



## **TEST REPORT**

### **No. 39-8910/1**

**Product:** Hot-water boiler burning wood with manual fuel supply

**Type designation:** ORLIGNO 200

**Versions:** ORLIGNO 200 18 kW, ORLIGNO 200 40 kW

**Customer:** EKO-VIMAR ORLAŃSKI Sp. Z o.o.  
ul. Nyska 17b  
48-385 Otmuchów  
Poland

**Manufacturer:** EKO-VIMAR ORLAŃSKI Sp. Z o.o.  
ul. Nyska 17b  
48-385 Otmuchów  
Poland

**Responsible employee:** Ing. Stanislav Buchta

**Report issue date:** 2011-02-02

**Distribution list:** 1 copy to the Engineering Test Institute  
1 copy to the Customer



This Report was drafted on the basis of Order B-38376 of 2010-09-01, Contract B-38376/39 of 2010-09-15 and Contract Supplement No. 1. The above mentioned Report reproduces the test results of Report No. 39-8811/1 of 2010-06-24.

## I. Product description

The steel hot-water boiler with manual fuel supply, type ORLIGNO 200, is designed for the burning of wood on the principle of upward burning with pyrolysis combustion.

The boiler is designed for the central heating of family homes, residential premises, flats, offices, small community premises, business premises and stores, etc.

The boiler body is made of welded steel, with a combined wall thickness of 6 and 4 mm. The charging chamber is situated in the upper part of the boiler body, and the combustion chamber with ceramic lining is situated in the bottom part.

The charging chamber is separated from the combustion chamber with a wall in which a ceramic nozzle is mounted with integrated openings for the secondary combustion air supply. Combustion products are discharged from the combustion chamber through a tubular heat exchanger to the boiler exhaust branch. The primary and secondary combustion air is supplied to the boiler via a forced draft blower situated in the front wall. The quantity of air can be regulated in combination of an electronic setup (40 ÷ 100)% and mechanical throttles. The boiler shell consists of painted steel plates lined with mineral wool.

Water connection branches in the rear part of the boiler have the dimension of G2 for heating water inlet and outlet, and G3/4 for the drainage and filling. The exhaust branch with a horizontal axis is situated on the rear side of the boiler.

There is a control panel in the upper part of the boiler with an electronic indication of the water temperature in the boiler and with regulating and security elements.

Basic technical specifications:

Size	Rated capacity wood [kW]	Water volume [l]	Max. operating temperature [°C]	Max. operating pressure [bar]	Weight [kg]
ORLIGNO 200 18 kW	18	55	95	3,0	425
ORLIGNO 200 40 kW	40	93			595

Verification were conducted at the testing station of the Engineering Test Institute in Brno in December 2010 by Milan Holomek (technician).



## II. Results of tests and evaluation

No.	Name and specification	Technical standard / regulation applied	Source data	Evaluation		
				Tests	Results	
1.	Surface temperatures	ČSN EN 303-5:2000, Art. 4.2.7	page 4 ÷ 6	+		
2.	Heat capacity, calorific efficiency, temperature of combustion products, draught after the boiler	ČSN EN 303-5:2000, Art. 4.2, 4.2.1, 4.2.2, 4.2.3, 4.2.4, 4.2.5, 5.8.2	Page 7÷12	+		
		ČSN EN 303-5:2000 Annex A, deviation A.1.1	page 13	+		
3.	Combustion efficiency, emissions	ČSN EN 303-5:2000, Art. 4.2.6	page 14 ÷ 16	+		
		ČSN EN 303-5:2000 Annex A (deviations A.1.2, A.2, A.5)	A.1.2.	page 17	+	
			A. 2	page 18÷19	+	
			A. 5	page 20÷21	+	

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 measurement**

Testing method: ČSN EN 303-5:2000, Art. 5.12

Sample tested: ORLIGNO 200 18 kW, ORLIGNO 200 40 kW

Measuring devices: see Report 39-8811/1

Place of testing:	at SZÚ	<input checked="" type="checkbox"/>	at the manufacturer	<input type="checkbox"/>	at the customer	<input type="checkbox"/>	other:
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**Test result:**

Requirement	Requirement specification	Test evaluation	Note
<p><b>Surface temperature</b></p> <p>During the tests according to 5.12, the average temperature of the boiler door surface and the cleaning eye covers on the operators' side must not exceed the ambient temperature by more than 100 K.</p> <p>During the tests according to 5.12, the surface temperature of the outer side of the boiler bottom must not exceed the ambient temperature by more than 65 K. This test is not performed if the manufacturer requires that the boiler is installed on a non-combustible material base. Alternative testing method: The surface temperature below the boiler (according to EN 304) at any place must not exceed 80°C.</p> <p>During the tests according to 5.12, the surface temperature of the operating handles and all parts with which the operating staff will come in contact must not exceed the ambient temperature by more than:</p> <ul style="list-style-type: none"> <li>- 35 K as regards metals and similar materials;</li> <li>- 45 K as regards porcelain and similar materials;</li> <li>- 60 K as regards plastic material and similar materials</li> </ul>	<p>ČSN EN 303-5 Art. 4.2.7</p>	<p>+</p>	



**Measurement results:** 1. boiler: ORLIGNO 200 18 kW

<b>Average temperatures of boiler walls, doors and covers (°C):</b>	
<b>Fuel type</b>	<b>wood</b>
Date of test	2008-02-04
Rel. humidity (%)	37
Bar. pressure (kPa)	98,498
Amb. temp (°C)	21,1
<b>Front wall</b>	55,5
<b>Rear wall</b>	26,6
<b>Right wall</b>	27,8
<b>Left wall</b>	28,3
<b>Upper wall</b>	32,2
<b>Lower wall</b>	32,6
<b>Charging door</b>	42,3
<b>Ash-pan door</b>	65,0
<b>Temperatures of control elements (°C):</b>	
<b>Loading door handle – plastic</b>	40
<b>Ash pan door handle – plastic</b>	55
<b>Charging throttle drawbar handle – plastic</b>	30
<b>Exchanger cleaning lever - plastic</b>	29



**Measurement results:** 2. boiler: ORLIGNO 200 40 kW

Average temperatures of boiler walls, doors and covers (°C):	
Fuel type	wood
Date of test	2008-04-16
Rel. humidity (%)	47
Bar. pressure (kPa)	98.312
Ambient temperature (°C)	21.7
Front wall	62.9
Rear wall	28.0
Right wall	27.3
Left wall	27.4
Upper wall	32.7
Lower wall	55.0
Charging door	46.7
Ash-pan door	79.0
Temperatures of control elements (°C):	
Loading door handle – plastic	43
Ash pan door handle – plastic	58
Charging throttle drawbar handle – plastic	32
Exchanger cleaning lever - plastic	28

**Measurement uncertainty:** 2°C for temperatures within the range of (0 ÷ 250) °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 the document EA 4/02."

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

Tested by: Milan Holomek

Date: 2010-12-10

Signed: 

Reviewed by: Ing. Stanislav Buchta

Date: 2010-12-10

Signed: 



Accredited test number: **1004.1** Test title: **Heating output, heating input and calorific efficiency test,**  
**1004.2** **Combustion product temperature test**

Testing method: ČSN EN 303-5:2000 Art. 5.7 to 5.10

Sample tested: ORLIGNO 200 18 kW, ORLIGNO 200 40 kW

Measuring devices: see Report 39-8811/1

Place of testing:	at SZÚ	<input checked="" type="checkbox"/>	at the manufacturer	<input type="checkbox"/>	at the customer	<input type="checkbox"/>	other:
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### Test result:

Requirement	Requirement specification	Test evaluation	Note
<p><b>Requirements regarding boiler capacity</b>            The fulfilment of the requirements specified below regarding the boiler capacity must be checked with the use of test fuels.            The rated heat capacity and the heat output range may fluctuate depending on the fuel.            The requirements regarding the boiler efficiency and emissions are divided into three categories. So that the requirements for the given category can be deemed fulfilled, all efficiency and emission limit values for the category concerned must be fulfilled.</p>	ČSN EN 303-5 Art. 4.2	+	
<p><b>Boiler efficiency</b>            During tests according to 5.7, 5.8 and 5.10, the boiler efficiency for the rated heat output must not be lower than the values specified in the formulas shown in figure 1.</p>	ČSN EN 303-5 Art. 4.2.1	+	
<p><b>Combustion product temperature</b>            In boilers operated under the rated heating output and at temperatures lower than 160 K above the ambient temperature, the manufacturer must provide recommendations regarding the mounting of the flue duct for adequate draught and to prevent condensation and soot depositing in the entire chimney.</p>	ČSN EN 303-5 Art. 4.2.2	+	
<p><b>Draught</b>            The values of draught determined, as specified on Fig. 2, are the maximum values. They also serve as the recommended values for the chimney.            In the case that the maximum draught values are exceeded, there must be a special reference to technical instruction manuals.</p>	ČSN EN 303-5 Art. 4.2.3	+	
<p><b>Period of burning</b>            In boilers with manual fuel charging and under the rated heating output, the period of burning must be declared by the manufacturer and must be at least:            - 2 hours as regards biological fuels            - 4 hours as regards fossil fuels            In boilers with automatic fuel charging, the period of burning must be at least 6 hours.</p>	ČSN EN 303-5 Art. 4.2.4	+	



<b>Minimum heating output</b> The minimum heating output must not be higher than 30% of the rated heating output. In boilers with manual fuel charging, the minimum heating output may be higher. In such a case, the manufacturer must state in the technical documentation how the generated heat will be dissipated.	ČSN EN 303-5 Art. 4.2.5	+	
<b>Determination of rated heating output</b> The heating output declared by the manufacturer must be verified by testing, with tolerance of $\pm 8\%$ . The rated heating output declared by the manufacturer must be achieved at least during one burning period. Otherwise, the rated heating output must be modified.	ČSN EN 303-5 Art. 5.8.2	+	

**Measurement results: 1. boiler: ORLIGNO 200 18 kW: wood**

**Average values measured and calculated (solid fuels):**

	I. ORLIGNO 200 18 kW 2008-02-04 rated capacity	II. ORLIGNO 200 18 kW 2008-02-04 rated capacity
Burning period: Type of boiler: Date of testing: Test conditions:		
Type of fuel:	wood/beechn/45cm	wood/beechn/45cm
Rated heat capacity (specified by manufacturer) [kW]	18	18
Ambient temperature [°C]	160.4	160.7
Fuel consumption [kg/hour]	4.922	4.730
Ambient temperature [°C]	54.8	52.4
Ambient temperature [°C]	77.2	73.7
Ambient temperature [°C]	9.5	9.0
Cooling water flow [m <sup>3</sup> /hour]	0.2390	0.2390
Draught after boiler [Pa]	10.0	10.0
Ambient temperature [°C]	22.1	20.1
Relative air humidity [%]	37.0	37.0
Barometric pressure [kPa]	98.498	98.498

**Analysis of combustion products:**

	I. ORLIGNO 200 18 kW 2008-02-04 rated capacity	II. ORLIGNO 200 18 kW 2008-02-04 rated capacity
Burning period: Type of boiler: Date of testing: Test conditions:		
Type of fuel:	wood/beechn/45cm	wood/beechn/45cm
Oxygen O <sub>2</sub> [%]	5.96	5.87
Carbon dioxide CO <sub>2</sub> [%]	15.15	15.32
Carbon monoxide CO [ppm]	923	449
Higher hydrocarbons OGC [ppm]	365	247
Nitrogen oxides NO <sub>x</sub> [ppm]	151	186



**Auxiliary combustion values (solid fuels):**

	I. ORLIGNO 200 18 kW 2008-02-04 rated capacity	II. ORLIGNO 200 18 kW 2008-02-04 rated capacity
Burning period: Type of boiler: Date of testing: Test conditions:		
Type of fuel:	wood/beech/45cm	wood/beech/45cm
Stoichiometric oxygen volume [m <sup>3</sup> /kg]	0.866	0.866
Stoichiometric air volume [m <sup>3</sup> /kg]	4.126	4.126
Stoichiometric volume of dry combustion products [m <sup>3</sup> /kg]	4.054	4.054
Maximum CO <sub>2</sub> volume [%]	19.56	19.56
Stoichiometric air multiple [-]	1.39	1.38
Volume of dry combustion products [m <sup>3</sup> /kg]	5.205	5.163
Volume of H <sub>2</sub> O in the combustion air [m <sup>3</sup> /kg]	0.058	0.051
Volume of H <sub>2</sub> O in the combustion products [m <sup>3</sup> /kg]	0.874	0.867

**Calculated values - thermal balance**

	I. ORLIGNO 200 18 kW 2008-02-04 rated capacity	II. ORLIGNO 200 18 kW 2008-02-04 rated capacity
Burning period: Type of boiler: Date of testing: Test conditions:		
Type of fuel:	wood/beech/45cm	wood/beech/45cm
Loss of sensible heat of combustion products (chimney) [%]	7.6	7.7
Loss of gas underburning [%]	0.4	0.2
Loss of mechanical underburning [%]	0.3	0.3
Loss of heat transfer into the environ. [%]	1.9	1.9
Total loss [%]	10.1	10.1
Calorific efficiency - indirect method [%]	89.9	89.9
Heat input [kW]	21.1	20.3
<b>Heating output [kW]</b>	<b>19.2</b>	<b>18.3</b>
Uncertainty of determining heating output [kW]	0.8	0.8
<b>Calorific efficiency – direct method [%]</b>	<b>90.8</b>	<b>90.2</b>
Capacity / rated capacity [%]	106.6	101.7

Under the rated output, the boiler efficiency regarding wood burning meets the requirements applicable to category 3 according to ČSN EN 303-5:2000, figure 1.



**Measurement results: 2. boiler: ORLIGNO 200 40 kW, fuel: wood**

**Average values measured and calculated (solid fuels):**

	I. ORLIGNO 200 40 kW 2008-04-16 rated capacity	II. ORLIGNO 200 40 kW 2008-04-16 rated capacity
Burning period: Type of boiler: Date of testing: Test conditions:		
Type of fuel:	wood/beechn/45cm	wood/beechn/45cm
Rated heat capacity (specified by manufacturer) [kW]	40	40
Ambient temperature [°C]	136.0	148.0
Fuel consumption [kg/hour]	8.905	9.720
Ambient temperature [°C]	52.6	56.6
Ambient temperature [°C]	73.6	79.3
Ambient temperature [°C]	10.2	10.1
Cooling water flow [m <sup>3</sup> /hour]	0.4665	0.4640
Draught after boiler [Pa]	24.0	31.0
Ambient temperature [°C]	21.4	22.0
Relative air humidity [%]	47.0	47.0
Barometric pressure [kPa]	98.312	98.312

**Analysis of combustion products:**

	I. ORLIGNO 200 40 kW 2008-04-16 rated capacity	II. ORLIGNO 200 40 kW 2008-04-16 rated capacity
Burning period: Type of boiler: Date of testing: Test conditions:		
Type of fuel:	wood/beechn/45cm	wood/beechn/45cm
Oxygen O <sub>2</sub> [%]	5.00	4.29
Carbon dioxide CO <sub>2</sub> [%]	14.73	15.05
Carbon monoxide CO [ppm]	804	1435
Higher hydrocarbons OGC [ppm]	155	147
Nitrogen oxides NO <sub>x</sub> [ppm]	146	136