



Strojírenský zkušební ústav, s.p., Brno, Česká republika
Engineering Test Institute, Public Enterprise, Czech Republic

OSVĚDČENÍ O ZKOUŠCE CERTIFICATE OF TEST

Číslo
Number **O-B-02351-19**

Výrobce – *Manufacturer* Eko Život d.o.o.
Kralja Aleksandra 30
79000 Prijedor
BOSNIA AND HERZEGOVINA

Výrobek – *Product* Kotel teplovodní – *Hot-water boiler*

Typové označení
Type designation **KOTAO NG 2K 150 kW**

Metoda zkoušek – *Test method* ČSN EN 303 – 5:2013

Způsob topení – *Heating method* ruční – *manual*

Preferované palivo – *Preferred fuel* dřevo – A – *wood – A*

Třída – *Class* 3

Výsledky – *Results*

Typ – <i>Type</i>	KOTAO NG 2K 150 kW	
Jmenovitý výkon – <i>Nominal output</i>		
CO (10% O ₂)	mg/m _n ³	1979
OGC (10% O ₂)	mg/m _n ³	8
Prach – <i>Dust</i> (10% O ₂)	mg/m _n ³	100
Účinnost – <i>Efficiency</i>	%	84.3

Podklad pro vydání osvědčení
Basis for Certificate issue

Protokol č. – *Report No.* 31–10076/T
vydaný Zkušební laboratoří č. 1045.1, akreditovanou ČIA o.p.s., číslo
osvědčení o akreditaci 491/2018
*issued by Testing Laboratory No. 1045.1, accredited by CAI,
Accreditation Certificate No. 491/2018*

Strojírenský zkušební ústav, s.p. tímto osvědčení o zkoušce potvrzuje, že u předmětného výrobku provedl zkoušky a výpočty s výše uvedenými výsledky.
The Engineering Test Institute certifies by this Certificate of Test to have conducted for the given product the test and calculation with above stated results.

Brno, 2019-08-28



Milan Holomek

vedoucí zkušebny tepelných a ekologických zařízení
Head of Heat and Ecological Equipment Test Station

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Testing Laboratory 1045.1

Accredited by the Czech Accreditation Institute pursuant to
ČSN EN ISO/IEC 17025:2005

Strojírenský zkušební ústav, s.p. Testing Laboratory, Hudcova 424/56b, 621 00 Brno
Workplace Brno, Hudcova 424/56b, 621 00 Brno, Czech Republic

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TEST REPORT
31-10076/T

Product: Hot-water boiler for solid fuel (wood - A) with
manual fuel supply

Type designation KOTAO NG 2K 150 kW

Customer: Eko Život d.o.o.
Kralja Aleksandra 30
79000 Prijedor
BOSNIA AND HERZEGOVINA

Manufacturer: Eko Život d.o.o.
Kralja Aleksandra 30
79000 Prijedor
BOSNIA AND HERZEGOVINA

Employee responsible: Ing. Michal Havlů

Report issue date: 2019-07-31

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

This report may be copied in its entirety without written consent of the Engineering Test Institute.
The results of tests and verifications only apply to the products tested.



The tests were performed based on these documents:

- Order B-60027 of 2017-08-08 (Order reg. no. B-60027 delivered on 2017-08-08)
- Contract B-60027/31

I. Description of product tested

The steel hot-water boiler with manual fuel supply, type KOTAO NG is designed for the burning of wood – A on the principle of downward burning with pyrolysis combustion.

Further detailed descriptions of individual assembly groups are provided in the enclosed technical documentation to Task 31-10076.

II. Sample tested

Boiler output versions that are the subject of the proceedings:

(table 1)

Boiler output version	Fuel	Heat output	Sample number	Place of testing
KOTAO NG 2K 150 kW	Wood – A	150 kW	–	Eko Život Kralja Aleksandra 30 790 00 Prijedor BOSNIA AND HERZEGOVINA

The visual inspection, tests and verification were carried out by Ing. Michal Havlů at the test station of Eko Život in Kralja Aleksandra 30, Bosnia and Herzegovina.

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

III. Methods, results of tests and verifications

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	viz KL 6051-KL-H0189-19
3.	Induction flow meter	022389-C/1	10/2021	viz KL 6015-KL-P0696-17
4.	Temperature measurement set	022399-D/8	11/2020	viz KL-T-0162-17
5.	Thermometer, Moisture meter	022435/T2	01/2023	see 6036-KL-V0009-18
6.	Barometer	112541	01/2021	viz KL 6013-KL-K0001-14
7.	Draught gauge	MaR11-Tah	06/2021	viz KL 6013-KL-C0465-19
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	04/2021	viz KL 14/KA-19
11.	Electronic thermometer	116557	03/2021	viz KL 160066
12.	Electrometer	022389-A/4	05/2025	viz KL 039/15/E
13.	Induction water meter	022435/F2	12/2021	6015-KL-P0894-17
14.	Weighing machine	022151	02/2021	viz KL 6051-KL-H0187-19
15.	Weighing machine	022211	02/2021	viz KL 6051-KL-H0190-19
16.	Tape measure	ME 477	10/2022	viz KL 8800/2017



IV. Results of tests and evaluation

No.	Requirement	Technical standard, regulation applied	Source material s	Test evaluation
1.	Surface temperature test (T 001*)	ČSN EN 303-5:2013 Art. 5.12, 5.16.4, 4.3.6	Pages 4 - 5	+
2.	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 6 - 8	+
3.	Combustion efficiency test – emissions (T 001 *)	ČSN EN 303-5:2013 Art. 5.7.3, 5.7.4, 5.9, 5.10.4	Pages 9 - 10	+

Evaluation:

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



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: KOTAO NG 2K 150 kW

Measuring equipment used: Chapter III - Measuring and test equipment

Test results:

Requirement	Requirement specification	Test evaluation	Note
<p>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.</p>	<p>ČSN EN 303-5:2013 Art. 5.12</p>	+	
<p>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:</p> <ul style="list-style-type: none"> - 35 K for metals and similar materials; - 45 K for porcelain and similar materials; - 60 K for plastics and similar materials. 	<p>ČSN EN 303-5:2013 Art. 4.3.6</p>	+	
<p>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.</p>	<p>ČSN EN 303-5:2013 Art. 5.16.4</p>	+	



Measurement results: BLAZE HARMONY 15 KOMFORT

Average temperatures of boiler walls, doors and covers (°C):	
Boiler type	KOTAO NG 2K 150 kW
Fuel type	Wood – A
Heat output	Nominal
Testing date	2017-10-31
Ambient temperature (°C)	19.0
Humidity (%)	35.0
Air pressure (kPa)	96.79
Front wall	84.4
Rear wall	49.6
Right wall	39.0
Left wall	39.0
Upper wall	80.2
Lower wall	45.1
Temperatures of control elements (°C):	
Upper door handle (metallic)	32.0
Lower door handle (metallic)	45.0
El. control panel (plastic)	32.0

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

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

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



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

Test method: ČSN EN 303-5:2013 Art. 4.4.2, 4.4.3, 5.7 to 5.10
Sample tested: KOTAO NG 2K 150 kW
Measuring equipment used: Chapter III - Measuring and test equipment

Test results: BLAZE HARMONY 15 KOMFORT – wood – A

Average measured and calculated values (solid fuels):

Test:	I.	II.	Average
Boiler type:	KOTAO NG 2K 150 kW		
Testing date:	2017-10-31		
Output tested:	Nominal		
Fuel type:	Wood – A		
Combustion period, (automatic) stoking	2 x 2 hours		
Nominal heat output (specified by manufacturer) [kW]	150	150	150
Flue gas temperature [°C]	167.2	148.0	157.6
Fuel mass added [kg/hod]	36.50	36.70	36.60
Inlet water temperature [°C]	64.8	58.7	61.7
Outlet water temperature [°C]	83.8	77.7	80.7
Cooling water temperature [°C]	11.0	11.0	11.0
Cooling water flow rate [m ³ /hod]	1.4900	1.6300	1.5600
Draught [Pa]	20.0	20.0	20.0
Ambient temperature [°C]	18.9	19.1	19.0
Relative air humidity [%]	34.9	35.1	35.0
Barometric pressure [kPa]	96.78	96.80	96.79

Analysis of combustion products:

Test (period of burning) :	I.	II.	Average
Oxygen O ₂ [%]	9.70	10.41	10.05
Carbon dioxide CO ₂ [%]	11.20	10.34	10.77
Carbon monoxide CO [ppm]	1480	1662	1571
Higher hydrocarbons THC/OGC [ppm]	6	5	5
Nitrogen oxides NO _x [ppm]	91	86	88
Sulfur oxides SO ₂ [ppm]	52	30	41



Auxiliary combustion values (solid fuels):

Test (period of burning) :		I.	II.	Average
Stoichiometric oxygen volume	[m ³ /kg]	0.844	0.846	0.845
Stoichiometric air volume	[m ³ /kg]	4.023	4.025	4.024
Stoichiometric volume of dry combustion products	[m ³ /kg]	3.977	3.979	3.978
Maximum content of CO ₂	[%]	20.06	20.08	20.07
Stoichiometric air multiple	[-]	1.84	1.96	1.90
Volume of dry combustion products. actual	[m ³ /kg]	7.031	7.596	7.313
Content of H ₂ O in combustion air	[m ³ /kg]	0.059	0.063	0.061
Content of H ₂ O in combustion products	[m ³ /kg]	0.821	0.825	0.823

Calculated values - thermal overview

Test (period of burning) :		I.	II.	Average
Loss of sensible heat of combustion products	[%]	10.5	9.8	10.2
Loss of gas underburning	[%]	0.9	1.0	1.0
Loss of mechanical underburning	[%]	1.1	1.1	1.1
Loss of heat transfer into environment	[%]	5.3	5.3	5.3
Total loss	[%]	17.9	17.3	17.6
Efficiency – indirect method	[%]	82.1	82.7	82.4
Fuel mass added - actual	[kg/hod]	36.891	37.093	36.992
Heat input	[kW]	155.7	156.5	156.1
Heat output	[kW]	126.3	126.5	126.4
Uncertainty of determining heat output	[kW]	5.3	5.3	5.3
Efficiency – direct method	[%]	81.1	80.9	81.0
Output / nominal output	[%]	84.2	84.4	84.3

At nominal output, when burning **Wood – A**, the boiler efficiency KOTAO NG 2K 150 kW meets the requirements applicable to **Class 3** as per ČSN EN 303-5:2013, Fig. 1.

Test evaluation:

The measured heat output is within the ± 8% tolerance;
Boiler Class 3;
At nominal output, combustion product temperature is less than 160 K above the ambient temperature;
When burning Wood – A, the period of burning is 2 x 2 hours;



Fuel analysis

Fuel type	Wood – A			
Analytical indicator	Symbol	Unit	Value	Uncertainty
Higher heating value	Q_s	[MJ/kg]	16.69	0.22
Lower heating value	Q_j	[MJ/kg]	15.19	0.22
All water in original condition	W_t^r	[% of mass]	12.02	0.08
Ash	A	[% of mass]	0.53	0.02
Carbon	C	[% of mass]	43.68	0.24
Hydrogen	H	[% of mass]	5.52	0.20
Nitrogen	N	[% of mass]	0.1	0.14
Sulphur	S	[% of mass]	0.014	0.001
Chlorine	Cl	[% of mass]	0.011	0.001
Oxygen – calculation for 100%	O	[% of mass]	38.12	
Conversion factor f_{emis} for emissions in [mg/m ³] to [mg/MJ]	f_{emis}	[-]	0.26530	

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 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:

KOTAO NG 2K 150 kW

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 kW	Emission limits mg/m ³ at 10% O ₂								
			CO			OGC/THC			Dust		
			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: KOTAO NG 2K 150 kW – wood – A


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]
I. period	9.70	11.20	1480	6	91	99	1801	9	181	97
II. period	10.41	10.34	1662	5	86	99	2157	8	183	103
Average	10.05	10.77	1571	5	88	99	1979	8	182	100

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

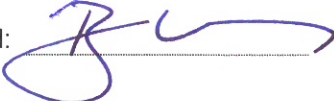
Test evaluation:

KOTAO NG 2K 150 kW – wood – A meets at nominal and minimum output the emission requirements for **Class 3**, as per ČSN EN 303-5:2013 Table 6.

Tested by: Ing. Michal Havlů Date: 10/2017

Signed: 

Reviewed by: Ing. Stanislav Buchta Date: 10/2017

Signed: 



V. A list of other referenced documents

- Order B-60027 of 2017-08-08 (Order reg. no. B-60027 delivered on 2017-08-08)
- Contract B-60027/31
- Amendment D1
- 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 15456:2008 - 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. Michal Havlů



Person responsible for correctness of the Report:

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

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