

TEST REPORT

No. 30-10802/T

Product: Hot-water boiler burning wood pellets
(with automatic fuel supply)

Type designation: ORLIGNO 500

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

**Employee responsible
for inspection and
evaluation:** Ing. Stanislav Buchta

Report issue date: 2010-07-26

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

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The results of tests and assessment only apply to the products tested.

(**) The parts of the Report marked with a double asterisk comprise findings verified otherwise than by tests according to

ČSN EN ISO/IEC 17025



This Report was processed pursuant to Order B-37348 of 2010-05-06, Contract B-37348/30 of 2010-05-17 and Contract Supplement 1. The Report reproduces the results of tests specified in Report No. 30-7271/T of 2008-04-10 and 30-7001/T of 2007-05-31.

I. Product description, intended use and application

The ORLIGNO 500 hot-water boiler with a rated capacity of 25 kW is designed for the central heating of small buildings. Wood pellets with the diameter of 6-8 mm and a length of 10-50 mm are the required fuel.

The boiler consists of a boiler body, a burner and a hopper with a capacity allowing for a long-term operation of the boiler without a need for human intervention. Fuel is supplied to the burner by two screw conveyors connected to the burner body. Combustion air is supplied by a blower. The boiler body is made of metal-sheets in the form of a weldment. The boiler is regulated by a control unit situated on the front side of the boiler.

The boiler body is thermally insulated from the outside with mineral felt inserted under the metal-sheet covers of the external cladding of the boiler.

The electronic regulation includes a JUMO temperature limiter, type 602031/80 (CE 0036).

Basic technical specifications:

Size	Rated capacity [kW]	Water volume [l]	Max. operating temperature [°C]	Max. operating pressure [bar]	Weight [kg]
ORLIGNO 500	25	60	90	2.5	300

II. Sample tested

Visual inspection, tests, and evaluation were conducted on a sample identified as follows:
ORLIGNO 500, prototype, EKV No 0211.10.13633.000

The visual inspection, testing, verification and evaluation were conducted at the Boiler and Industrial Heating Equipment Test Station of the Engineering Test Institute in Brno, in 05/2010 - 07/2010, by Milan Holomek, test engineer.

III. Measuring and testing equipment

No.	Description	Inventory number	Calibration valid until	Precision
1.	Recorder, Therm 3280-8M	02-2153	05/2011	see Calibration Sheet 080120
2.	Humidity meter, thermometer	11-6258	11/2012	see Calibration Sheet 7630F/09
3.	Barometer	11-2541	11/2013	see Calibration Sheet 613-KL-K011-08
4.	Chronometer	18-2507	02/2011	see Calibration Sheet 0248E-06



IV. Results of tests and assessment

1.**	Accompanying technical documentation	ČSN EN 303-5:2000, Art. 8, 8.1, 8.2 ČSN 06 1008:1997, Art. 12.2	Page 4 ÷ 6		+
2.**	Product data, marking	ČSN EN 303-5:2000, Art. 7, 7.1, 7.2	Page 7		+
3.**	Construction and design	ČSN EN 303-5:2000, Art. 4.1.1, 4.1.3.4, 4.1.5.1 ÷ 4.1.5.8, 4.1.5.11, 4.1.5.11.1, 4.1.5.11.2, 4.1.5.12, 4.1.5.13, 4.1.5.14.2, 4.1.5.15	Page 8÷11		+
4.**	Material, surface finish	ČSN EN 303-5:2000, Art. 4.1.1, 4.1.2.1, 4.1.3.3	Page 12		+
5.	Test of strength and tightness of pressurized components	ČSN EN 303-5:2000, Art. 5.4.1, 5.4.2	Page 13	+	
6.	Test of surface temperatures	ČSN EN 303-5:2000, Art. 4.2.7	Page 14 ÷ 16	+	
7.	Test of heat capacity, input and efficiency; Test of combustion product temperature	ČSN EN 303-5:2000 Art. 4.2, 4.2.1 ÷ 4.2.5, 5.8.2	Page 17÷20	+	
		ČSN EN 303-5:2000, Annex A, Deviation A.1.1	Page 21	+	
8.	Combustion efficiency test - emissions	ČSN EN 303-5:2000, Art. 4.2.6	Page 22	+	
		ČSN EN 303-5:2000 Annex A (deviations A.1.2, A.2 and A.5)	A.1.2 Page 23	0	
			A. 2 Page 24	0	
		A. 5 Page 25	0		
9.	Test of tightness of combustion product ducts	ČSN EN 303-5:2000 Art. 4.1.5.10		0	
10.	Test of control, regulation and security elements	ČSN EN 303-5:2000 Art. 5.13	Page 26	+	

Note:

No.:

(**) Not a test.

Evaluation:

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



Requirement assessed: **Accompanying technical documentation**

Requirement specification: ČSN EN 303-5:2000, Art. 8, 8.1, 8.2; ČSN 06 1008:1997, Art. 12.2

Sample assessed: ORLIGNO 500

Evaluation results: see the table below

Requirement	Requirement specification	Evaluation	Note
Content of accompanying technical documentation			
The documentation specified below must be available for each boiler in the corresponding language of the country of destination. Documents in accordance with Art. 8.1 and 8.2 must be supplied with each boiler.	ČSN EN 303-5:2000, Art. 8	+	
<p>Technical information and installation instructions These documents must contain at least the following particulars:</p> <ul style="list-style-type: none"> - Required draught (mbar) - Water capacity (litres) - Outlet temperature of combustion products at the rated and minimum heat capacity (°C) - Outlet mass flow rate of the combustion products at the rated and minimum heat capacity (kg/s) - Flue connecting dimension (mm) - Boiler hydraulic loss (mbar) - Rated heat capacity and regulating range of the heat capacity for each fuel type (kW) - Boiler class - Burning time for each fuel type at QN (hours) - Temperature control range (°C) - Minimum inlet water temperature at the boiler supply water connection (°C) - Fuel type, water content in the fuel, fuel size - Volume of the fuel duct in litres and dimensions of the feeding hole (mm) - Required accumulation reservoir in litres if $Q_{min} > 0.3 Q_a$ - Requirements for auxiliary power input (W) - Cold water temperature and pressure in bar for the safety heat exchanger - Electrical connections including boiler switch-off and power supply <p>The installation instructions must contain the following particulars:</p> <ul style="list-style-type: none"> - Assembly of the boiler at the point of operation (if necessary) and the required water testing pressure in accordance with 5.4.2 or 5.5.2.2 - Installation procedure - Boiler commissioning incl. information about the boiler capacity, which must be set within the regulation range of heat capacities - Information concerning the placement of the probes of the control, measuring and safety equipment 	ČSN EN 303-5:2000, Art. 8.1	<ul style="list-style-type: none"> + + + + + + + + + + + + + + 0 + 0 + + + 0 	



Requirement	Requirement specification	Evaluation	Note
In addition, it is necessary to provide reference to standards and regulations in the documentation, which must be considered during the safety equipment installation.		+	
<i>Content of accompanying technical documentation</i>			
<p>Instructions for operation</p> <p>The operating instructions must contain information concerning:</p> <ul style="list-style-type: none"> - Risk-free operation of the boiler, fuel supply method and door opening method - Cleaning and intervals between the individual cleaning operations including the necessary cleaning equipment - Measures that must be taken in the event of a failure - Reasons for regular servicing interventions performed by authorized staff and intervals between the individual servicing interventions - Type of fuel, including water content and size of fuel - Maximum fuel filling height in the fuel duct - Burning time for the individual fuel types at the rated heat capacity <p>Other printed materials (brochures, etc.) must not contain information contrary to the operating instructions.</p>	<p>ČSN EN 303-5:2000, Art. 8.2</p>	<p style="margin-bottom: 10px;">+</p> <p style="margin-bottom: 10px;">+</p> <p style="margin-bottom: 10px;">+</p> <p style="margin-bottom: 10px;">+</p> <p style="margin-bottom: 10px;">+</p> <p style="margin-bottom: 10px;">+</p> <p style="margin-bottom: 10px;">+</p> <p style="margin-bottom: 10px;">+</p> <p style="margin-bottom: 10px;">+</p>	
<p>Each heating equipment must be supplied with technical documentation in Czech, including the following:</p> <p>a) Characteristics of the environment where the heating appliance may be located</p> <p>b) Installation and operating instructions indicating the following:</p> <p>1) Installation guideline</p> <p>2) Operation and servicing guideline</p> <p>The installation guidelines shall indicate the following data:</p> <ul style="list-style-type: none"> - Use of protective equipment (protective curtains, protective and insulation mats) - Safe installation and use of the combustion product exhaust system (flues, chimneys) and the warning that the installation must comply with the applicable regulations and technical standards, such as ČSN 73 4201 - Manner of attachment of the heating equipment - Safe distances from the surfaces of the materials of individual combustibility grades and information regarding the combustibility grade of standard constructions materials - Safe installation and operation of the in-built appliance <p>The operation and maintenance guideline must contain:</p> <ul style="list-style-type: none"> - Prescribed fuel (for liquid and gas fuels their rated supply pressure or maximum admissible pressure at which the corresponding heating appliance may be operated) - For electric power, its rated supply voltage or range of the rated supply voltage, type of current - direct, alternating current, and/or frequency and total installed power input in kW or kVA of the heating appliance concerned - Instructions for commissioning and use of the heating appliance, with warnings on the necessity to contact professional servicing personnel whenever necessary and required. 	<p>ČSN 06 1008:1997, Art. 12.2</p>	<p style="margin-bottom: 10px;">+</p> <p style="margin-bottom: 10px;">+</p> <p style="margin-bottom: 10px;">0</p> <p style="margin-bottom: 10px;">+</p> <p style="margin-bottom: 10px;">0</p> <p style="margin-bottom: 10px;">+</p> <p style="margin-bottom: 10px;">0</p> <p style="margin-bottom: 10px;">+</p> <p style="margin-bottom: 10px;">+</p> <p style="margin-bottom: 10px;">+</p>	



Requirement	Requirement specification	Evaluation	Note
<p>The operation and maintenance guideline must contain: Electrical equipment to be used by individuals without electrical engineering qualification is subject to the safety regulations, including requirements for the accompanying technical documentation in accordance with ČSN 33 1310.</p> <ul style="list-style-type: none"> - Method for in-operation heating equipment supervision (not applicable to heating equipment which is designed to be operated without supervision) - Instructions for regular intervals in which surfaces and surrounding of the equipment shall be cleaned, if the equipment is designed to work in fire- or explosion-hazardous environment - Warning that no combustible objects shall be placed or located on the equipment or within a distance lower than the safety distance - Measures to adopt prior to starting the work which might change or cause a change to the environment in which the heating equipment is installed (e.g. equipment shut-down during painting works, gluing, etc.) - Information about the intervals for regular maintenance and specification of the person allowed to carry out such maintenance - Measures to adopt with the heating equipment installed in the vehicles/cars before and after relocation of the vehicle (operation interruption, fuel supply closure, securing the equipment in position, etc.) - Warnings concerning improper use of the heating appliance concerned (e.g. overload prohibited, etc.) - Warning of safety removal of ash at the appliances fired by solid fuels - Data necessary for safe refuelling of appliances burning liquid fuels - Data for use of cylinders with liquid hydrocarbon gas in appliances with in-built gas fuel cylinders - Warning of other regulations, guidelines and/or standards which shall be followed with respect to fire safety 	<p>ČSN 06 1008:1997, Art. 12.2</p>	+	
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		+	
		+	
		0	
		+	
		+	
		0	
		0	
		+	

Note:

- + Compliant.
- Non-compliant.
- 0 Not applicable.
- x Not assessed.

Evaluation drafted by: Milan Holomek

Date: 2010-07-26

Signed: 

Person responsible for evaluation:

Ing. Stanislav Buchta

Date: 2010-07-26

Signed: 



Requirement assessed: **Product data, marking**

Requirement specification: ČSN EN 303-5:2000, Art. 7, 7.1, 7.2

Sample assessed: ORLIGNO 500

Evaluation results: see the table below

Requirement	Requirement specification	Evaluation	Note
Marking – boiler name plate			
- Marking of the boiler with a label, accessibility, country of destination	ČSN EN 303-5:2000, Art. 7	+	
Data on the name plate			
- Manufacturer's name and address, its brand name	ČSN EN 303-5:2000, Art. 7.1	+	
- Registered trademark, type		+	
- Serial number and year of manufacture (or code)		+	
- Rated heat capacity or regulating range of heat capacity (kW)		+	
- Boiler class		+	
- Permissible operating pressure (bar)		+	
- Permissible operating temperature (°C)		+	
- Water capacity (litres)		+	
- Power connection (V, Hz, A) and wattage (W)		+	
Requirements regarding the name plate			
- Durability, readability, resistance to wear	ČSN EN 303-5:2000, Art. 7.2	+	

Note: + Compliant.
- Non-compliant.
0 Not applicable.
x Not assessed.

Evaluation drafted by: Milan Holomek

Date: 2010-07-26

Signed: 

Person responsible for evaluation:

Ing. Stanislav Buchta

Date: 2010-07-26

Signed: 



Requirement	Requirement specification	Evaluation	Note
<p>correspond to the boiler with the minimum rated calorific efficiency.</p> <p>The tolerances for walls made of carbon steel must comply with the data specified in EN 10029.</p> <p>The minimum rated wall thickness according to Table 3 applies to pressurized sheet metal, pipes (except for the in-built through-flow heaters and safety heat exchangers) and forged pieces. Lower wall thickness is acceptable only after the presentation of evidence expressing the equivalent functionality, as regards corrosion, thermal resistance and stress.</p>			
<p>Air bleeding of the area for the heat transfer substance (water) and combustion product ducts</p> <p>The boiler and its parts must be constructed so that the heat transfer (water) compartment allows for proper air bleeding. The boiler must be constructed so that under standard operation according to the manufacturer's instructions, no excessive noise is generated while the water is boiling. The combustion chamber and the combustion product routes must be designed so as to avoid hazardous accumulation of combustion gases.</p>	<p>ČSN EN 303-5:2000, Art. 4.1.5.1</p>	+	
<p>Cleaning of heated surfaces</p> <p>Heated surfaces must be accessible from the combustion product side through an adequate number of suitably arranged cleaning openings for inspection and cleaning using chemical products and brushes. If cleaning and maintenance of the boiler require special tools (e.g. special brushes), such tools must be included in the delivery.</p>	<p>ČSN EN 303-5:2000, Art. 4.1.5.2</p>	+	
<p>Flame observation</p> <p>Technical equipment must be used for the observation of the flame or the fuel layer. If the device in question is the door, the observation must be prevented if dangerous.</p>	<p>ČSN EN 303-5:2000, Art. 4.1.5.3</p>	+	
<p>Water tightness</p> <p>The openings for bolts and similar components used for the connection of removable parts must not lead to areas where the heat transfer substance (water) is flowing. This does not apply to the connection of measuring, regulating or safety devices.</p>	<p>ČSN EN 303-5:2000, Art. 4.1.5.4</p>	+	
<p>Replaceable components</p> <p>Replaceable components and spare parts (e.g. inserts, fire clay bricks, combustion gas valves, etc.) must be designed, manufactured and labelled so that they can be correctly installed according to the manufacturer's instructions.</p>	<p>ČSN EN 303-5:2000, Art. 4.1.5.5</p>	+	
<p>Water connections</p> <p>Water connections must comply with ISO 7-1, ISO 7-2, ISO 228-1 and ISO 228-2; flange connections must comply with ISO 7005-1, ISO 7005-2 and ISO 7005-3. The connections must be arranged so that they are easily accessible and must be chosen in order to ensure due functioning. Around the connection branches there must be a sufficiently large area enabling the fitting of connection tubes and the use of adequate tools.</p> <p>Threaded pipe connections exceeding DN 50 are not</p>	<p>ČSN EN 303-5:2000, Art. 4.1.5.6</p>	+	



Requirement	Requirement specification	Evaluation	Note
<p>recommended. Threaded pipe connections with the rated diameters exceeding DN 80 are not permissible. If there are flanges fitted, it is also necessary to supply counterflanges and sealing, unless standardized flanges are supplied. The boiler must have at least one connection point for filling and drainage. This connection can be shared. The connection dimension must be at least:</p> <ul style="list-style-type: none"> - G 1/2 for rated heat capacity not exceeding 70 kW - G 3/4 for rated heat capacity exceeding 70 kW. <p>It is possible to design these connection points outside the boiler on condition that satisfactory filling and drainage of the boiler is ensured.</p>			
<p>Connection of regulating and indicating devices and safety temperature regulators</p> <p>Each boiler must be fitted with at least one connection for a submerged temperature control sensor, temperature limiter and thermometer. Its minimum nominal diameter must be G 1/2. Deviations are only acceptable in the case that the control devices are supplied with a boiler and cannot be replaced with other components.</p> <p>The connections must be placed so that the water temperature in the boiler is measured with a sufficient accuracy. If there are additional connections on the boiler for safety devices, e.g. for a pressure reader, for a manometer, for the drop in the water level below the permissible limit or for a safety valve, the size – of particularly the safety valve – must be chosen according to the boiler capacity.</p>	<p>ČSN EN 303-5:2000, Art. 4.1.5.7</p>	+	
<p>Thermal insulation</p> <p>All boilers must have thermal insulation. The thermal insulation must be resistant to standard thermal and mechanical load. The insulation must be made of non-combustible material and under standard conditions it must not release any substances damaging health.</p>	<p>ČSN EN 303-5:2000, Art. 4.1.5.8</p>	+	
<p>Fuel hopper</p> <p>The fuel hopper must be constructed so that the fuel moves freely and the corresponding burning time is guaranteed.</p>	<p>ČSN EN 303-5:2000, Art. 4.1.5.12</p>	+	
<p>Ash-pan</p> <p>With the use of the determined fuel and at the rated heat capacity, the volume of the ash pan must allow the fire to burn for at least 12 hours; free flow of combustion air under the grid must be allowed.</p> <p>If the boiler is designed to feature a device for automatic removal of ash and clinker, the requirement above shall be deemed fulfilled.</p>	<p>ČSN EN 303-5:2000, Art. 4.1.5.13</p>	+	
<p>Automatic fuel supply</p> <p>The device for the automatic fuel supply must feature a safety element which will prevent burning in the feeder or distributor as well as the lick-through of the flame into this device.</p>	<p>ČSN EN 303-5:2000, Art. 4.1.5.14.2</p>	+	
<p>Boiler accessories</p> <p>If the manufacturer provides the boiler with additional</p>	<p>ČSN EN 303-5:2000, Art. 4.1.5.15</p>	+	



Requirement	Requirement specification	Evaluation	Note
<p>accessories (for a safe and reliable performance) requiring maintenance, such maintenance must be easy and must not require excessive disassembly operations.</p>			
<p>Temperature control regulator and limit temperature regulators The control and safety devices described and further specified in the articles below and the choice thereof, depending on the manner of installation, must secure each boiler depending on the type of the heating system and the security of the determined installation within which the boiler is to be installed. The manufacturer shall supply the devices required for individual cases together with the boiler; otherwise, an exact specification must be specified in the instructions for installation, especially as regards limit values and time constants for temperature limiters.</p>	<p>ČSN EN 303-5:2000, Art. 4.1.5.11</p>	<p>+</p>	
<p>Temperature control regulator and limit temperature regulators for open heating systems If the boiler's operation within a heating system is secured physically (temperature limited by the system pressure), the boiler must be equipped with the following devices: - temperature control regulator; - temperature limiter with automatic recovery. The temperature limiter is not necessary provided that the heating system cannot be quickly or partly disconnected; in these cases (e.g. in boiler without forced exhaust with automatic control), excess heat is released by the opening of the discharge pipeline, in the form of steam released to the environment.</p>	<p>ČSN EN 303-5:2000, Art. 4.1.5.11.1</p>	<p>+</p>	



Requirement assessed: **Material, surface finish**

Requirement specification: ČSN EN 303-5:2000, Art. 4.1.2.1, 4.1.3.3

Sample assessed: ORLIGNO 500

Evaluation results: see the table below

Requirement	Requirement specification	Evaluation	Note
<p>Drawings</p> <p>The following must be specified in the boiler drawings or the respective documentation:</p> <ul style="list-style-type: none"> - Materials used; - Welding procedures, type of weld joints (generally the weld type mark is sufficient) and the filler material; - Maximum permissible operating temperature (°C); - Maximum permissible operating pressure (bar); - Testing pressure (bar); - rated heat capacity or the range of heat capacities in accordance with the prescribed fuel for each boiler size (kW). 	ČSN EN 303-5:2000, Art. 4.1.2.1	<p>+</p> <p>+</p> <p>+</p> <p>+</p> <p>+</p> <p>+</p>	
<p>Pressurized steel components</p> <p>The steel specified in Table 1 must be used.</p>	ČSN EN 303-5:2000, Art. 4.1.3.3	+	

Note:

- + Compliant.
- Non-compliant.
- 0 Not applicable.
- x Not assessed.

Evaluation drafted by: Milan Holomek

Date: 2010-07-26

Signed: 

Person responsible for evaluation:

Ing. Stanislav Buchta

Date: 2010-07-26

Signed: 



Accredited test number: **1001.1** Test title: **Pressurized component tightness and strength test**

Testing method: ČSN EN 303-5:2000, Art. 5.4.1, 5.4.2

Sample tested: ORLIGNO 500

Measuring equipment used: see Report 30-7001/T

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

Requirement	Requirement specification	Test evaluation	Note
Pressure test in boilers made from steel sheets or other metal sheets	ČSN EN 303-5:2000, Art. 5.4		
Tests required to be conducted prior to the commencement of manufacture The maximum test pressure is $2 \times p_1$ (p_1 is the maximum operating pressure). The test duration must be at least 10 minutes and, should the testing apply for the whole of the boiler type series, it must be conducted on at least three boiler sizes (smallest, medium and largest). No leakage or visible permanent deformation may appear during the test. A test report containing the following data must be issued: - Exact description of the boiler tested, specifying the drawing number; - Test pressure in bar and test duration; - Test result; - Place and date of testing and the names of the individuals conducting the tests. The test report must be signed by an authorized test engineer and one witness.	ČSN EN 303-5:2000, Art. 5.4.1	+ + + + +	$p_1 = 2.5$ bar
Test conducted in the course of the manufacturing process The test pressure must be 1.3 times p_1 , but at least 4 bar.	ČSN EN 303-5:2000, Art. 5.4.2	+	Without leakage and deformations

Test evaluation: No leakage or visible permanent deformation appeared during the test.

Tested by: Milan Holomek

Date: 2010-07-26

Signed: 

Reviewed by: Ing. Stanislav Buchta

Date: 2010-07-26

Signed: 



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

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

Sample tested: ORLIGNO 500

Measuring equipment used: see Report 30-7271/T

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	Requirement specification	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 operator's 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>	<p>The boiler must be installed on a fireproof support, see the Technical Instructions.</p>



Measurement results: 1. ORLIGNO 500 boiler, rated capacity

Average temperatures of boiler walls, doors and covers (°C):	
Fuel type	Wood pellets
Date of testing	2007-09-13
Rel. humidity (%)	46
Bar. pressure (kPa)	99.485
Ambient temperature (°C)	26.5
Front wall	34.2
Rear wall	30.9
Right wall	25.2
Left wall	33.2
Upper wall	28.4
Lower wall	72.8
Upper door	57.0
Lower door	52.0
Temperatures of control elements (°C):	
Upper door lever - plastic	42
Bottom door lever - plastic	41
Hopper lid lock - plastic	27



Measurement results: 2. ORLIGNO 500 boiler, minimum capacity

Average temperatures of boiler walls, doors and covers (°C):	
Fuel type	Wood pellets
Date of testing	2007-09-14
Rel. humidity (%)	49
Bar. pressure (kPa)	99.112
Ambient temperature (°C)	26.7
Front wall	30.6
Rear wall	28.2
Right wall	24.0
Left wall	28.3
Upper wall	25.4
Lower wall	57.3
Upper door	51.7
Lower door	45.7
Temperatures of control elements (°C):	
Upper door lever - plastic	36
Bottom door lever - plastic	34
Hopper lid lock - plastic	27

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, except for the boiler bottom; see the follow-up data in the Technical Instructions.

Tested by: Milan Holomek

Date: 2010-07-26

Signed: 

Reviewed by: Ing. Stanislav Buchta

Date: 2010-07-26

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 500

Measuring equipment used: see Report 30-7271/T

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	Requirement specification	Test evaluation	Note
<p>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.</p>	ČSN EN 303-5 Art. 4.2	+	
<p>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.</p>	ČSN EN 303-5 Art. 4.2.1	+	
<p>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.</p>	ČSN EN 303-5 Art. 4.2.2	+	
<p>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.</p>	ČSN EN 303-5 Art. 4.2.3	+	
<p>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.</p>	ČSN EN 303-5 Art. 4.2.4	+	



<p>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.</p>	<p>ČSN EN 303-5 Art. 4.2.5</p>	<p>+</p>	
<p>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.</p>	<p>ČSN EN 303-5 Art. 5.8.2</p>	<p>+</p>	

Measurement results: 1st boiler - ORLINGO 500, fuel: wood pellets

Average measured and calculated values (solid fuels):

Test No.: Type of boiler: Date of testing: Test conditions:	I. ORLINGO 500 2007-09-13 Rated capacity	II. ORLINGO 500 2007-09-14 Minimum capacity
Type of fuel:	Wood pellets	Wood pellets
Rated heat capacity (spec. by manufacturer) [kW]	25	25
Combustion product temperature [°C]	141.9	92.7
Fuel consumption [kg/hour]	5.57	1.66
Input water temperature [°C]	59.5	64.2
Output water temperature [°C]	75.5	81.7
Cooling water temperature [°C]	16.9	19.0
Cooling water flow rate [m ³ / hour]	0.3570	0.0950
Draught after the boiler [Pa]	18.0	12.0
Ambient temperature [°C]	26.5	26.7
Relative air humidity [%]	46.0	49.0
Barometric pressure [kPa]	99.485	99.112

Analysis of combustion products:

Period of burning: Type of boiler: Date of testing: Test conditions:	I. ORLINGO 500 2007-09-13 Rated capacity	II. ORLINGO 500 2007-09-14 Minimum capacity
Type of fuel:	Wood pellets	Wood pellets
Oxygen O ₂ [%]	8.81	10.54
Carbon dioxide CO ₂ [%]	11.92	10.34
Carbon monoxide CO [ppm]	212	431
Higher hydrocarbons OGC [ppm]	18	55
Nitrogen oxides NO _x [ppm]	135	81



Auxiliary combustion values (solid fuels):

Period of burning: Type of boiler: Date of testing: Test conditions:		I. ORLINGO 500 2007-09-13 Rated capacity	II. ORLINGO 500 2007-09-14 Minimum capacity
Type of fuel:		Wood pellets	Wood pellets
Stoichiometric oxygen volume	[m ³ /kg]	0.966	0.966
Stoichiometric air volume	[m ³ /kg]	4.601	4.601
Stoich. vol. of dry comb. products	[m ³ /kg]	4.519	4.519
Maximum volume of CO ₂	[%]	19.50	19.50
Stoichiometric air multiple	[-]	1.71	1.99
Vol. of dry comb. products, actual	[m ³ /kg]	7.379	8.485
Volume of H ₂ O in the combustion air	[m ³ /kg]	0.128	0.161
Volume of H ₂ O in the combustion products	[m ³ /kg]	0.904	0.937

Calculated values - thermal overview

Period of burning: Type of boiler: Date of testing: Test conditions:		I. ORLINGO 500 2007-09-13 Rated capacity	II. ORLINGO 500 2007-09-14 Minimum capacity
Type of fuel:		Wood pellets	Wood pellets
Loss of sensible heat of comb. prod. (chimney)	[%]	7.5	4.8
Loss of gas underburning	[%]	0.1	0.4
Loss of mechanical underburning	[%]	0.1	0.1
Loss of heat exchange into the environ.	[%]	2.1	3.4
Total loss	[%]	9.8	8.7
Calorific efficiency - indirect method	[%]	90.2	91.3
Heat input	[kW]	27.1	8.1
Heat capacity	[kW]	24.6	7.3
Uncertainty of determining heat capacity	[kW]	1.0	0.3
Efficiency – direct method	[%]	90.6	90.6
Output / nominal output	[%]	98.4	29.3

At the rated capacity, the boiler efficiency regarding wood pellet burning meets the requirements applicable to Class 3 according to ČSN EN 303-5:2000, Fig. 1.



Fuel analysis

Fuel type	Wood pellets			
Analytical indicator	Symbol	Unit	Value	Uncertainty
Heat of combustion	Q_s	[MJ/kg]	19.07	0.14
Caloric value	Q_j	[MJ/kg]	17.54	0.14
All water in original condition	W_t^r	[% by weight]	6.85 ± 0.02	
Ash	A	[% by weight]	0.46 ± 0.02	
Carbon	C	[% by weight]	47.67	0.25
Hydrogen	H	[% by weight]	6.23	0.10
Nitrogen	N	[% by weight]	0.41	0.10
Sulphur	S	[% by weight]	0.00	
Chlorine	Cl	[% by weight]	0.02 ± 0.01	
Oxygen – calculation for 100%	O	[% by weight]	38.36	
CO ₂ max.	CO _{2max}	[% by volume]	19.47	
Conversion factor f_{emis} for the conversion of emissions in [mg/m ³] to [mg/MJ]	f_{emis}	[-]	0.25822	
Min. required volume of O ₂	$V_{O_2 min}$	[m ³ /kg]	0.96721	
Min. required dry air volume	$V_{vz min}$	[m ³ /kg]	4.60578	
Min. quantity of dry chimney gas	$V_{ks min}$	[m ³ /kg]	4.52844	

Note: Sample in the original condition

Measurement uncertainty: specified in the table of 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% 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."

The rated heat capacity measured is within the tolerance of $\pm 8\%$;
Boiler class 3;
The temperature of combustion products is lower than 160°C above the ambient temperature, see the respective data in the Technical Instructions;
The measured draught values do not exceed the maximum values according to Figure 2;
The period of burning is more than 6 hours during wood pellet burning;
The minimum heat capacity does not exceed 30% of the rated heat capacity.

Tested by: Milan Holomek Date: 2010-07-26 Signed: 

Reviewed by: Ing. Stanislav Buchta Date: 2010-07-26 Signed: 



Accredited test number: **1004.1** Test title: **Test of heat capacity, input and efficiency Deviation of type A.1.1**

Testing method: ČSN EN 303-5:2000, Art. 5.7, 5.8 and 5.10

Sample tested: ORLIGNO 500

Measuring equipment used: see Report 30-7271/T

Date of test and ambient conditions - see the "Heat capacity, input and efficiency" test

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	Requirement specification	Test evaluation	Note
Type A deviations			
A.1 Deviation for Austria			
Boiler efficiency for rated heat capacity and minimum heat capacity:			
<i>a) Manual fuel supply</i>			
≤ 10 kW	73 %	ČSN EN 303-5 Annex A Art. A 1.1	+
> 10 kW ≤ 200 kW	$(65.3 + 7.7 \log Q_N) \%$		
> 200 kW	83 %		
<i>b) Automatic fuel supply</i>			
≤ 10 kW	73 %	ČSN EN 303-5 Annex A Art. A 1.1	+
> 10 kW ≤ 200 kW	$(65.3 + 7.7 \log Q_N) \%$		
> 200 kW	83 %		

Measurement results: 1st boiler - ORLIGNO 500, rated capacity, fuel: wood pellets

Boiler capacity	Calorific efficiency required	Calorific efficiency measured
Rated	79.1	90.6
Minimum	79.1	90.6

Test evaluation: The measured efficiency is higher than the required minimum.

Tested by: Milan Holomek

Date: 2010-07-26

Signed: 

Reviewed by: Ing. Stanislav Buchta

Date: 2010-07-26

Signed: 



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

Testing method: ČSN EN 303-5:2000, Art. 5.7, 5.9 and 5.10

Sample tested: ORLIGNO 500

Measuring equipment used: see Report 30-7271/T

Date of test and ambient conditions - see the "Heat capacity, input and efficiency" test

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	Requirement specification	Test evaluation	Note
Limit emission values The emission values must be low during burning. This requirement is considered fulfilled if the emission values specified in Table 7 are not exceeded, provided that the boiler is operated under rated heat capacity, or as regards boilers with a range of heat capacity, operated under the rated heat capacity and the minimum heat capacity in accordance with 5.7, 5.9 and 5.10. The requirement regarding the limit values of dust emissions under the minimum heat capacity is fulfilled if the requirements concerned are fulfilled under the rated heat capacity.	ČSN EN 303-5 Art. 4.2.6	+	Class 3

Measurement results: 1st boiler - ORLIGNO 500, rated capacity, fuel: wood pellets

Average values of gas emissions of O₂, CO₂, CO, OGC, NO_x and dust:

Boiler capacity	O ₂ [%]	CO ₂ [%]	CO [ppm]	OGC [ppm]	NO _x [ppm]	Dust [mg/m ³]	CO [mg/m ³] O ₂ = 10 %	OGC [mg/m ³] O ₂ = 10 %	NO _x [mg/m ³] O ₂ = 10 %	Dust [mg/m ³] O ₂ = 10 %
Rated	8.81	11.92	212	18	135	40	240	9	251	36
Minimum	10.54	10.34	431	55	81	-	566	31	175	-

Test evaluation: Emissions – category 3.

Tested by: Milan Holomek

Date: 2010-07-26

Signed: 

Reviewed by: Ing. Stanislav Buchta

Date: 2010-07-26

Signed: 



Accredited test number: **1005.1** Test title: **Combustion efficiency test - emissions Deviation of type A.1.2**

Testing method: ČSN EN 303-5:2000, Art. 5.7, 5.9 and 5.10

Sample tested: ORLIGNO 500

Measuring equipment used: see Report 30-7271/T

Date of test and ambient conditions - see the "Heat capacity, input and efficiency" test

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						Requirement specification	Test evaluation	Note	
A.1 Deviation for Austria									
Limit emission values						ČSN EN 303-5 Annex A Art. A 1.2	+		
		mg/MJ ¹⁾	CO	NO _x	OGC				Dust
Manual fuel supply	Biological fuels	1100	150 ²⁾	80	80				60
	Fossil fuels	1100	100	80	80				60
Automatic fuel supply	Biological fuels	500 ³⁾	150 ²⁾	40	40				60
	Fossil fuels	500	100	40	40	40			
¹⁾ With respect to the caloric value of the fuel used ²⁾ Limit values of NO _x apply only to boilers burning wood ³⁾ At 30% of the rated heat capacity, the limit value may be exceeded by 50%									

Measurement results: 1st boiler - Orlan Pellet, rated capacity, fuel: wood pellets

Boiler capacity	Average emission values								
	Measured values					Converted values			
	O ₂ [%]	CO [ppm]	NO _x [ppm]	OGC [ppm]	Dust [mg/m ³]	CO [mg/MJ]	NO _x [mg/MJ]	OGC [mg/MJ]	Dust [mg/MJ]
Rated	8.81	212	135	18	40	118	123	4	18
Minimum	10.54	431	81	55	-	279	86	15	-

Test evaluation: The measured emission values do not exceed the limit values.

Tested by: Milan Holomek

Date: 2010-07-26

Signed:

Reviewed by: Ing. Stanislav Buchta

Date: 2010-07-26

Signed:



Accredited test number: **1005.1** Test title: **Combustion efficiency test - emissions Deviation of type A.2**

Testing method: ČSN EN 303-5:2000, Art. 5.7, 5.9 and 5.10

Sample tested: ORLIGNO 500

Measuring equipment used: see Report 30-7271/T

Date of test and ambient conditions - see the "Heat capacity, input and efficiency" test

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	Requirement specification	Test evaluation	Note
A.2 Deviation for Germany			
For Germany, only Class 3 in accordance with Table 7 is acceptable. Central heating boilers burning solid fuels with the rated heat capacity exceeding 15 kW must be constructed and operated so that the emissions meet the following requirements, depending on the fuel used:			
Fuel	Emission values [g/m ³]	CO	Dust
Black and brown coal	Reference content of O ₂ = 8%	-	0.15
Wood in natural condition	Reference content of O ₂ = 13%	4 ¹⁾ 2 ²⁾ 1 ³⁾ 0.5 ⁴⁾	0.15
¹⁾ 15 kW < O _N ≤ 50 kW ²⁾ 50 kW < O _N ≤ 150 kW ³⁾ 150 kW < O _N ≤ 500 kW ⁴⁾ O _N > 500 kW		ČSN EN 303-5 Annex A Art. A.2	+

Measurement results: 1st boiler - ORLIGNO 500, rated capacity, fuel: wood pellets

Boiler capacity	Average emission values								
	Measured values				Converted values				
	O ₂ [%]	CO [ppm]	OGC [ppm]	Dust [mg/m ³]	CO O ₂ = 10 % [mg/m ³]	OGC O ₂ = 10 % [mg/m ³]	Dust O ₂ = 10 % [mg/m ³]	CO O ₂ = 13 % [g/m ³]	Dust O ₂ = 13 % [g/m ³]
Rated	8.81	212	18	40	240	9	36	0.174	0.026
Minimum	10.54	431	55	-	566	31	-	0.412	-

Test evaluation: The measured emission values do not exceed the limit values.

Tested by: Milan Holomek

Date: 2010-07-26

Signed:

Reviewed by: Ing. Stanislav Buchta

Date: 2010-07-26

Signed:



Accredited test number: **1005.1** Test title: **Combustion efficiency test - emissions Deviation of type A.5**

Testing method: ČSN EN 303-5:2000, Art. 5.7, 5.9 and 5.10

Sample tested: ORLIGNO 500

Measuring equipment used: see Report 30-7271/T

Date of test and ambient conditions - see the "Heat capacity and calorific efficiency" test

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					Requirement specification	Test evaluation	Note
A.5 Deviation for Switzerland							
For boilers burning wood in natural condition, only Class 3 of Table 7 is acceptable. The use of coal, coal briquettes and coke with the specific content of sulphur > 1% is not permitted.					ČSN EN 303-5 Annex A Art. A.5	+	
Fuel	Q _N [kW]	Emissions [mg/m ³]	CO	Dust			
Fossil	O _N ≤ 70 70 < O _N ≤ 1000	reference content of O ₂ = 7%	4,000 1,000	- 150			
Wood in natural condition	O _N ≤ 70 70 < O _N ≤ 200 200 < O _N ≤ 500 500 < O _N ≤ 1000	Reference content of O ₂ = 13%	4,000 2,000 1,000 500	- 150 150 150			

Measurement results: 1st boiler - ORLIGNO 500, rated capacity, fuel: wood pellets

Boiler capacity	Average emission values								
	Measured values				Converted values				
	O ₂ [%]	CO [ppm]	OGC [ppm]	Dust [mg/m ³]	CO O ₂ = 10 % [mg/m ³]	OGC O ₂ = 10 % [mg/m ³]	Dust O ₂ = 10 % [mg/m ³]	CO O ₂ = 13 % [mg/m ³]	Dust O ₂ = 13 % [mg/m ³]
Rated	8.81	212	18	40	240	9	36	174	26
Minimum	10.54	431	55	-	566	31	-	412	-

Test evaluation:

The measured emission values do not exceed the limit values.

Tested by: Milan Holomek

Date: 2010-07-26

Signed: 

Reviewed by: Ing. Stanislav Buchta

Date: 2010-07-26

Signed: 



Accredited test number:

1006.1 Test title: **Test of control, regulation and security elements**

Testing method: ČSN EN 303-5:2000, Art. 5.13

Sample tested: ORLIGNO 500

Measuring equipment used: No. 1 ÷ 4

Date of testing:	2010-05-17	$t_{ok} = 20.4$	°C	r.h. = 44.8	%	$p_a = 98.64$	kPa
Place of testing:	at the Engineering Test Institute	x	at the manufacturer	<input type="checkbox"/>	at the customer	<input type="checkbox"/>	other:

Test results:

Requirement	Requirement specification	Test evaluation	Note
<p>Inspection of the function of the temperature regulator and temperature limiter If the temperature regulator is in normal operation, the temperature on the temperature indicator must not exceed 100°C; the thermal fuse or temperature limiter, or the heat dissipation device must not be in operation. The test is repeated with the control temperature regulator out of order. The aim is to check whether the temperature limiter or temperature sensor will stop the heating regime when the maximum temperature declared by the manufacturer (max. 110°C) is reached.</p>	ČSN EN 303-5, Art. 5.13	+	

Measurement results: 1st boiler, ORLIGNO 500

Temperature regulator test

Adjusted burner (boiler) output	Heat collection by cooling device	Temperature set at the regulator	Water temperature at regulator off	Temperature at boiler thermometer, at regulator off
Rated	$(40 \pm 5)\%$	80°C	82.4°C	80°C

Temperature limiter test

Adjusted burner (boiler) output	Heat collection by cooling device	Temperature set at the limiter	Water temperature at limiter off	Temperature at boiler thermometer, at limiter off
Rated	$(40 \pm 5)\%$	110°C	107.6°C	108°C

During the temperature regulator test, the water temperature at the output from the boiler did not exceed 100°C.

During the safety temperature regulator test, the water temperature at the output from the boiler did not exceed 110°C.

Test evaluation:

Tested by: Milan Holomek

Date: 2010-07-26

Signed: 

Reviewed by: Ing. Stanislav Buchta

Date: 2010-07-26

Signed: 



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

V. List of referenced documents

- Order B-37348 of 2010-05-06
- Contract B-37348/30 of 2010-05-17
- Contract Supplement No. 1 of 2010-07-26, see letter with ref. No. 0215-Hol/4582, of 2010-07-26
- ČSN EN 303-5:2000 – Central heating boilers – Part 5: Central heating boilers burning solid fuels, with manual or automatic fuel feeding and rated heat capacity of up to 300 kW. Terminology, requirements, testing and marking.
- Instructions for use, assembly and maintenance of ORLIGNO 500

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


Ing. Stanislav Buchta
Head of Boiler and Industrial Heat
Equipment Team




Ing. Jiří Dvořák
Head of Heat and Ecological
Equipment Test Station

