Strojírenský zkušební ústav, s.p.
(Engineering Test Institute, Public Enterprise)
Testing Laboratory 1045.1, Workplace 1
Accredited by the Czech Accreditation Institute
Hudcova 424/56b, 621 00 Brno, Czech Republic

L 1045.1

TEST REPORT
39-10872/1

Product:	Hot-water boilers for wood chips and wood pellets
Type designation:	SMART 499
Customer:	Smart Heating Technology s.r.o. U Statku 653/24, 717 00 Ostrava - Bartovice Czech Republic Company ID No.: 28616774
Manufacturer:	Smart Heating Technology s.r.o. U Statku 653/24, 717 00 Ostrava - Bartovice Czech Republic
Employee responsible:	Mr. Milan Holomek
Report issue date:	2016-05-16
Distribution list:	1 copy to the Customer 1 copy to the Engineering Test Institute

The tests were carried out based on these documents:
- Order B-55787 of 2016-04-27 (Order reg. no. B-55787, received on 2016-04-27)

I. Product description

The SMART 499 steel hot-water boiler is intended for central heating of houses, office blocks, industrial premises etc. The fuels to be used under the warranty are wood chips – B1 and wood pellets – C1.
The boiler body consists of a combustion chamber and a vertical tubular exchanger. The combustion chamber is fitted with a retort burner with holes to let in primary combustion air. Two perforated hollow burner rings for supply of secondary combustion air are placed above it. The boiler is equipped with one radial fan for supply of primary air and two radial fans for supply of secondary air. A screw feeder brings the fuel from the operational bin through the centre of the burner. The feeder is fitted with an extinguishing device to prevent back-burning. The ash falls over the burner edge and it is cyclically removed by screws into an ash bin on the boiler side. The tubular heat exchanger is fitted with revolving turbulators, which together with motor drive clean the exchanger. Part of the boiler is a cyclone separator that is connected to the flue gas outlet ducting. On the outlet side, the separator is fitted with a radial fan with electronic speed control to ensure that negative pressure is maintained in the combustion chamber. The feeding screw is joined to the operational fuel bin with an inbuilt separation valve against the back draught.
The boiler body is doubly insulated: one layer of 80 mm Rotaflex mineral wool is inserted on the side of the body and the other layer of 50 mm Orsil mineral wool is inserted under the boiler steel casing.

As opposed to the certification tests, the boiler has additionally been fitted with a cased pocket fabric filter with automatic regeneration of the filtration medium by compressed air.

II. Sample tested

Boiler capacity version	Fuel	Output [kW]	Place of testing
SMART 499	Wood pellets C1 Wood chips B1	499	Watford

The visual inspection, tests and evaluations were carried out by Ing. Pavel Fojtů, Test Engineer, at Watford, in 05/2016.

The tests were performed with validly calibrated measuring and test equipment.

III. Test results

Measuring and test equipment

No.	Description	Inventory number	Calibration valid until:	Accuracy
1.	Combustion products analyser, Horiba, type 680 P	92-0004	Calibration prior to every measurement	See CRM 103000237769 See CRM 103000237770
2.	Scale	02-2290	10/2017	See Calibration Sheet 6051-KL-H-0168-13
3.	Water meter, NW 20	02-1575	10/2017	See Calibration Sheet AKL-P/006/2009
4.	Measuring centre	02-2241	12/2016	See Calibration Sheet 130129
5.	Hygrometer, thermometer	11-6258	11/2017	See Calibration Sheet 8346F/12
6.	Barometer	11-2541	01/2019	See Calibration Sheet 6013-KL-K001
7.	Draught gauge	11-7275	10/2017	See Calibration Sheet 1165F/13
8.	Stop watch	99-0760	11/2017	See Calibration Sheet 2955E-12
9.	Calorimeter, IKA , type C 5000	02-2236	Calibration prior to every measurement	± 0.12 MJ/kg
10.	Elemental analyser, Perkin Elmer, type 2400 CHNS)	02-2107	Calibration prior to every measurement	± 0.2 % rel.
11.	Gravimat SHC 501	02-2328	10/2017	See Calibration Sheet 120080-120084
12.	Laboratory scale	02-1458	10/2017	See Calibration Sheet 6051-KL-H0403-13
13.	Scale, Ohaus MB 45	02-2274	10/2017	See Calibration Sheet 6051-KL-H0400-13
14.	Pressure gauge	111985	04/2019	See Calibration Sheet 090162
15.	Prandtl tube, 0.3 m	ME 484	11/2017	See Calibration Sheet 5012-KL-RS090-09
16.	Psychro-meter, C455	022007	10/2017	See Calibration Sheet 090176
17.	Electrometer	03524781	03/2022	See Calibration Sheet 002/12/E

No.	Name and specification	Technical standard, regulation applied	Source materials	Evaluation	
				Tests	Evaluation
1.	**Test of combustion efficiency – emissions (1005.1*)**	ČSN EN 303-5:2013 Art. 4.4.7, 5.7.3, 5.7.4, 5.9, 5.10.4	Pages 12 - 13	+ (*)	

Note:
No.:
(*) - The emissions of CO and OGC were not measured.

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

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: SMART 499

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	+ (*)	

Note: (*) – The emissions of CO and OGC were not measured.

Table 6

Fuel supply	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 % O_2.

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Measurement results: SMART 499, wood pellets – C1 (nominal output)

Date of sampling	Sample designation	Sampling location	Flue gas temperature (°C)	Measured O_2 (%)	Extraction volume (m^3)	Difference in sample weight (mg)
4.5.2016	10,0-2605	Before filter	103	6.0	0.860	8.5
	10,0-2624		120	6.0	0.707	9.3
	10,0-2596	After filter	87	6.5	0.649	1.1
	10,0-2620		87	6.5	0.560	0.5
	10,0-2613		95	6.5	0.564	0.7

Sample designation	Sampling location	Sample volume in n. c. (l)	Dry sample volume in n. c. (l)	Dust concentration (mg/m^3)	Dust concentration converted to 10% O_2 (%)	Resultant dust concentration converted to 10% O_2 (%)
10,0-2605	Before filter	625	531	16	**12**	**14**
10,0-2624		491	418	22	**16**	
10,0-2596	After filter	492	418	3	**2**	**2**
10,0-2620		425	361	1	**1**	
10,0-2613		418	356	2	**1**	

Note: Only the concentration of dust particles was measured (the concentration of CO, NO_x, SO_2 and THC/OGC was not measured).

Measurement results: SMART 499, wood pellets – C1 (minimum output)

Date of sampling	Sample designation	Sampling location	Flue gas temperature (°C)	Measured O_2 (%)	Extraction volume (m^3)	Difference in sample weight (mg)
4.5.2016	10,0-213	Before filter	77	11.0	0.796	4.3
	10,0-2402		77	11.0	0.631	4.3
	10,0-2634	After filter	70	11.2	0.553	0.4
	10,0-2587		68	11.2	0.549	0.5
	10,0-214		65	11.2	0.561	1.0

Sample designation	Sampling location	Sample volume in n. c. (l)	Dry sample volume in n. c. (l)	Dust concentration (mg/m^3)	Dust concentration converted to 10% O_2 (%)	Resultant dust concentration converted to 10% O_2 (%)
10,0-213	Before filter	621	528	8	**9**	**10**
10,0-2402		492	418	10	**11**	
10,0-2634	After filter	440	374	1	**1**	**2**
10,0-2587		440	374	1	**2**	
10,0-214		453	385	3	**3**	

Note: Only the concentration of dust particles was measured (the concentration of CO, NO_x, SO_2 and THC/OGC was not measured).

Measurement results: SMART 499, wood chips – B1 (nominal output)

Date of sampling	Sample designation	Sampling location	Flue gas temperature (°C)	Measured O_2 (%)	Extraction volume (m^3)	Difference in sample weight (mg)
4.5.2016	8,0-2401	Before filter	81	9.5	0.803	14.4
	8,0-2491		81	9.5	0.813	11.5
	8,0-2850	After filter	75	8.5	0.362	4.0
	8,0-3022		75	9.0	0.382	4.1

Sample designation	Sampling location	Sample volume in n. c. (l)	Dry sample volume in n. c. (l)	Dust concentration (mg/m^3)	Dust concentration converted to 10% O_2 (%)	Resultant dust concentration converted to 10% O_2 (%)
8,0-2401	Before filter	616	524	28	**26**	**24**
8,0-2491		624	530	22	**21**	
8,0-2850	After filter	284	241	17	**15**	**15**
8,0-3022		300	255	16	**15**	

Note: Only the concentration of dust particles was measured (the concentration of CO, NO_x, SO_2 and THC/OGC was not measured).

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Measurement results: SMART 499, wood chips – B1 (minimum output)

Date of sampling	Sample designation	Sampling location	Flue gas temperature (°C)	Measured O_2 (%)	Extraction volume (m^3)	Difference in sample weight (mg)
3.5.2016	6,4-2459	Before filter	70	10.5	0.236	40.0
	6,4-2820		68	10.5	0.223	31.3
	6,4-2425		65	10.5	0.214	35.4
	6,4-2444	After filter	45	10.5	0.270	4.8
	8,0-213		45	10.5	0.290	5.2
	8,0-2526		45	10.5	0.401	4.5

Sample designation	Sampling location	Sample volume in n. c. (l)	Dry sample volume in n. c. (l)	Dust concentration (mg/m^3)	Dust concentration converted to 10% O_2 (%)	Resultant dust concentration converted to 10% O_2 (%)
6,4-2459	Before filter	188	160	251	**262**	**244**
6,4-2820		179	152	206	**216**	
6,4-2425		173	149	241	**252**	
6,4-2444	After filter	232	197	24	**26**	**23**
8,0-213		249	212	25	**26**	
8,0-2526		344	293	15	**16**	

Note: Only the concentration of dust particles was measured (the concentration of CO, NO_x, SO_2 and THC/OGC was not measured).

Tested by: Ing. Pavel Fojtů Date: 05/2016 Signed:

Reviewed by: Ing. Stanislav Buchta Date: 05/2016 Signed:

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

IV. A list of referenced background materials

- Order B-55787 of 2016-04-27 (received on 2016-04-27)
- 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 ISO 80000-1:2011 – Quantities and units – Part 1: General

Report compiled by: Ing. Pavel Fojtů

Person responsible for correctness of the Report:

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