviewed by: Ing. Stanislav Buchta Date: 07/2013 Signed:

Accredited test number:	**1004.1*** Test title: **Test of heat output, input and efficiency** **1005.1*** **Combustion efficiency test - emissions**	
Test method:	ČSN EN 303-5:2013 Annex C C.6 Deviation from Switzerland	
Sample tested:	EG PELLET 10, EG PELLET 15, EG PELLET 40	
Measuring equipment used:	Chapter III - Measuring and test equipment	

Test results:

<table>
<tr><th>Requirement</th><th>Requirement specification</th><th>Test evaluation</th></tr>
<tr><td colspan="2"></td><td rowspan="4">Pellets – C1</td></tr>
<tr><td colspan="2">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="4">ČSN EN 303-5:2013
Annex C
C.6 Deviation from Switzerland</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><td></td></tr>
<tr><td>Boilers for chipped wood and boilers for coal, automatic stoking</td><td>400</td><td>60</td><td></td></tr>
<tr><td>Boilers for wood pellets, automatic stoking</td><td>300</td><td>40</td><td>+</td></tr>
<tr><td colspan="4">[a] Referred to oxygen basis:
– for boilers for natural state wood 13 % volume;
– for boilers for coal 7 % volume.</td></tr>
</table>

Measurement results: EG PELLET 10 – 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]
Minimum	11.77	196	11	212	9

Measurement results: EG PELLET 15 – 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]
Minimum	11.77	196	11	212	9

Measurement results: EG PELLET 40 – 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]
Minimum	10.42	286	27	270	20

Test evaluation:

The measured emission values for EG PELLET 10, EG PELLET 15, EG PELLET 40 (Pellets - C1) **do not exceed** the specified values.

Tested by: Ing. Michal Havlů Date: 07/2013 Signed:

Reviewed by: Ing. Stanislav Buchta Date: 07/2013 Signed:

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

V. List of source materials

The tests were performed based on Order B-46835 of 2013-06-11, Contract B-46835/39 of 2013-06-27, and Amendment to the Contract of 2013-07-22.

- 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
- Instructions for assembly, installation and operation of the boiler
- A set of required drawing documentation as per ČSN EN 303-5:2013; Boiler EG PELLET 10, EG PELLET 15, EG PELLET 40

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

STROJÍRENSKÝ ZKUŠEBNÍ ÚSTAV, s.p.

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