SLOVENSKI STANDARD
SIST EN 297:1997/A2:1997

01-marec-1997

Plinski kotli za centralno ogrevanje - Tipa B <(indeks)11> in B<(indeks)11BS> z atmosferskimi gorilniki z imensko močjo do vključno 70 kW - Dopolnilo A2

Gas-fired central heating boilers - Type B11 and B11BS boilers, fitted with atmospheric burners of nominal heat input not exceeding 70 kW

Heizkessel für gasförmige Brennstoffe - Heizkessel der Typen B11 und B11BS mit atmosphärischen Brennern mit einer Nennwärmebelastung kleiner als oder gleich 70 kW

Chaudieres de chauffage central utilisant les combustibles gazeux - Chaudieres des types B11 et B11BS équipées de bruleurs atmosphériques, dont le débit calorifique nominal est inférieur ou égal a 70 kW

Ta slovenski standard je istoveten z: **EN 297:1994/A2:1996**

ICS:

91.140.10	Sistemi centralnega ogrevanja	Central heating systems
97.100.20	Plinski grelniki	Gas heaters

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EUROPEAN STANDARD

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Descriptors: heaters, central heating, gas appliances, burners, heat balance, determination, thermal efficency

English version

Gas-fired central heating boilers - Type B_{11} and B_{11BS} boilers, fitted with atmospheric burners of nominal heat input not exceeding 70 kW

Chaudières de chauffage central utilisant les combustibles gazeux - Chaudières des types B_{11} et B_{11BS} équipées de brûleurs atmospheriques, dont le débit calorifique nominal est inférieur ou égal à 70 kW

Heizkessel für gasförmige Brennstoffe - Heizkessel der Typen B_{11} und B_{11BS} mit atmosphärischen Brennern mit einer Nennwärmebelastung kleiner als oder gleich 70 kW

This amendment 2 modifies the European Standard EN 297:1994.This amendment was approved by CEN on 1995-11-12. CEN members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this amendment the status of a national standard without any alteration.

Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the Central Secretariat or to any CEN member.

The European Standards exist in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CEN member into its own language and notified to the Central Secretariat has the same status as the official versions.

CEN members are the national standards bodies of Austria, Belgium, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and United Kingdom.

CEN

European Committee for Standardization
Comité Européen de Normalisation
Europäisches Komitee für Normung

Central Secretariat: rue de Stassart,36 B-1050 Brussels

Ref. No. EN 297:1994/A2:1996 E

Foreword

This Amendment EN 297:1994/A2:1996 to EN 297:1994 has been prepared by Technical Committee CEN/TC 109 "Central heating boilers using gaseous fuels", the secretariat of which is held by NNI.

This Amendment to the European Standard EN 297:1994 shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by November 1996, and conflicting national standards shall be withdrawn at the latest by November 1996.

This Amendment, if approved, will modify the European Standard EN 297:1994. It has been prepared to incorporate the Directive 92/42/EEC on efficiency requirements in EN 297:1994.

This Amendment of the European Standard EN 297:1994 has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association, and supports essential requirements of EU Directive(s).

For relationship with EU Directive(s), see informative Annex G, which is an integral part of this standard.

Member States shall take all necessary measures to ensure that boilers cannot be put into service unless they satisfy the efficiency requirements set out in this Amendment.
However, Member States where back-boilers and/or boilers that are to be installed in the living space, are widely adopted at the date of the adoption of Directive 92/42/EEC, shall continue to authorize their entry into service, provided that their efficiency both at rated output and at 30 % part load is not more than 4 % below the requirements laid down in this Amendment.

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this Amendment: Austria, Belgium, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and the United Kingdom.

3.7 Useful efficiencies

Replace the sub-clauses 3.7.1 and 3.7.2 by the following :

3.7.1 Useful efficiency at the nominal heat input

"Under the test conditions of 4.7.1, the useful efficiency at the nominal heat input, or the maximum heat input for range rated boilers, expressed in percent, shall be at least :

$$84 + 2 \log_{10} P_n$$

where :

P_n is the nominal output (maximum output for range rated boilers), expressed in kilowatts (kW).

In addition, for range rated boilers, the efficiency at a rate, corresponding to the arithmetic mean of the maximum and minimum heat input, expressed in percent, shall be at least:

$$84 + 2 \log_{10} P_a$$

where :

P_a is the arithmetic mean of the maximum and minimum useful heat output as stated by the manufacturer, expressed in kilowatts (kW)."

3.7.2 Useful efficiency at part load

"Under the test conditions of 4.7.2, the useful efficiency for a load corresponding to 30 % of the nominal heat input (or the arithmic mean of the maximum and minimum heat input for range rated boilers), expressed in percent, shall be at least :

$$80 + 3 \log_{10} P_i$$

where :

P_i is the nominal output P_n, or the arithmetic mean P_a of the maximum and minimum useful output as stated by the manufacturer for range rated boilers.

4.7.1 Useful efficiency at the nominal heat input

Replace the last paragraph by :

"The useful efficiency is determined at the nominal heat input for boilers without a range-rating device. For range rated boilers the useful efficiency is determined at the maximum heat input and at the arithmetic mean of the maximum and minimum heat input."

Add at the end of the subclause :

"It is checked that the requirements of 3.7.1 are met."

4.7.2 Useful efficiency at part load

Replace subclause 4.7.2 by the following :

"To determine the useful efficiency at a load corresponding to 30 % of the nominal heat input, or the arithmetic mean of the maximum and minimum heat input for range rated boilers, the manufacturer has the choice of either the direct method or the indirect method.

It is checked that the requirements of 3.7.2 are met.

4.7.2.1 Direct method

The boiler is installed as stated in 4.1.6 and supplied with one of the reference gases as for the determination of the useful efficiency at nominal heat input or at the arithmetic mean of the maximum and minimum heat input in the case of range rated boilers.

Throughout the test, the water volume rate is maintained constant within ± 1 %, taking into account temperature variations, and the pump operates continuously.

4.7.2.1.1 Operating mode n° 1

The boiler is fitted to the test rig illustrated in figure 10 (or any other test rig giving at least comparable results and equivalent measurement accuracies).

The boiler return temperature is held constant at (47 ± 1) °C, with a maximum variation in this temperature of ± 1 K during the measurement period.

If the boiler control does not permit operation at a return temperature that is low enough, the test is carried out at the lowest return temperature compatible with the operation of the boiler.

A timepiece is fitted to the room-thermostat to obtain a working cycle of 10 minutes.

The shutdown and operating times are calculated as indicated in table 12.

TABLE 12 :
Calculation of the useful part load efficiency

	Conditions of operation	Heat input (kW)	Cycle time (s)	Meas.	Useful efficiency (%)
1	30 % reduced rate	$Q_2 = 0,3\ Q_1$	$t_2 = 600$	η_2	$\eta_u = \eta_2$
2	Full rate	Q_1	$t_1 = \dfrac{180\ Q_1 - 600\ Q_3}{Q_1 - Q_3}$	η_1	$\eta_u = \dfrac{\frac{\eta_1}{100}\ Q_1\ t_1 + (0,8\ Q_3 - P_s)\ t_3}{Q_1\ t_1 + Q_3\ t_3} \times 100$
	Controlled off	Q_3 = permanent ignition burner	$t_3 = 600 - t_1$	P_s	
3	Reduced rate	$Q_2 > 0,3\ Q_1$	$t_2 = \dfrac{180\ Q_1 - 600\ Q_3}{Q_2 - Q_3}$	η_2	$\eta_u = \dfrac{\frac{\eta_2}{100}\ Q_2\ t_2 + (0,8\ Q_3 - P_s)\ t_3}{Q_2\ t_2 + Q_3\ t_3} \times 100$
	Controlled off	Q_3 = permanent ignition burner	$t_3 = 600 - t_{21}$	P_s	
4	Full rate	Q_1	$t_1 = \dfrac{180\ Q_1 - 600\ Q_2}{Q_1 - Q_2}$	η_1	$\eta_u = \dfrac{\frac{\eta_1}{100}\ Q_1\ t_1 + (\frac{\eta_2}{100})\ Q_2\ t_2}{Q_1\ t_1 + Q_2\ t_2} \times 100$
	Reduced rate	$Q_2 < 0,3\ Q_1$	$t_2 = 600 - t_1$	η_2	
5	Reduced rate 1	$Q_{21} > 0,3\ Q_1$	$t_{21} = \dfrac{180\ Q_1 - 600\ Q_{22}}{Q_{21} - Q_{22}}$	η_{21}	$\eta_u = \dfrac{\frac{\eta_{21}}{100}\ Q_{21}\ t_{21} + \frac{\eta_{22}}{100}\ Q_{22}\ t_{22}}{Q_{21}\ t_{21} + Q_{22}\ t_{22}} \times 100$
	Reduced rate 2	$Q_{22} < 0,3\ Q_1$	$t_{22} = 600 - t_{21}$	η_{22}	
6	Full rate	Q_1	t_1 = measured value (see annex K)	η_1	$\eta_u = \dfrac{\frac{\eta_1}{100} Q_1\ t_1 + \frac{\eta_2}{100} Q_2\ t_2 + (0,8\ Q_3 - P_s)\ t_3}{Q_1\ t_1 + Q_2\ t_2 + Q_3\ t_3} \times 100$
	Reduced rate	Q_2	$t_2 = \dfrac{(180 - t_1) Q_1 - (600 - t_1) Q_3}{Q_2 - Q_3}$	η_2	
	Controlled off	Q_3 = permanent ignition burner	$t_3 = 600 - (t_1 + t_2)$	P_s	

The temperatures are measured continuously directly on the flow and return of the boiler.

The boiler is considered to be in thermal equilibrium when the efficiency measurement of three consecutive cycles, combining any two results from three, does not vary by more than 0,5 %. In this case, the result is equal to the average value of at least three consecutive measurement cycles. For any other case, the average value shall be calculated from at least ten consecutive cycles.

The respective gas and water consumptions over complete cycles are measured.

The efficiency is determined using the formula in 4.7.1.

A variation of ± 2 %, with respect to the 30 % of the nominal heat input is permitted. For variations up to ± 4 % it is necessary to carry out two measurements, one above and one below 30 % of the nominal heat input. The efficiency corresponding to 30 % is determined by interpolation.

4.7.2.1.2 Operating mode n° 2

The boiler is fitted to the test rig illustrated in figure 1a or 1b (or any other test rig giving at least comparable results and equivalent measurement accuracies).

The boiler flow and return temperatures and the operating and off cycles are given by the boiler control. The temperatures are measured continuously as close as possible to the flow and at the return of the boiler when (30 ± 2) % of the nominal input or the arithmetic mean of the maximum and minimum input for range rated boilers, is drawn through the heat exchanger.

The average water temperature shall be no less than 50 °C.

If the boiler control does not permit operation at a return temperature that is low enough, the test is carried out at the lowest return temperature compatible with the operation of the boiler.

The boiler is considered to be in thermal equilibrium when the efficiency measurement of three consecutive cycles, combining any two results from three, does not vary by more than 0,5 %. In this case, the result is equal to the average value of at least three consecutive measurement cycles. For any other case, the average value shall be calculated from at least ten consecutive cycles.

The respective gas and water consumptions over complete cycles are measured.

The efficiency is determined using the formula in 4.7.1.

A variation of ± 2 %, with respect to the 30 % of the nominal heat input is permitted. For variations up to ± 4 % it is necessary to carry out two measurements, one above and one below 30 % of the nominal heat input. The efficiency corresponding to 30 % is determined by linear interpolation.

4.7.2.2 Indirect method

4.7.2.2.1 Measurements

4.7.2.2.1.1 Useful efficiency at the nominal heat input at 50 °C

The test of 4.7.1, at the nominal heat input (or at the arithmetic mean of the maximum and minimum heat input for range rated boilers), is repeated with a flow temperature of (60 ± 2) °C and a return temperature of (40 ± 1) °C so that the average water temperature shall be (50 ± 1) °C.

The measured value η_1 is noted.

4.7.2.2.1.2 Efficiency at the minimum controlled rate

If the boiler is fitted with a control system incorporating a main burner reduced rate, a test is carried out at the minimum heat input allowed by the control for a water flow temperature of (55 ± 2) °C and a return temperature of (45 ± 1) °C so that the average temperature shall be (50 ± 1) °C.

The measured value is designated η_2.

If the boiler is fitted with a control system incorporating two main burner reduced rates, in which one has a heat input greater than 30 % of the nominal heat input and the other has a heat input less than 30 % of the nominal heat input, the efficiencies corresponding to the two inputs are determined.

The measured values are designated by :

- η_{21} for the larger heat input ;
- η_{22} for the smaller heat input.

4.7.2.2.1.3 Standby losses

The test installation is described in figure 11.

The circuits joining the different parts of the installation shall be insulated and as short as possible. The inherent losses of the test installation and the thermal contribution of the pump for the different flow rates shall be determined at the beginning to be able to take account of them (see annex J).

The boiler is fitted with a largest diameter test flue as stated by the manufacturer in the technical instructions.

The boiler water temperature is brought to a mean temperature of (30 ± 5) K above ambient temperature. The gas supply is then shut off, the pump (11) and the boiler pump, if any, are stopped, the exchanger circuit (12) is shut off.

With the water circulating continuously by means of the pump (5) of the test rig, the thermal contribution of the electric boiler is adjusted so as to obtain, in the steady state condition, a difference of (30 ± 5) K between the mean water temperature and the ambient temperature.

Throughout the test, the variation in room temperature shall not exceed 2 °C per hour.