



TEST REPORT

39-10876/T2

Product: Hot-water boiler for solid fuel (wood pellets – C1) with automatic fuel supply

Type designation: EG PELLET MINI

Versions: EG PELLET MINI16 - REVO, EG PELLET MINI 32 - REVO, EG PELLET MINI 45 - REVO

Customer: Zakład Slusarski "GREN" sp.j
ul. Miarki 1B, 43-200 Pszczyna
Poland

Manufacturer: Zakład Slusarski "GREN" sp.j
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Distribution list: 1 copy to the Engineering Test Institute
1 copy to the Customer



The tests were conducted on the basis of Order B-55799 dated 2016-04-26 (received on 2016-04-27), Contract B-55799/39 and Implementation date change Z1.

I. Product description, intended use and mode of application

The Hot-water boilers for solid fuel (wood pellets – C1) with automatic fuel supply, EG PELLETT MINI version REVO is intended for heating of large residential buildings and similar buildings. The boiler is designed for burning of wood pellets – C1. The boiler assembly comprises the boiler body, boiler rotation burner, feed screw and the fuel chamber (storage of fuel). The boiler body is equipped with automatic mechanism for cleaning of combustion product passages. The boiler body is a steel-sheet weldment, cylindrical in shape. The boiler body is thermally insulated with mineral felt.

Further detailed descriptions of individual assembly groups are provided in the enclosed technical documentation to Task 39-10876 and 31-9563.

II. Sample tested

Boiler output versions that are the subject of the proceedings:

(table 1)

| Boiler output version | Heat output | Place of testing |
|---------------------------|-------------|------------------|
| EG PELLETT MINI 16 - REVO | 16 kW | SZÚ Brno |
| EG PELLETT MINI 32 - REVO | 32 kW | |
| EG PELLETT MINI 45 - REVO | 45 kW | |

Visual inspection, testing and evaluation were carried out by Ing. Pavel Fojtů, Test Engineer, at Engineering Test Institute SZÚ Brno, in 09/2015.

The tests were performed with the measurement and test equipment with valid calibration.



III. Measuring and test equipment

| No. | Description | Inventory number | Calibration valid until | Accuracy |
|-----|--|------------------|---------------------------------------|--|
| 1. | Combustion product analyser, Horiba, type 680 P | 92-0004 | calibration prior to each measurement | see CRM 103000237769 see CRM 103000237770 |
| 2. | Weighing machine | 02-2290 | 02/2017 | see CS 6051-CS-H-0651-10 |
| 3. | Water meter, NW 20 | 02-1575 | 03/2017 | see CS ACS-P/006/2009 |
| 4. | Data collection system | 02-2241 | 12/2016 | see CS 110002 |
| 5. | Moisture meter, thermometer | 11-6258 | 11/2016 | see CS 7630F/09 |
| 6. | Barometer | 11-2541 | 01/2019 | see CS 613-CS-K011-08 |
| 7. | Draught gauge | 11-7275 | 02/2017 | see CS 0144F/11 |
| 8. | Stop watch | 99-0760 | 10/2017 | see CS 2850E-07 |
| 9. | Calorimeter, IKA, type C 5000 | 02-2236 | 03/2017 | $\pm 0,12$ MJ/kg |
| 10. | Elemental analyser, Perkin Elmer, type 2400 CHNS | 02-2107 | 03/2017 | $\pm 0,2$ % rel. |
| 11. | Gravimat, SHC 501 | 02-2328 | 04/2018 | see CS 090177 (8,9), 090180 |
| 12. | Laboratory weighing machine | 02-1458 | 06/2017 | see CS 6051-CS-H376-09 |
| 13. | Weighing machine, Ohaus MB 45 | 02-2274 | 06/2017 | see CS 6051-CS-H374-09 |
| 14. | Manometer | 18-3336 | 06/2017 | see CS 130052 |
| 15. | Prandtl tube, 0.3 m | ME 484 | 11/2016 | see CS 5012-CS-RS090-09 |
| 16. | Psychrometer H 4220 | 92-0005 | 12/2016 | see CS 090176 |
| 17. | Electrometer | 03524781 | 03/2022 | see CS 002/12/E |



IV. Results of tests and evaluation

| No. | Requirement | Technical standard, regulation applied | Source materials | Test evaluation | |
|-----|---|---|------------------|-----------------|---|
| 7. | Pressurized component tightness and strength test (1001.1*) | ČSN EN 303-5:2013 Art. 5.4, 5.4.1, 5.4.2 | Page 5 | + | |
| 8. | Surface temperature test (1003*) | ČSN EN 303-5:2013 Art. 5.12, 5.16.4, 4.3.6 | Pages 6 - 9 | + | |
| 9. | Test of heat output, input and efficiency(1004.1*) Test of combustion product temperature (1004.2*) | 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 10 - 17 | + | |
| 10. | Combustion efficiency test – emissions (1005.1*) | ČSN EN 303-5:2013 Art. 5.7.3, 5.7.4, 5.9, 5.10.4 | Pages 18 - 19 | + | |
| 11. | Test of heat output, input and efficiency (1004.1*) Combustion efficiency test – emissions (1005.1*) | ČSN EN 303-5:2013 Annex C, Deviation from Austria, C.2.2, C.2.3 | Pages 20 - 22 | C.2.2 | + |
| | | ČSN EN 303-5:2013 Annex C, C.3 Deviation from Croatia | - | C.2.3 | - |
| | | ČSN EN 303-5:2013 Annex C, C.3 Deviation from Croatia | - | 0 | |
| | | ČSN EN 303-5:2013 Annex C, Deviation from Denmark , C.4.1, C.4.2 | Pages 23 - 25 | + | |
| | | ČSN EN 303-5:2013 Annex C, Deviation from Germany, C.5.1, C.5.2 | Pages 26 - 27 | - | |
| | | ČSN EN 303-5:2013 Annex C C.6 Deviation from Switzerland | Pages 28 - 29 | - | |
| | | ČSN EN 303-5:2013 Annex C C.8 Deviation from Italy | Pages 30 | + | |
| 12. | Test of control, regulation and safety elements (1006.1*) Combustion efficiency test – emissions (1005.1*) | ČSN EN 303-5:2013 Art. 5.13, 5.14, 5.16.2, 5.16.3 ČSN EN 303-5:2013 Art. 5.9, 5.10.4 | Pages 31 - 34 | + | |

Evaluation:

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



Test results:

| Requirement | Requirement specification | Test evaluation | Note |
|--|------------------------------|--|-----------------------------------|
| Pressure test for boilers of sheet or sheet metal of non-ferrous metal | ČSN EN 303-5:2013 Art. 5.4 | | |
| <p>Tests to be carried out before production</p> <p>The type test pressure is $2 \times PS$ using hydraulic pressure where PS is the maximum permissible operating pressure. The test period shall be at least 10 min and if it is to apply to a range of boilers, the test shall be carried out on at least 3 boiler sizes (smallest, medium, and largest size). No leakage or noticeable permanent deformation shall occur during the test.</p> <p>A record shall be made of the test, including the following details:</p> <ul style="list-style-type: none"> - exact description of the boiler tested by stating the drawing number; - test pressure in bar and duration of the test; - test result; - place and date of the test, including the names of persons carrying out the test. <p>The test report shall be signed by, as a minimum, the works tester responsible and one witness.</p> | ČSN EN 303-5:2013 Art. 5.4.1 | <p style="text-align: center;">+</p> <p style="text-align: center;">+</p> <p style="text-align: center;">+</p> <p style="text-align: center;">+</p> <p style="text-align: center;">+</p> | Enclosed technical documentation. |
| <p>Test during production</p> <p>Each boiler shall be tested during the production and the test pressure shall be at least $1.43 \times PS$.</p> | ČSN EN 303-5:2013 Art. 5.4.2 | + | |

Test evaluation:

No leakages or visible permanent deformations appeared during the test.



Accredited test number: **1003*** Test title: **Surface temperature test**

Test method: ČSN EN 303-5:2013 Art. 5.12, 5.16.4, 4.3.6

Sample tested: EG PELLET MINI16 - REVO, EG PELLET MINI 32 - REVO, EG PELLET MINI 45 - REVO

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: EG PELLETT MINI 16 - REVO

| Average temperatures of boiler walls, doors and covers (°C): | | |
|---|---------------------------|---------|
| Boiler type | EG PELLETT MINI 16 - REVO | |
| Fuel type | Wood Pellets - C1 | |
| Heat output | Nominal | Minimal |
| ambient temperature (°C) | 25.9 | 27.2 |
| humidity (%) | 35.7 | 51.2 |
| air pressure (kPa) | 99.05 | 98.61 |
| Front wall | 31.8 | 29.2 |
| Rear wall | 37.1 | 36.2 |
| Right wall | 39.2 | 37.2 |
| Left wall | 38.4 | 35.2 |
| Upper wall | 40.6 | 37.2 |
| Lower wall | 40.2 | 30.3 |
| Temperatures of control elements (°C): | | |
| Handle of lower upper (plastic) | 28 | |
| Handle of lower door (plastic) | 63 | |
| Cleaning handle (plastic) | 56 | |
| Handle cover (metal) | 28 | |



Measurement results: EG PELLETT MINI 32 - REVO

| Average temperatures of boiler walls, doors and covers (°C): | | |
|---|---------------------------|---------|
| Boiler type | EG PELLETT MINI 32 - REVO | |
| Fuel type | Wood Pellets - C1 | |
| Heat output | Nominal | Minimal |
| ambient temperature (°C) | 26.0 | 26.2 |
| humidity (%) | 54.5 | 54.3 |
| air pressure (kPa) | 97.44 | 97.56 |
| Front wall | 30.9 | 29.1 |
| Rear wall | 40.4 | 36.8 |
| Right wall | 39.8 | 37.6 |
| Left wall | 38.5 | 35.3 |
| Upper wall | 35.4 | 34.3 |
| Lower wall | 52.0 | 36.3 |
| Temperatures of control elements (°C): | | |
| Handle of lower upper (plastic) | 70 | |
| Handle of lower door (plastic) | 62 | |
| Cleaning handle (plastic) | 52 | |
| Handle cover (metal) | 28 | |



Measurement results: EG PELLET MINI 45 - REVO

| Average temperatures of boiler walls, doors and covers (°C): | | |
|--|--------------------------|---------|
| Boiler type | EG PELLET MINI 45 - REVO | |
| Fuel type | Wood Pellets - C1 | |
| Heat output | Nominal | Minimal |
| ambient temperature (°C) | 25.6 | 27.2 |
| humidity (%) | 35.8 | 51.4 |
| air pressure (kPa) | 99.04 | 98.61 |
| Front wall | 32.6 | 31.0 |
| Rear wall | 31.3 | 30.9 |
| Right wall | 30.6 | 30.7 |
| Left wall | 28.8 | 28.1 |
| Upper wall | 34.6 | 33.9 |
| Lower wall | 41.2 | 36.1 |

| Temperatures of control elements (°C): | |
|--|----|
| Handle of lower upper (plastic) | 38 |
| Handle of lower door (plastic) | 51 |
| Cleaning handle (plastic) | 32 |

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 specified temperature rise values have not been exceeded.



Accredited test number: **1004.1*** Test title: **Test of heat output, input and efficiency**
1004.2* **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: EG PELLET MINI 16 - REVO, EG PELLET MINI 32 - REVO,
 EG PELLET MINI 45 - REVO

Measuring equipment used: Chapter III - Measuring and test equipment

Test results:

Average measured and calculated values (solid fuels):

| Test: | I. | II. |
|--|--------------------------|---------|
| Boiler type: | EG PELLET MINI 16 - REVO | |
| Output tested: | Nominal | Minimum |
| Fuel type: | Wood pellets - C1 | |
| Combustion period, (automatic) stoking | Minimally 6 hours | |
| Nominal heat output (specified by manufacturer) [kW] | 16 | 16 |
| Flue gas temperature [°C] | 137.8 | 89.2 |
| Fuel mass added [kg/h] | 3.491 | 1.056 |
| Inlet water temperature [°C] | 54.8 | 60.1 |
| Outlet water temperature [°C] | 72.4 | 75.1 |
| Temperature of the entering cold water [°C] | 18.1 | 18.5 |
| Cooling water flow rate [m ³ /h] | 0.7875 | 0.2745 |
| Draught [Pa] | 9.6 | 4.4 |
| Ambient temperature [°C] | 25.9 | 27.2 |
| Relative air humidity [%] | 35.7 | 51.2 |
| Barometric pressure [kPa] | 99.05 | 98.61 |

Analysis of combustion products:

| Test (period of burning) : | I. | II. |
|---------------------------------------|-------|-------|
| Oxygen O ₂ [%] | 7.53 | 12.73 |
| Carbon dioxide CO ₂ [%] | 12.20 | 7.53 |
| Carbon monoxide CO [ppm] | 111 | 115 |
| Higher hydrocarbons THC/OGC [ppm] | 2 | 3 |
| Nitrogen oxides NO _x [ppm] | 132 | 78 |
| Sulfur oxides SO ₂ [ppm] | 0 | 0 |



Auxiliary combustion values (solid fuels):

| Test (period of burning) : | | I. | II. |
|--|------------------------|-------|--------|
| Stoichiometric oxygen volume | [m ³ /kg] | 0.990 | 0.986 |
| Stoichiometric air volume | [m ³ /kg] | 4.713 | 4.696 |
| Stoichiometric volume of dry combustion products | [m ³ /kg] | 4.625 | 4.609 |
| Maximum content of CO ₂ | [%] | 19.49 | 19.49 |
| Stoichiometric air multiple | [-] | 1.55 | 2.51 |
| Volume of dry combustion products. actual | [m ³ /kg] | 7.381 | 11.909 |
| Content of H ₂ O in combustion air | [m ³ /kg] | 0.089 | 0.225 |
| Content of H ₂ O in combustion products | [m ³ /kg] | 0.862 | 0.998 |

Calculated values - thermal overview

| Test (period of burning) : | | I. | II. |
|--|---------------|-------------|-------------|
| Loss of sensible heat of combustion products | [%] | 7.0 | 5.9 |
| Loss of gas underburning | [%] | 0.1 | 0.1 |
| Loss of mechanical underburning | [%] | 0.2 | 0.5 |
| Loss of heat transfer into environment | [%] | 2.3 | 4,6 |
| Total loss | [%] | 9.5 | 11.2 |
| Efficiency – indirect method | [%] | 90.5 | 88.8 |
| Fuel mass added - actual | [kg/h] | 3.507 | 1.063 |
| Heat input | [kW] | 17.6 | 5.3 |
| Heat output | [kW] | 15.9 | 4.7 |
| Uncertainty of determining heat output | [kW] | 0.7 | 0.2 |
| Efficiency – direct method | [%] | 90.1 | 88.4 |
| Output / nominal output | [%] | 99.2 | 29.5 |

At nominal output, when burning **Wood pellets – C1**, the boiler efficiency meets the requirements applicable to **Class 5** as per ČSN EN 303-5:2013, Fig. 1.

Test evaluation:

The measured heat output is within the $\pm 8\%$ tolerance;
 Boiler Class 5;
 At nominal output, combustion product temperature is less than 160 K above the ambient temperature;
 When burning Wood pellets – C1, the period of burning is more than 6 hours;
 The minimum heat output is less than 30% of nominal heat output.



Test results:

Average measured and calculated values (solid fuels):

| Test: | I. | II. |
|--|--------------------------|---------|
| Boiler type: | EG PELLET MINI 32 - REVO | |
| Output tested: | Nominal | Minimum |
| Fuel type: | Wood pellets - C1 | |
| Combustion period, (automatic) stoking | Minimally 6 hours | |
| Nominal heat output (specified by manufacturer) [kW] | 32 | 32 |
| Flue gas temperature [°C] | 101.4 | 72.9 |
| Fuel mass added [kg/h] | 6.466 | 2.091 |
| Inlet water temperature [°C] | 55.9 | 63.0 |
| Outlet water temperature [°C] | 72.9 | 76.7 |
| Temperature of the entering cold water [°C] | 18.4 | 18.0 |
| Cooling water flow rate [m ³ /h] | 1.5653 | 0.6144 |
| Draught [Pa] | 15.2 | 7.6 |
| Ambient temperature [°C] | 26.0 | 26.2 |
| Relative air humidity [%] | 54.5 | 54.3 |
| Barometric pressure [kPa] | 97.44 | 97.56 |

Analysis of combustion products:

| Test (period of burning) : | I. | II. |
|---------------------------------------|-------|-------|
| Oxygen O ₂ [%] | 7.61 | 13.85 |
| Carbon dioxide CO ₂ [%] | 12.38 | 6.94 |
| Carbon monoxide CO [ppm] | 31 | 78 |
| Higher hydrocarbons THC/OGC [ppm] | 1 | 1 |
| Nitrogen oxides NO _x [ppm] | 123 | 66 |
| Sulfur oxides SO ₂ [ppm] | 3 | 0 |

Auxiliary combustion values (solid fuels):

| Test (period of burning) : | I. | II. |
|---|-------|--------|
| Stoichiometric oxygen volume [m ³ /kg] | 0.990 | 0,990 |
| Stoichiometric air volume [m ³ /kg] | 4.716 | 4.713 |
| Stoichiometric volume of dry combustion products [m ³ /kg] | 4.628 | 4.626 |
| Maximum content of CO ₂ [%] | 19.49 | 19.49 |
| Stoichiometric air multiple [-] | 1.56 | 2.90 |
| Volume of dry combustion products. actual [m ³ /kg] | 7.283 | 12.971 |
| Content of H ₂ O in combustion air [m ³ /kg] | 0.141 | 0.263 |
| Content of H ₂ O in combustion products [m ³ /kg] | 0.914 | 1.036 |



Calculated values - thermal overview

| Test (period of burning) : | | I. | II. |
|--|---------------|-------------|-------------|
| Loss of sensible heat of combustion products | [%] | 4.7 | 4.8 |
| Loss of gas underburning | [%] | 0.0 | 0.1 |
| Loss of mechanical underburning | [%] | 0.1 | 0.1 |
| Loss of heat transfer into environment | [%] | 1.7 | 3.6 |
| Total loss | [%] | 6.5 | 8.7 |
| Efficiency – indirect method | [%] | 93.5 | 91.3 |
| Fuel mass added - actual | [kg/h] | 6.493 | 2.100 |
| Heat input | [kW] | 32.6 | 10.5 |
| Heat output | [kW] | 30.3 | 9.6 |
| Uncertainty of determining heat output | [kW] | 1.3 | 0.4 |
| Efficiency – direct method | [%] | 93.0 | 90.6 |
| Output / nominal output | [%] | 94.7 | 29.9 |

At nominal output, when burning **Wood pellets – C1**, the boiler efficiency meets the requirements applicable to **Class 5** as per ČSN EN 303-5:2013, Fig. 1.

Test evaluation:

The measured heat output is within the $\pm 8\%$ tolerance;
 Boiler Class 5;
 At nominal output, combustion product temperature is less than 160 K above the ambient temperature;
 When burning Wood pellets – C1, the period of burning is more than 6 hours;
 The minimum heat output is less than 30% of nominal heat output.



Test results:

Average measured and calculated values (solid fuels):

| Test: | | I. | II. |
|---|-----------------------|--------------------------|---------|
| Boiler type: | | EG PELLET MINI 45 - REVO | |
| Output tested: | | Nominal | Minimum |
| Fuel type: | | Wood pellets - C1 | |
| Combustion period, (automatic) stoking | | Minimally 6 hours | |
| Nominal heat output (specified by manufacturer) | [kW] | 45 | 45 |
| Flue gas temperature | [°C] | 113.6 | 82.6 |
| Fuel mass added | [kg/h] | 9.336 | 2.864 |
| Inlet water temperature | [°C] | 54.6 | 62.5 |
| Outlet water temperature | [°C] | 74.0 | 77.7 |
| Temperature of the entering cold water | [°C] | 18.2 | 18.5 |
| Cooling water flow rate | [m ³ /h] | 1.9684 | 0.7709 |
| Draught | [Pa] | 17.1 | 8.9 |
| Ambient temperature | [°C] | 25.6 | 27.2 |
| Relative air humidity | [%] | 35.8 | 51.4 |
| Barometric pressure | [kPa] | 99.04 | 98.61 |

Analysis of combustion products:

| Test (period of burning) : | | I. | II. |
|---------------------------------|-------|-------|-------|
| Oxygen O ₂ | [%] | 7.51 | 12.24 |
| Carbon dioxide CO ₂ | [%] | 12.60 | 8.02 |
| Carbon monoxide CO | [ppm] | 241 | 299 |
| Higher hydrocarbons THC/OGC | [ppm] | 4 | 9 |
| Nitrogen oxides NO _x | [ppm] | 132 | 83 |
| Sulfur oxides SO ₂ | [ppm] | 3 | 4 |

Auxiliary combustion values (solid fuels):

| Test (period of burning) : | | I. | II. |
|--|------------------------|-------|--------|
| Stoichiometric oxygen volume | [m ³ /kg] | 0.990 | 0.975 |
| Stoichiometric air volume | [m ³ /kg] | 4.715 | 4.641 |
| Stoichiometric volume of dry combustion products | [m ³ /kg] | 4.627 | 4.554 |
| Maximum content of CO ₂ | [%] | 19.49 | 19.47 |
| Stoichiometric air multiple | [-] | 1.55 | 2.37 |
| Volume of dry combustion products. actual | [m ³ /kg] | 7.143 | 11.009 |
| Content of H ₂ O in combustion air | [m ³ /kg] | 0.087 | 0.211 |
| Content of H ₂ O in combustion products | [m ³ /kg] | 0.860 | 0.983 |



Calculated values - thermal overview

| Test (period of burning) : | | I. | II. |
|--|---------------|-------------|-------------|
| Loss of sensible heat of combustion products | [%] | 5.3 | 4.9 |
| Loss of gas underburning | [%] | 0.1 | 0.2 |
| Loss of mechanical underburning | [%] | 0.1 | 1.6 |
| Loss of heat transfer into environment | [%] | 0.8 | 1.5 |
| Total loss | [%] | 6.4 | 8.3 |
| Efficiency – indirect method | [%] | 93.6 | 91.7 |
| Fuel mass added - actual | [kg/h] | 9.376 | 2.901 |
| Heat input | [kW] | 47.1 | 14.6 |
| Heat output | [kW] | 43.9 | 13.3 |
| Uncertainty of determining heat output | [kW] | 1.8 | 0.6 |
| Efficiency – direct method | [%] | 93.2 | 91.4 |
| Output / nominal output | [%] | 97.5 | 29.6 |

At nominal output, when burning **Wood pellets – C1**, the boiler efficiency meets the requirements applicable to **Class 5** as per ČSN EN 303-5:2013, Fig. 1.

Test evaluation:

The measured heat output is within the $\pm 8\%$ tolerance;
 Boiler Class 5;
 At nominal output, combustion product temperature is less than 160 K above the ambient temperature;
 When burning Wood pellets – C1, the period of burning is more than 6 hours;
 The minimum heat output is less than 30% of nominal heat output.

Test results:

| EG PELLET MINI 16 - REVO | |
|---|-------|
| Electricity consumption | |
| During the tests, the electrical consumption shall be determined according to EN 15456. | |
| The values for maximum consumption, for stand-by, nominal heat output and minimum heat output shall be stated in the test report. For boilers with automatic feeding systems (fuel line), the electrical consumption of the boiler and the fuel line shall be determined and stated separately. | |
| The average electrical power consumption during stand by shall be measured for a minimum duration of 10 min and shall be stated in watts. In cases where control operations influence the intrinsic energy consumption, a longer duration might be necessary. | |
| Maximum electrical input | 394 W |
| Electrical input at nominal heat output | 35 W |
| Electrical input at minimum heat output | 17 W |
| Electrical input for STAND BY mode | 2.5 W |
| Maximum electrical input for ignition system | 326 W |
| Maximum electrical input for fuel supply (fuel line) | 40 W |



EG PELLETT MINI 32 - REVO

Electricity consumption

During the tests, the electrical consumption shall be determined according to EN 15456.

The values for maximum consumption, for stand-by, nominal heat output and minimum heat output shall be stated in the test report. For boilers with automatic feeding systems (fuel line), the electrical consumption of the boiler and the fuel line shall be determined and stated separately.

The average electrical power consumption during stand by shall be measured for a minimum duration of 10 min and shall be stated in watts. In cases where control operations influence the intrinsic energy consumption, a longer duration might be necessary.

| | |
|--|-------|
| Maximum electrical input | 384 W |
| Electrical input at nominal heat output | 89 W |
| Electrical input at minimum heat output | 35 W |
| Electrical input for STAND BY mode | 2.5 |
| Maximum electrical input for ignition system | 284 W |
| Maximum electrical input for fuel supply (fuel line) | 75 W |

EG PELLETT MINI 45 - REVO

Electricity consumption

During the tests, the electrical consumption shall be determined according to EN 15456.

The values for maximum consumption, for stand-by, nominal heat output and minimum heat output shall be stated in the test report. For boilers with automatic feeding systems (fuel line), the electrical consumption of the boiler and the fuel line shall be determined and stated separately.

The average electrical power consumption during stand by shall be measured for a minimum duration of 10 min and shall be stated in watts. In cases where control operations influence the intrinsic energy consumption, a longer duration might be necessary.

| | |
|--|-------|
| Maximum electrical input | 479 W |
| Electrical input at nominal heat output | 97 W |
| Electrical input at minimum heat output | 45 W |
| Electrical input for STAND BY mode | 2.5 W |
| Maximum electrical input for ignition system | 354 W |
| Maximum electrical input for fuel supply (fuel line) | 100 W |



Fuel analysis

| Fuel type | Wood pellets – C1 | | | |
|---|-------------------|-----------------|---------|-------------|
| Analytical indicator | Symbol | Unit | Value | Uncertainty |
| Higher heating value | Q_s | [MJ/kg] | 19.60 | 0.14 |
| Lower heating value | Q_j | [MJ/kg] | 18.08 | 0.14 |
| All water in original condition | W_t^r | [% by weight] | 5.65 | 0.003 |
| Ash | A | [% by weight] | 0.37 | 0.003 |
| Carbon | C | [% by weight] | 48.82 | 0.25 |
| Hydrogen | H | [% by weight] | 6.53 | 0.10 |
| Nitrogen | N | [% by weight] | 0.07 | 0.10 |
| Sulphur | S | [% by weight] | 0.000 | 0.000 |
| Chlorine | Cl | [% by weight] | 0.016 | 0.003 |
| Oxygen – calculation for 100% | O | [% by weight] | 38.75 | |
| Conversion factor f_{emis} for emissions in [mg/m ³] to [mg/MJ] | f_{emis} | [-] | 0.25649 | |

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. 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”.



Accredited test number:

1005.1* 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:

EG PELLET MINI 16 - REVO, EG PELLET MINI 32 - REVO,
 EG PELLET MINI 45 - REVO

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: EG PELLET MINI 16 - REVO – Wood pellets – C1

| 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] |
| Nominal | 7.53 | 12.20 | 111 | 2 | 132 | 32 | 114 | 2 | 221 | 26 |
| Minimum | 12.73 | 7.53 | 115 | 3 | 78 | 28 | 191 | 6 | 214 | 37 |

Test evaluation:

EG PELLET MINI 16 - REVO - Wood pellets - C1 meets at nominal and minimum output the emission requirements for **Class 5**, as per ČSN EN 303-5:2013 Table 6.

Measurement results: EG PELLET MINI 32 - REVO – Wood pellets – C1

| 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] |
| Nominal | 7.61 | 12.38 | 31 | 1 | 123 | 15 | 31 | 1 | 207 | 12 |
| Minimum | 13.85 | 6.94 | 78 | 1 | 66 | 17 | 150 | 3 | 208 | 26 |

Test evaluation:

EG PELLET MINI 32 - REVO - Wood pellets - C1 meets at nominal and minimum output the emission requirements for **Class 5**, as per ČSN EN 303-5:2013 Table 6.

Measurement results: EG PELLET MINI 45 - REVO – Wood pellets – C1

| 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] |
| Nominal | 7.51 | 12.60 | 241 | 4 | 132 | 29 | 245 | 6 | 221 | 24 |
| Minimum | 12.24 | 8.02 | 299 | 9 | 83 | 29 | 469 | 18 | 214 | 36 |

Test evaluation:

EG PELLET MINI 45 - REVO - Wood pellets - C1 meets at nominal and minimum output the emission requirements for **Class 5**, as per ČSN EN 303-5:2013 Table 6.



Accredited test number: **1004.1*** Test title: **Test of heat output input and efficiency**
1005.1* **Combustion efficiency test - emissions**

Requirement: ČSN EN 303-5:2013
 Annex C,
 Deviation from Austria, C.2.2, C.2.3

Sample tested: EG PELLET MINI16 - REVO, EG PELLET MINI 32 - REVO,
 EG PELLET MINI 45 - REVO

Test results: Evaluation of the test results stated in this Test Report only.

| Requirement | Requirement specification | Test evaluation | |
|--|--|-----------------------|---|
| Boiler efficiency for nominal heat output and minimum heat output | ČSN EN 303-5:2013 Annex C, Deviation from Austria, C.2.2 | Wood Pellets – C1 | |
| Boiler | | | |
| Minimum efficiency | | | |
| Heating boilers for solid fuels | | 75 % | + |
| a) manually loaded | | | |
| up to 10 kW | | 79 % | |
| >10 to 200 kW | | (71.3 + 7.7 log Pn) % | |
| >200 kW | | 89 % | |
| a) automatically loaded | | | |
| up to 10 kW | | 80 % | |
| >10 to 200 kW | (72.3 + 7.7 log Pn) % | + | |
| >200 kW | 90 % | | |
| NOTE <i>Pn is the nominal heat output (Qn in this standard)</i> | | | |

| Requirement | Requirement specification | Test evaluation | | | | |
|---|--|-------------------|----------------------------------|-------------------------------------|--------------------|------------------------------------|
| Emission limits | ČSN EN 303-5:2013 Annex C, Deviation from Austria, C.2.3 | Wood Pellets – C1 | | | | |
| Small burners used for solid fuels automatically loaded | | | | | | |
| | | | Emission limits mg-MJ | | | |
| Parameter | | | Wooden Wood Pellets Room heaters | Wooden Wood Pellets Central heaters | Other wooden fuels | Other standardised biogenous fuels |
| CO | | | 500 ^a | 250 ^a | 250 ^a | 500 ^a |
| NO _x | | | 100 | 100 | 100 | 300 |
| OGC/THC | 30 | 20 | 30 | 20 | | |
| Dust | 25 | 20 | 30 | 35 | | |

^a The limit value can be exceeded by 50 % during partial load operation at 30 % of nominal heat output.



Measurement results: EG PELLET MINI16 - REVO – Wood pellets – C1

| Boiler output | Minimum efficiency | Measured efficiency |
|---------------|--------------------|---------------------|
| Nominal | 81.6 | 90.1 |
| Minimum | | 88.4 |

Test evaluation:

The measured efficiency of EG PELLET MINI 16 - REVO - Wood pellets - C1 is **higher** than required.

Measurement results: EG PELLET MINI 32 - REVO – Wood pellets – C1

| Boiler output | Minimum efficiency | Measured efficiency |
|---------------|--------------------|---------------------|
| Nominal | 83.9 | 93.0 |
| Minimum | | 90.6 |

Test evaluation:

The measured efficiency of EG PELLET MINI 32 - REVO - Wood pellets - C1 is **higher** than required.

Measurement results: EG PELLET MINI 45 - REVO – Wood pellets – C1

| Boiler output | Minimum efficiency | Measured efficiency |
|---------------|--------------------|---------------------|
| Nominal | 85.0 | 93.2 |
| Minimum | | 91.4 |

Test evaluation:

The measured efficiency of EG PELLET MINI 45 - REVO - Wood pellets - C1 is **higher** than required.

Measurement results: EG PELLET MINI 16 - REVO – Wood pellets – C1

| Boiler output | Average values | | | | | | | | |
|---------------|--------------------|----------|-----------------------|---------------|---------------------------|-------------------------------------|-------------------------|-----------------|--------------|
| | Measured values | | | | | Converted values O ₂ =0% | | | |
| | O ₂ [%] | CO [ppm] | NO _x [ppm] | OGC/THC [ppm] | Dust [mg/m ³] | CO [mg/MJ] | NO _x [mg/MJ] | OGC/THC [mg/MJ] | Dust [mg/MJ] |
| Nominal | 7.53 | 111 | 132 | 2 | 32 | 56 | 108 | 1 | 13 |
| Minimum | 12.73 | 115 | 78 | 3 | 28 | 93 | 104 | 3 | 18 |

Test evaluation:

The measured emission values for EG PELLET MINI 16 - REVO - Wood pellets - C1 **exceed** the specified values.



Measurement results: EG PELLET MINI 32 - REVO – Wood pellets – C1

| Boiler output | Average values | | | | | | | | |
|---------------|--------------------|----------|-----------------------|---------------|---------------------------|-------------------------------------|-------------------------|-----------------|--------------|
| | Measured values | | | | | Converted values O ₂ =0% | | | |
| | O ₂ [%] | CO [ppm] | NO _x [ppm] | OGC/THC [ppm] | Dust [mg/m ³] | CO [mg/MJ] | NO _x [mg/MJ] | OGC/THC [mg/MJ] | Dust [mg/MJ] |
| Nominal | 7.61 | 31 | 123 | 1 | 15 | 15 | 101 | 1 | 6 |
| Minimum | 13.85 | 78 | 66 | 1 | 17 | 73 | 102 | 1 | 13 |

Test evaluation:

The measured emission values for EG PELLET MINI 32 - REVO - Wood pellets - C1 **exceed** the specified values.

Measurement results: EG PELLET MINI 45 - REVO – Wood pellets – C1

| Boiler output | Average values | | | | | | | | |
|---------------|--------------------|----------|-----------------------|---------------|---------------------------|-------------------------------------|-------------------------|-----------------|--------------|
| | Measured values | | | | | Converted values O ₂ =0% | | | |
| | O ₂ [%] | CO [ppm] | NO _x [ppm] | OGC/THC [ppm] | Dust [mg/m ³] | CO [mg/MJ] | NO _x [mg/MJ] | OGC/THC [mg/MJ] | Dust [mg/MJ] |
| Nominal | 7.51 | 241 | 132 | 4 | 29 | 120 | 108 | 3 | 12 |
| Minimum | 12.24 | 299 | 83 | 9 | 29 | 226 | 103 | 9 | 18 |

Test evaluation:

The measured emission values for EG PELLET MINI 45 - REVO - Wood pellets - C1 **exceed** the specified values.



Accredited test number: **1004.1*** Test title: **Test of heat output, input and efficiency**
 1005.1* **Combustion efficiency test - emissions**

Requirement: ČSN EN 303-5:2013
 Annex C,
 Deviation from Denmark, C.4.1, C.4.2

Sample tested: EG PELLET MINI16 - REVO, EG PELLET MINI 32 - REVO,
 EG PELLET MINI 45 - REVO

Test results: Evaluation of the test results stated in this Test Report only.

| Requirement | Requirement specification | Test evaluation |
|---|--|-------------------|
| Boiler Efficiency | ČSN EN 303-5:2013 Annex C, Deviation from Denmark , C.4.1 | Wood Pellets – C1 |
| According to the Danish Construction Code BR08, Clause 8.5.1.4, Sub-clause 7, boilers for coal, coke, bio fuel or biomass shall have an efficiency equivalent to Class 3 in EN 303-5. | | |
| Minimum efficiency (67 + 6 log Qn) % | | |
| For boilers above 300 kW, the requirement corresponding to 300 kW shall be used. | | |
| | | + |

| Requirement | Requirement specification | Test evaluation | | | | |
|---|--|-------------------|---|---------------------|---------|------|
| Emission limits | ČSN EN 303-5:2013 Annex C, Deviation from Denmark , C.4.2 | Wood Pellets – C1 | | | | |
| According to the Danish EPA Statutory Order no. 1432 of 11-12-2007, only Class 3 (or higher) is acceptable for Denmark. | | | | | | |
| | | | mg-m ³ at 10% O ₂ | | | |
| | | | | Class 3 | | |
| Stoking | | | CO | | OGC/THC | Dust |
| Fuel | | | | Nominal heat output | | |
| | | | kW | | 5000 | 150 |
| | | | | ≤ 50 | | |
| | | | > 50 to 150 | 1200 | | |
| | | | > 150 to 300 | 5000 | 150 | 125 |
| | ≤ 50 | 2500 | 100 | | | |
| | > 50 to 150 | 1200 | | | | |
| | > 150 to 300 | 3000 | 80 | 150 | | |
| | ≤ 50 | 2500 | 100 | | | |
| | > 50 to 150 | 1200 | | | | |
| | > 150 to 300 | 3000 | 80 | 125 | | |
| | ≤ 50 | 2500 | 100 | | | |
| | > 50 to 150 | 1200 | | | | |
| | > 150 to 300 | 1200 | | | | |

^a Referring to dry exit flue gas, 0 °C, 1 013 mbar.



Measurement results: EG PELLETT MINI16 - REVO – Wood pellets - C1

| Boiler output | Minimum efficiency | Measured efficiency |
|---------------|--------------------|---------------------|
| Nominal | 74.2 | 90.1 |
| Minimum | | 88.4 |

Test evaluation:

Measured efficiency for EG PELLETT MINI 16 - REVO - Wood pellets - C1 is **higher** than required.

Measurement results: EG PELLETT MINI 32 - REVO – Wood pellets - C1

| Boiler output | Minimum efficiency | Measured efficiency |
|---------------|--------------------|---------------------|
| Nominal | 76.0 | 93.0 |
| Minimum | | 90.6 |

Test evaluation:

Measured efficiency for EG PELLETT MINI 32 - REVO - Wood pellets - C1 is **higher** than required.

Measurement results: EG PELLETT MINI 45 - REVO – Wood pellets - C1

| Boiler output | Minimum efficiency | Measured efficiency |
|---------------|--------------------|---------------------|
| Nominal | 76.9 | 93.2 |
| Minimum | | 91.4 |

Test evaluation:

Measured efficiency for EG PELLETT MINI 45 - REVO - Wood pellets - C1 is **higher** than required.

Measurement results: EG PELLETT MINI 16 - REVO – Wood pellets - C1

| Boiler output | Average emission values | | | | | | |
|---------------|-------------------------|-------------|------------------|------------------------------|--------------------------------------|---------------------------------|------------------------------|
| | Measured values | | | | Converted values O ₂ =10% | | |
| | O ₂ [%] | CO [ppm] | OGC/THC [ppm] | Dust [mg/m ³] | CO [mg/m ³] | OGC/THC [mg/m ³] | Dust [mg/m ³] |
| Nominal | 7.53 | 111 | 2 | 32 | 114 | 2 | 26 |
| Minimum | 12.73 | 115 | 3 | 28 | 191 | 6 | 37 |

Test evaluation:

The measured emission values for EG PELLETT MINI 16 - REVO - Wood pellets - C1 **do not exceed** the specified values.



Measurement results: EG PELLETT MINI 32 - REVO – Wood pellets - C1

| Boiler output | Average emission values | | | | | | |
|---------------|-------------------------|-------------|------------------|------------------------------|--------------------------------------|---------------------------------|------------------------------|
| | Measured values | | | | Converted values O ₂ =10% | | |
| | O ₂ [%] | CO [ppm] | OGC/THC [ppm] | Dust [mg/m ³] | CO [mg/m ³] | OGC/THC [mg/m ³] | Dust [mg/m ³] |
| Nominal | 7.61 | 31 | 1 | 15 | 31 | 1 | 12 |
| Minimum | 13.85 | 78 | 1 | 17 | 150 | 3 | 26 |

Test evaluation:

The measured emission values for EG PELLETT MINI 32 - REVO - Wood pellets - C1 **do not exceed** the specified values.

Measurement results: EG PELLETT MINI 45 - REVO – Wood pellets - C1

| Boiler output | Average emission values | | | | | | |
|---------------|-------------------------|-------------|------------------|------------------------------|--------------------------------------|---------------------------------|------------------------------|
| | Measured values | | | | Converted values O ₂ =10% | | |
| | O ₂ [%] | CO [ppm] | OGC/THC [ppm] | Dust [mg/m ³] | CO [mg/m ³] | OGC/THC [mg/m ³] | Dust [mg/m ³] |
| Nominal | 7.51 | 241 | 4 | 29 | 245 | 6 | 24 |
| Minimum | 12.24 | 299 | 9 | 29 | 469 | 18 | 36 |

Test evaluation:

The measured emission values for EG PELLETT MINI 45 - REVO - Wood pellets - C1 **do not exceed** the specified values.



Accredited test number: **1004.1*** Test title: **Test of heat output, input and efficiency**
1005.1* **Combustion efficiency test - emissions**

Requirement: ČSN EN 303-5:2013
 Annex C,
 Deviation from Germany, C.5.1, C.5.2

Sample tested: EG PELLET MINI 16 - REVO, EG PELLET MINI 32 - REVO,
 EG PELLET MINI 45 - REVO

Test results: Evaluation of the test results stated in this Test Report only.

| Requirement | | | | | Requirement specification | Test evaluation |
|--|----------------------------|--------------------------------|-----------------------------|---------------------------|---|-------------------|
| Emission limits | | | | | ČSN EN 303-5:2013 Annex C, Deviation from Germany, C.5.1, C.5.2 | Wood Pellets – C1 |
| Table 7 – Emission limits | | | | | | |
| The emission limits are regulated in Chapter 2, paragraphs 4, 5 and Annex 2 of the German Immission Control Ordinance "Erste Verordnung zur Durchführung des Bundes-Immissionsschutzgesetzes (Verordnung über kleine und mittlere Feuerungsanlagen - 1. BImSchV)". Boilers operated with solid fuels shall only be installed, possess the quality and be put into operation if they fulfil the following specifications of the 1. BImSchV: | | | | | | |
| | Fuel acc. to §3 (1) | Nominal output range kW | Dust g/m³ | CO g/m³ | | |
| Stage 2: Appliances, which will be installed after 31.12.2014 | Numbers 1 to 5a | ≥ 4 | 0.02 | 0.4 | - | |
| | Numbers 6 to 7 | ≥ 30 ≤ 500 | 0.02 | 0.4 | | |
| | | > 500 | 0.02 | 0.3 | | |
| Numbers 8 to 13 | ≥ 4 < 100 | 0.02 | 0.4 | | | |
| NOTE Differing from sentence 1 for firing systems (appliances) which will exclusively be fired by fuels according §3 article 1 Number 4 in the form of split logs, the limits according Stage 2 apply for firing systems (appliances) if they are installed after 31.12.2016. | | | | | | |



Measurement results: EG PELLET MINI 16 - REVO – Wood pellets - C1

| Boiler output | Average emission values | | | | |
|---------------|-------------------------|-------------|------------------------------|--------------------------------------|-----------------------------|
| | Measured values | | | Converted values O ₂ =13% | |
| | O ₂ [%] | CO [ppm] | Dust [mg/m ³] | CO [g/m ³] | Dust [g/m ³] |
| Nominal | 7.53 | 111 | 32 | 0.083 | 0.019 |
| Minimum | 12.73 | 115 | 28 | 0.139 | 0.027 |

Test evaluation:

The measured emission values for EG PELLET MINI 16 - REVO - Wood pellets - C1 **exceed** the specified values.

Measurement results: EG PELLET MINI 32 - REVO – Wood pellets - C1

| Boiler output | Average emission values | | | | |
|---------------|-------------------------|-------------|------------------------------|--------------------------------------|-----------------------------|
| | Measured values | | | Converted values O ₂ =13% | |
| | O ₂ [%] | CO [ppm] | Dust [mg/m ³] | CO [g/m ³] | Dust [g/m ³] |
| Nominal | 7.61 | 31 | 15 | 0.023 | 0.009 |
| Minimum | 13.85 | 78 | 17 | 0.109 | 0.019 |

Test evaluation:

The measured emission values for EG PELLET MINI 32 - REVO - Wood pellets - C1 **do not exceed** the specified values.

Measurement results: EG PELLET MINI 45 - REVO – Wood pellets - C1

| Boiler output | Average emission values | | | | |
|---------------|-------------------------|-------------|------------------------------|--------------------------------------|-----------------------------|
| | Measured values | | | Converted values O ₂ =13% | |
| | O ₂ [%] | CO [ppm] | Dust [mg/m ³] | CO [g/m ³] | Dust [g/m ³] |
| Nominal | 7.51 | 241 | 29 | 0.178 | 0.017 |
| Minimum | 12.24 | 299 | 29 | 0.341 | 0.026 |

Test evaluation:

The measured emission values for EG PELLET MINI 45 - REVO - Wood pellets - C1 **exceed** the specified values.



Accredited test number: **1004.1*** Test title: **Test of heat output, input and efficiency**
1005.1* **Combustion efficiency test - emissions**

Requirement: ČSN EN 303-5:2013
 Annex C
 C.6 Deviation from Switzerland

Sample tested: EG PELLETT MINI 16 - REVO, EG PELLETT MINI 32 - REVO,
 EG PELLETT MINI 45 - REVO

Test results: Evaluation of the test results stated in this Test Report only.

| Requirement | | Requirement specification | Test evaluation | | | | | | | | | | | |
|--|--|--|-------------------|----------------------------|--------------------------|----------------------------|---|-----|----|--|-----|----|---|-----|
| Emission limits | | | | | | | | | | | | | | |
| Clause 4.4.7, Table 7 The emission limits are regulated in Annex 4 of the Swiss Ordinance on Air Pollution Control ([OAPC] SR 814.318.142.1) of 1985-12-16 (as at 2010-07-15). Boilers operated with woody biomass shall only be put on the market if they fulfil the following specifications of the OAPC: – declarations of conformity (Figure 20 OAPC); – Figures 1, 212, 23 Annex 4 OAPC; – Figures 31, 32 Annex 5 OAPC. Emissions for boilers operated with coal or wood fuels shall not exceed the following limits: | | ČSN EN 303-5:2013 Annex C C.6 Deviation from Switzerland | Wood Pellets - C1 | | | | | | | | | | | |
| Type of installation | Particular requirements (emission limits)^a for carbon monoxide (CO) and particulate matter (dust) | | | | | | | | | | | | | |
| | <table border="1"> <thead> <tr> <th></th> <th>CO (mg·m⁻³)</th> <th>Dust (mg·m⁻³)</th> </tr> </thead> <tbody> <tr> <td>Boilers for log wood and boilers for coal, manual stoking</td> <td>800</td> <td>50</td> </tr> <tr> <td>Boilers for chipped wood and boilers for coal, automatic stoking</td> <td>400</td> <td>60</td> </tr> <tr> <td>Boilers for Wood Pellets, automatic stoking</td> <td>300</td> <td>40</td> </tr> </tbody> </table> | | | | CO (mg·m ⁻³) | Dust (mg·m ⁻³) | Boilers for log wood and boilers for coal, manual stoking | 800 | 50 | Boilers for chipped wood and boilers for coal, automatic stoking | 400 | 60 | Boilers for Wood Pellets, automatic stoking | 300 |
| | CO (mg·m ⁻³) | | | Dust (mg·m ⁻³) | | | | | | | | | | |
| Boilers for log wood and boilers for coal, manual stoking | 800 | 50 | | | | | | | | | | | | |
| Boilers for chipped wood and boilers for coal, automatic stoking | 400 | 60 | | | | | | | | | | | | |
| Boilers for Wood Pellets, automatic stoking | 300 | 40 | | | | | | | | | | | | |
| ^a Referred to oxygen basis: – for boilers for natural state wood 13 % volume; – for boilers for coal 7 % volume. | | | | | | | | | | | | | | |
| The sulphur content of coal, coal briquettes and coke shall not exceed 3 %. Boilers operated with non-woody biomass shall comply with the following specifications of the OAPC: – Figures 741, 742, 743 Annex 2 OAPC; – Figures 81, 82 Annex 3 OAPC. According to Figure 743, Annex 2 OAPC, non-woody biomass, such as biogenic waste and products from agriculture, may only be burnt in boilers with a heat input of at least 70 kW. Such units need an approval and shall meet stronger emission limits according to Figure 742, Annex 2 OAPC. | | | 0 | | | | | | | | | | | |



Measurement results: EG PELLET MINI 16 - REVO – Wood pellets - C1

| Boiler output | Average emission values | | | | |
|---------------|-------------------------|-------------|------------------------------|--------------------------------------|------------------------------|
| | Measured values | | | Converted values O ₂ =13% | |
| | O ₂ [%] | CO [ppm] | Dust [mg/m ³] | CO [mg/m ³] | Dust [mg/m ³] |
| Nominal | 7.53 | 111 | 32 | 83 | 19 |
| Minimum | 12.73 | 115 | 28 | 139 | 27 |

Test evaluation:

The measured emission values for EG PELLET MINI 16 - REVO - Wood pellets - C1 **do not exceed** the specified values.

Measurement results: EG PELLET MINI 32 - REVO – Wood pellets - C1

| Boiler output | Average emission values | | | | |
|---------------|-------------------------|-------------|------------------------------|--------------------------------------|------------------------------|
| | Measured values | | | Converted values O ₂ =13% | |
| | O ₂ [%] | CO [ppm] | Dust [mg/m ³] | CO [mg/m ³] | Dust [mg/m ³] |
| Nominal | 7.61 | 31 | 15 | 23 | 9 |
| Minimum | 13.85 | 78 | 17 | 109 | 19 |

Test evaluation:

The measured emission values for EG PELLET MINI 32 - REVO - Wood pellets - C1 **do not exceed** the specified values.

Measurement results: EG PELLET MINI 45 - REVO – Wood pellets - C1

| Boiler output | Average emission values | | | | |
|---------------|-------------------------|-------------|------------------------------|--------------------------------------|------------------------------|
| | Measured values | | | Converted values O ₂ =13% | |
| | O ₂ [%] | CO [ppm] | Dust [mg/m ³] | CO [mg/m ³] | Dust [mg/m ³] |
| Nominal | 7.51 | 241 | 29 | 178 | 17 |
| Minimum | 12.24 | 299 | 29 | 341 | 26 |

Test evaluation:

The measured emission values for EG PELLET MINI 45 - REVO - Wood pellets - C1 **exceed** the specified values.



Accredited test number: **1004.1*** Test title: **Test of heat output, input and efficiency**
1005.1* **Combustion efficiency test - emissions**

Requirement: ČSN EN 303-5:2013
 Annex C,
 C.8 Deviations from Italy

Sample tested: EG PELLET MINI 45 - REVO

| Requirement | Specification of requirement | | Test evaluation |
|--|--|--------------------------------|-------------------|
| Italian emission limits for heating plants fuelled with biomass solid fuels | Emissions refer to an 11% O ₂ | | Wood Pellets – C1 |
| Plant nominal thermal output (MW) | >0,035 ÷ <0,15 (>35kW÷<150kW) | >0,15 ÷ <1 (>150kW÷<1000kW) | |
| Total Particulate Matter | 200mg-Nm ³ | 100mg-Nm ³ | + |
| Total Organic Carbon (COT) | | - | |
| Carbon Monoxide (CO) | | 350 mg-Nm ³ | |
| Nitrogen Dioxide (expressed as NO ₂) | | 500 mg-Nm ³ | |
| Sulphur Dioxide (expressed as SO ₂) | | 200mg-Nm ³ | |
| Italian emission limits for heating plants fuelled with non-biomass solid fuels | Emissions refer to an 6% O ₂ | | |
| Nominal Thermal output (MW) | >0.35 (350kW) | | |
| Total Particulate Matter | 50 mg-Nm ³ | | |

Measurement results: EG PELLET MINI 45 - REVO – Wood pellets - C1

| Boiler output | Average emission values | | | | |
|---------------|-------------------------|-------------|------------------------------|--------------------------------------|------------------------------|
| | Measured values | | | Converted values O ₂ =11% | |
| | O ₂ [%] | CO [ppm] | Dust [mg/m ³] | CO [mg/m ³] | Dust [mg/m ³] |
| Nominal | 7.51 | 241 | 29 | 223 | 22 |
| Minimum | 12.24 | 299 | 29 | 427 | 33 |

Test evaluation:

The measured emission values for EG PELLET MINI 45 - REVO – Wood pellets - C1 **do not exceed** the specified values.



Accredited test number: **1006.1*** **1005.1*** Test title: **Function test of control, regulation and safety elements
 Combustion efficiency test - emissions**

Test method: ČSN EN 303-5:2013
 Art. 5.13, 5.14, 5.16.1, 5.16.2, 5.16.3
 ČSN EN 303-5:2013
 Art. 5.9, 5.10.4

Sample tested: EG PELLET MINI 16 - REVO, EG PELLET MINI 32 - REVO,
 EG PELLET MINI 45 - REVO

Measuring equipment used: Chapter III - Measuring and test equipment

Test results:

| Requirement | Requirement specification | Test evaluation | Note |
|--|---|-----------------|------|
| <p>Function check of the temperature controller and safety temperature limiter at the boiler</p> <p>The water-side flow rate shall comply with that specified for the nominal heat output test. The flow temperature of 75 °C shall not be exceeded at the start of the test °C.</p> <p>Adjust the firing so that it corresponds to the nominal heat output Q_N of the boiler. A steady state condition shall be reached and the outlet pressure at the flue gas section shall be according to the nominal heat output setting. For manual stoked boilers, the boiler shall be refuelled after reaching steady state with a full batch before starting the test.</p> <p>The dissipated output shall be reduced to (40 ± 5) % of the nominal heat output of the boiler, circulating pump running in continuous operation; temperature controller adjusted to maximum set value.</p> <p>When the temperature controller is operating normally, the measured flow temperature shall not exceed 100 °C; the safety temperature cut out or limiter or the device for dissipating excess heat shall not trigger.</p> <p>Repeat the test with the temperature controller out of function. This time, check if the safety temperature limiter-detector switches off the firing system at the highest value specified by the boiler manufacturers and if all hazardous operation states are avoided (see 4.1).</p> | <p>ČSN EN 303-5:2013 Art. 5.13</p> | <p>+</p> | |



| Requirement | Requirement specification | Test evaluation | Note |
|---|---|-----------------|------|
| <p>Function test for the rapidly disconnectable firing system</p> <p>– Sudden absence of heat dissipation</p> <p>The water-side flow rate shall comply with that specified for the nominal output test. The flow temperature of 75 °C shall not be exceeded at the start of the test.</p> <p>Adjust the firing so that it corresponds to the nominal heat output Q_N of the boiler, a steady state condition is reached and the outlet pressure at the flue spigot is according to the rated heat output.</p> <p>The heat consumption is set to 0; water circulation in the boiler is permitted; temperature controller is adjusted to manufacture recommended maximum set value.</p> <p>Check if the safety temperature limiter or the temperature controller switches off the firing system and all hazardous operation states are avoided.</p> <p>- Loss of the electrical power supply</p> <p>The water-side flow rate shall comply with that specified for the nominal heat output test. The flow temperature of 75 °C shall not be exceeded at the start of the test.</p> <p>Adjust the firing so that it corresponds to the nominal heat output Q_N of the boiler, a steady state condition is reached and the outlet pressure at the flue gas section is according to the rated heat output.</p> <p>The electrical power supply including the circulation is cut off, check that no hazardous operation conditions occur.</p> <p>For the evaluation of the temperatures and the CO-concentrations, only mean values at a maximum average time of one minute shall be considered.</p> | <p>ČSN EN 303-5:2013 Art. 5.14</p> | <p>+</p> | |
| <p>Safety test of consequences of fuel overload and effect of a blockage of the fuel supply</p> <p>The safety of the boiler shall be checked at continuous operation of the boiler with the fuel feed rate of the stoking device set at possible maximum capacity, taking into account failures according to the risk analyses and the electrical safety. If other fuel feed rates lower than the maximum are categorised as critical by the risk analysis, these shall also be tested.</p> <p>The functionality of the safety device for the shut-down of the fuel shall occur by prevention of the ignition after release of fuel if no or insufficient combustion in the combustion chamber occurs.</p> <p>The test for blocked fuel line shall be achieved by deactivating the stoking device.</p> <p>The requirements specified in 4.3.4 shall be satisfied.</p> | <p>ČSN EN 303-5:2013 Art. 5.16.2</p> | <p>+</p> | |



| Requirement | Requirement specification | Test evaluation | Note |
|---|---|-----------------|------|
| <p>Function test for the rapidly disconnectable firing system</p> <p>– Sudden absence of heat dissipation</p> <p>The water-side flow rate shall comply with that specified for the nominal output test. The flow temperature of 75 °C shall not be exceeded at the start of the test.</p> <p>Adjust the firing so that it corresponds to the nominal heat output Q_N of the boiler, a steady state condition is reached and the outlet pressure at the flue spigot is according to the rated heat output.</p> <p>The heat consumption is set to 0; water circulation in the boiler is permitted; temperature controller is adjusted to manufacture recommended maximum set value.</p> <p>Check if the safety temperature limiter or the temperature controller switches off the firing system and all hazardous operation states are avoided.</p> <p>- Loss of the electrical power supply</p> <p>The water-side flow rate shall comply with that specified for the nominal heat output test. The flow temperature of 75 °C shall not be exceeded at the start of the test.</p> <p>Adjust the firing so that it corresponds to the nominal heat output Q_N of the boiler, a steady state condition is reached and the outlet pressure at the flue gas section is according to the rated heat output.</p> <p>The electrical power supply including the circulation is cut off, check that no hazardous operation conditions occur.</p> <p>For the evaluation of the temperatures and the CO-concentrations, only mean values at a maximum average time of one minute shall be considered.</p> | <p>ČSN EN 303-5:2013 Art. 5.14</p> | <p>+</p> | |
| <p>Safety test of consequences of fuel overload and effect of a blockage of the fuel supply</p> <p>The safety of the boiler shall be checked at continuous operation of the boiler with the fuel feed rate of the stoking device set at possible maximum capacity, taking into account failures according to the risk analyses and the electrical safety. If other fuel feed rates lower than the maximum are categorised as critical by the risk analysis, these shall also be tested.</p> <p>The functionality of the safety device for the shut-down of the fuel shall occur by prevention of the ignition after release of fuel if no or insufficient combustion in the combustion chamber occurs.</p> <p>The test for blocked fuel line shall be achieved by deactivating the stoking device.</p> <p>The requirements specified in 4.3.4 shall be satisfied.</p> | <p>ČSN EN 303-5:2013 Art. 5.16.2</p> | <p>+</p> | |



| Requirement | Requirement specification | Test evaluation | Note |
|--|---|-----------------|------|
| <p>Loss of combustion air supply The safety of the heating boiler shall be checked at maximum heat input under the following conditions:</p> <ul style="list-style-type: none"> - failure of combustion air fan; - failure to close of the adjustable combustion air supply. <p>In each case, only one failure shall be simulated. The CO concentrations in the boiler shall not exceed 5 % volume. The measurement of CO concentration shall be carried out in the flue gas measuring section. Test of combustion air supply loss</p> | <p>ČSN EN 303-5:2013 Art. 5.16.3</p> | + | |

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

Measurement results:

| Temperature controller | | |
|--------------------------|--------|---|
| Temperature | [°C] | Note: |
| Pre-set | 85 | Temperature set on the operating thermostat regulator |
| Shutdown | 88 | Fan and stoking switched off (suppression mode) |
| Restoration of operation | 75 | Fan and stoking restored |

| Temperature limiter (manual restoration of temperature) STB | | |
|---|--|--|
| Temperature | [°C] | Note: |
| Pre-set | 100 | Temperature set on the temperature limiter |
| Shutdown | 102 | Fan and stoking switched off |
| Restoration of operation | The boiler irreversibly switched off. In order to restore operation, a manual intervention required, after the temperature drops under the limiter switching temperature | |

Test evaluation:

Proper functioning of safety elements has been verified.

Tested by: Ing. Pavel Fojtů Date: 02/2016

Signed: 

Reviewed by: Ing. Stanislav Buchta Date: 02/2016

Signed: 



V. List of source materials

The tests were performed based on

- Order B-55799 dated 2016-04-26 (received on 2016-04-27)
- Contract B-55799/39
- Implementation date change Z1
- Test Report 31-9563/T/2 of 2016-02-17
- 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

Report compiled by: Ing. Alžběta Mračková

Person responsible for correctness of the Report:

A blue ink handwritten signature consisting of several overlapping loops.

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

