



TEST REPORT

No. 39-8910/3

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

Type designation: ORLIGNO 200

Versions: ORLIGNO 200 60 kW

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

Manufacturer: EKO-VIMAR ORLAŃSKI Sp. Z o.o.
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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. 39-8811/3 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 components, 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 coated 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 60 kW	60	180	95	3.0	975

The verification was conducted in the testing station of SZÚ, s.p. Brno, in December 2010 by Milan Holomek (technician).

The testing was conducted using measurement and testing equipment with valid calibration.



II. Results of tests and evaluation

No.	Name and specification	Technical standard and regulation applied	Source materials	Results		
				Test	Evaluation	
1.	Test of surface temperatures	ČSN EN 303-5:2000, Art. 4.2.7	Page 4 ÷ 5	+		
2.	Test of heat capacity, input and efficiency; Test of combustion product temperature	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 6÷9	+		
		ČSN EN 303-5:2000, Annex A, Deviation A.1.1	Page 10	+		
3.	Combustion efficiency test - emissions	ČSN EN 303-5:2000, Art. 4.2.6	Page 11 ÷ 12	+		
		ČSN EN 303-5:2000 Annex A (deviations A.1.2, A.2, A.5)	A.1.2	Page 13	+	
			A. 2	Page 14	+	
			A. 5	Page 15	+	

Note:

No.:

(**) Not a test.

Evaluation:

+ Requirement fulfilled.
 - Requirement not fulfilled.
 x Not assessed.
 0 Not applicable



Accredited test number: **1003** Test title: **Test of surface temperatures**

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

Sample tested: ORLIGNO 200 60 kW

Measuring equipment used: See report 39-8811/3

Place of testing:	at the Engineering Test Institute	<input checked="" type="checkbox"/>	at the manufacturer	<input type="checkbox"/>	at the customer	<input type="checkbox"/>	other:
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Test results:

Requirement	Specification of requirement	Test evaluation	Note
<p>Surface temperature</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 test 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"> - 35 K as regards metals and similar materials; - 45 K as regards porcelain and similar materials; - 60 K as regards plastic material and similar materials 	<p>ČSN EN 303-5 Art. 4.2.7</p>	<p>+</p>	



Measurement results: 1. boiler: ORLIGNO 200 60 kW

Average temperatures of boiler walls, doors and covers (°C):	
Fuel type	wood
Date of testing	2009-07-20
Rel. humidity (%)	41
Bar. press. (kPa)	99.885
Ambient temperature (°C)	27.6
Front wall	82.5
Rear wall	34.0
Right wall	27.8
Left wall	27.3
Upper wall	32.0
Lower wall	63.5
Charging door	68.0
Ash-pan door	126.0
Temperatures of control elements (°C):	
Loading door handle - plastic	42
Ash pan door handle - plastic	61
Charging throttle drawbar handle - plastic	29
Exchanger cleaning lever - plastic	31

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 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: **Test of heat capacity, input and efficiency**
 1004.2 **Test of combustion product temperature**

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

Sample tested: ORLIGNO 200 60 kW

Measuring equipment used: See report 39-8811/3

Place of testing:	at the Engineering Test Institute	<input checked="" type="checkbox"/>	at the manufacturer	<input type="checkbox"/>	at the customer	<input type="checkbox"/>	other:
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Test results:

Requirement	Specification of requirement	Test evaluation	Note
Requirements regarding boiler capacity 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.	ČSN EN 303-5 Art. 4.2	+	
Boiler efficiency During tests according to 5.7, 5.8 and 5.10, the boiler efficiency for the rated heat capacity must not be lower than the values specified in the formulas shown in Fig. 1.	ČSN EN 303-5 Art. 4.2.1	+	
Combustion product temperature In boilers operated under the rated heat capacity 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.	ČSN EN 303-5 Art. 4.2.2	+	
Draught The determined values of draught, as specified in Fig. 2, are the maximum values. They also serve as the recommended values for the chimney. If the maximum draught values are exceeded, there must be a special reference to technical instruction manuals.	ČSN EN 303-5 Art. 4.2.3	+	
Period of burning In boilers with manual fuel charging and under the rated heat capacity, 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.	ČSN EN 303-5 Art. 4.2.4	+	



Minimum heat capacity The minimum heat capacity must not be higher than 30% of the rated heat capacity. In boilers with manual fuel charging, the minimum heat 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	+	
Determination of rated heat capacity The heat capacity declared by the manufacturer must be verified by testing, with tolerance of $\pm 8\%$. The rated heat capacity declared by the manufacturer must be achieved at least during one burning period. Otherwise, the rated heat capacity must be modified.	ČSN EN 303-5 Art. 5.8.2	+	

Measurement results: 1. boiler: ORLIGNO 200 60 kW: wood

Average measured and calculated values (solid fuels):

	I. ORLIGNO 200 60 kW 2009-07-20 Rated capacity	II. ORLIGNO 200 60 kW 2009-07-20 Rated capacity
Period of burning: Type of boiler: Date of testing: Test conditions:		
Type of fuel:	wood/beech/45cm	wood/beech/45cm
Rated heat capacity (specified by manufacturer) [kW]	60.0	60.0
Combustion product temperature [°C]	139.5	140.3
Fuel consumption [kg/hour]	15.38	15.17
Outlet water temperature [°C]	57.7	57.0
Outlet water temperature [°C]	78.5	77.0
Cooling water temperature [°C]	18.7	18.2
Cooling water flow rate [m ³ / hour]	0.806	0.804
Draught behind boiler [Pa]	27.0	28.0
Ambient temperature [°C]	27.3	27.9
Relative air humidity [%]	41.0	41.0
Barometric pressure [kPa]	99.885	99.885

Analysis of combustion products:

	I. ORLIGNO 200 60 kW 2009-07-20 Rated capacity	II. ORLIGNO 200 60 kW 2009-07-20 Rated capacity
Period of burning: Type of boiler: Date of testing: Test conditions:		
Type of fuel:	wood/beech/45cm	wood/beech/45cm
Oxygen O ₂ [%]	6.13	5.88
Carbon dioxide CO ₂ [%]	13.45	13.68
Carbon monoxide CO [ppm]	1139	973
Higher hydrocarbons OGC [ppm]	167	116
Nitrogen oxides NO _x [ppm]	117	121

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

		I. ORLIGNO 200 60 kW 2009-07-20 Rated capacity	II. ORLIGNO 200 60 kW 2009-07-20 Rated capacity
Period of burning: Type of boiler: Date of testing: Test conditions:			
Type of fuel:		wood/beech/45cm	wood/beech/45cm
Stoichiometric oxygen volume	[m ³ /kg]	0.845	0.845
Stoichiometric air volume	[m ³ /kg]	4.025	4.025
Stoich. vol. of dry comb. products	[m ³ /kg]	3.934	3.934
Maximum volume of CO ₂	[%]	19.13	19.13
Stoichiometric air multiple	[-]	1.40	1.38
Vol. of dry comb. products, actual	[m ³ /kg]	5.551	5.464
Volume of H ₂ O in the combustion air	[m ³ /kg]	0.085	0.087
Volume of H ₂ O in the combustion products	[m ³ /kg]	0.953	0.955

Calculated values - thermal overview

		I. ORLIGNO 200 60 kW 2009-07-20 Rated capacity	II. ORLIGNO 200 60 kW 2009-07-20 Rated capacity
Period of burning: Type of boiler: Date of testing: Test conditions:			
Type of fuel:		wood/beech/45cm	wood/beech/45cm
Loss of sensible heat of comb. products (chimney) [%]		6.8	6.8
Loss of gas underburning	[%]	0.8	0.6
Loss of mechanical underburning	[%]	0.5	0.5
Loss of heat transfer into the environ.	[%]	1.8	1.8
Total loss	[%]	9.9	9.7
Efficiency – indirect method	[%]	90.1	90.3
Heat input	[kW]	63.0	62.2
Heat capacity	[kW]	56.2	55.1
Uncertainty of determining heat capacity	[kW]	1.2	1.2
Efficiency – direct method	[%]	89.2	88.6
Capacity / rated capacity	[%]	93.7	91.8

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.