DIN EN 15502-1:2022-02 (E)

Gas-fired heating boilers - Part 1: General requirements and tests

Contents

Page

European foreword ... 9
Introduction ... 11
1 Scope ... 12
2 Normative references ... 13
3 Terms, definitions and symbols ... 15
4 Classification ... 36
4.1 Gases and categories ... 36
4.2 Mode of air supply and evacuation of the combustion products ... 36
4.3 Maximum water-side operating pressure ... 36
5 Construction ... 36
5.1 General ... 36
5.1.1 General requirements ... 36
5.1.2 General verfication ... 37
5.2 Conversion to different gases ... 37
5.3 Materials ... 37
5.3.1 General ... 37
5.3.2 Materials and thicknesses of walls or tubes with water side operating pressure for boilers of pressure class-3 ... 38
5.3.3 Domestic water connections ... 39
5.3.4 Thermal Insulation ... 39
5.3.5 Materials in contact with water for human consumption ... 39
5.3.6 Durability against corrosion of metallic combustion product circuits ... 40
5.4 Method of construction ... 41
5.4.1 Design ... 41
5.4.2 Checking the state of operation ... 42
5.4.3 Use and servicing ... 42
5.4.4 Connections to the gas and water pipes ... 43
5.4.5 Soundness ... 43
5.4.6 Supply of combustion air and evacuation of the combustion products ... 44
5.4.7 Dampers ... 44
5.4.8 Air proving ... 44
5.4.9 Gas/air ratio controls ... 45
5.4.10 Fan ... 46

5.4.11 Drainage 46
5.4.12 Operational safety in the event of failure of the auxiliary energy 46
5.4.13 Special provision for Low Temperature Boilers and Condensing Boilers 46
5.5 Burners 47
5.6 Pressure test points 48
5.7 Requirements for the application of control and safety devices 48
5.7.1 General 48
5.7.2 Adjusters and range-rating devices 48
5.7.3 Gas circuit 49
5.7.4 Gas pressure regulator 50
5.7.5 Ignition devices 51
5.7.6 Flame supervision devices 51
5.7.7 Gas/air ratio control tubes 52
5.7.8 Thermostats and water flow temperature limiting devices 52
5.7.9 Remote control 53
5.7.10 Expansion vessel and pressure gauge 54
5.7.11 Protection against frost for boilers intended to be installed in a partially protected place 54
5.7.12 Adjusting, control and safety devices for the domestic hot water circuit 55
6 Electrical and electromagnetic safety 55
7 Controls 55
7.1 General 55
7.2 Detailed specifications 56
7.2.1 Control and safety devices 56
7.2.2 Valves used in boilers 56
7.2.3 Not relevant aspects for controls tested in combination with the boiler 56
7.2.4 Relevant aspects for controls tested in combination with the boiler 57
7.3 Thermostats and flow temperature limiting devices 57
7.3.1 General 57
7.3.2 Construction requirements 58
7.3.3 Performance 59
8 Operational requirements 61
8.1 General 61
8.1.1 Characteristics of the reference and limit gases 61
8.1.2 General test conditions 62

8.2 Soundness 66
8.2.1 Soundness of the gas circuit 66
8.2.2 Soundness of the combustion circuit 67
8.2.3 Soundness of the water circuit 67
8.2.4 Soundness of the domestic water circuit 68
8.3 Hydraulic resistance 68
8.3.1 Requirements 68
8.3.2 Test conditions 68
8.4 Heat inputs and heat output 69
8.4.1 Determination of the nominal heat input or the maximum and minimum heat input 69
8.4.2 Adjustment of the heat input by the downstream gas pressure 71
8.4.3 Ignition rate 71
8.4.4 Nominal output 71
8.4.5 Verification of the nominal condensing output 71
8.4.6 Nominal domestic hot water heat input 72
8.4.7 Water pressure to obtain the nominal heat input for instantaneous combination boilers 72
8.4.8 Obtaining the domestic hot water temperature for instantaneous combination boilers 72
8.4.9 Heating-up time of the domestic hot water 73
8.5 Limiting temperatures 73
8.5.1 General 73
8.5.2 Limiting temperatures of the adjusting, control and safety devices 73
8.5.3 Limiting temperatures of the side walls, the front and the top 74
8.5.4 Limiting temperature of the test panels and the floor 74
8.6 Ignition, cross lighting, flame stability 75
8.6.1 General 75
8.6.2 Limit conditions 75
8.6.3 Special flue conditions 76
8.6.4 Reduction of the gas rate of the ignition burner 77
8.7 Reduction of the gas pressure 77
8.7.1 Requirements 77
8.7.2 Test conditions 77
8.8 Defective closure of the gas valve immediately upstream of the main burner 77
8.8.1 Requirements 77
8.8.2 Test conditions 78

8.9 Pre-purge 78
8.10 Functioning of a permanent ignition burner when the fan stops during the standby time 78
8.10.1 Requirements 78
8.10.2 Test conditions 78
8.11 Adjustment, control and safety devices 78
8.11.1 Requirement 78
8.11.2 Test method for determining the operating temperature range 78
8.11.3 Combination Boilers 79
8.11.4 Control devices 82
8.11.5 Ignition devices 82
8.11.6 Flame supervision device 84
8.11.7 Gas pressure regulator 87
8.11.8 Thermostats and flow temperature limiting devices 88
8.12 Carbon monoxide 90
8.12.1 General 90
8.12.2 Limit conditions 92
8.12.3 Special conditions 92
8.12.4 Sooting 93
8.12.5 Condensate discharge blockage test 94
8.13 NO_x 94
8.13.1 Requirement 94
8.13.2 Test methods 95
8.13.3 Calculation of emissions of NO_X in mg/kWh based on GCV 97
8.14 Special provisions for boilers intended to be installed in a partially protected place 98
8.14.1 Frost protection system for boilers intended to be installed in a partially protected place 98
8.14.2 Protection against the ingress of rain 98
8.15 Formation of condensate 98
8.15.1 Requirements 98
8.15.2 Test conditions 98
8.16 Temperature of combustion products 99
8.16.1 Requirements 99
8.16.2 Test conditions 99
8.17 Sound power level L_{WA} 99
9 Useful efficiencies 99

9.1 General 99
9.1.1 Correction of measured efficiency to reference conditions 99
9.1.2 Use of the general test conditions 100
9.2 Useful efficiency at the nominal heat input 100
9.2.1 Requirements 100
9.2.2 Tests 100
9.3 Useful efficiency at part load 102
9.3.1 Requirements 102
9.3.2 Tests 102
9.4 Heat output, Seasonal energy efficiency and energy consumption 109
9.4.1 Rated heat output (P_{rated} and P_4) 109
9.4.2 Useful heat output at 30 % of rated heat output and low-temperature regime (P_1) 109
9.4.3 Useful efficiency (GCV) at rated heat output and high-temperature regime (η_4) 109
9.4.4 Useful efficiency (GCV) at 30 % of rated heat output and low-temperature regime (η_1) 110
9.4.5 Ignition burner power consumption (GCV) (P_{ign}) 110
9.4.6 Calculation of the seasonal space heating energy efficiency (η_s) 110
9.4.7 Calculation of the annual energy consumption for space heating (Q_{HE}) (GCV) 112
9.4.8 Water heating energy efficiency and energy consumption of combination boilers for water heating mode 112
10 Electric auxiliary energy 113
10.1 Auxiliary energy consumption 113
10.1.1 General 113
10.1.2 System boundaries 113
10.1.3 Auxiliary energy at nominal heat input 113
10.1.4 Auxiliary energy at part load 114
10.1.5 Auxiliary energy at stand-by 114
10.2 Auxiliary electricity consumption measurements required for eco-design and labelling regulations 114
10.2.1 General 114
10.2.2 System boundaries 114
10.2.3 Auxiliary electricity consumption [kW] at nominal heat input 115
10.2.4 Auxiliary electricity consumption at part load [kW] 115
10.2.5 Auxiliary electricity consumption at stand by [kW] 115
11 Risk assessment 115
12 Marking and instructions 116

12.1 Boiler marking **116**
12.1.1 Data plate **116**
12.1.2 Markings related to the state of adjustment **117**
12.1.3 Packaging **117**
12.1.4 Warnings notices on the boiler and the packaging **117**
12.1.5 Other information **118**
12.2 Instructions **119**
12.2.1 Instructions for installation **119**
12.2.2 Instructions for use and servicing **124**
12.2.3 Conversion instructions **124**
12.3 Presentation **125**
Annex A (normative) **Properties of carbon and stainless steels** **133**
Annex B (normative) **Minimum requirements for cast iron** **134**
Annex C (normative) **Parts in aluminium and aluminium alloys** **135**
Annex D (normative) **Parts in copper or copper alloys** **136**
Annex E (normative) **Minimum thicknesses for rolled parts** **137**
Annex F (normative) **Nominal minimum thicknesses of boiler sections of cast materials under water pressure** **138**
Annex G (normative) **Parameters for welded joints and welding processes** **139**
Annex H (informative) **Examples of the composition of the gas circuit according to 5.7.3.2** **144**
Annex I (informative) **Compilation of the test conditions for the various gas families** **153**
Annex J (normative) **Calculation of conversions of NOx** **155**
Annex K (informative) **Example of calculation of the weighting factors NOx** **157**
Annex L (informative) **Practical method of calibrating the test rig to enable the heat loss Dp to be determined** **159**
Annex M (informative) **Means of determining the ignition time at full rate** **160**
Annex N (informative) **Determination of the heat losses from the test rig of the indirect method and the contributions of the circulating pump of the test rig** **161**
Annex O (informative) **Example of a risk assessment method** **162**
Annex P (informative) **Examples of risk assessment with a method described in Annex O** **165**
Annex Q (informative) **Realisation of a protective measure** **170**
Annex R (informative) **Overall classification of a basic risk** **172**
Annex S (informative) **Not exhaustive list of classification examples** **175**
Annex T (normative) **Correction for the determined efficiency in the low water temperature test of low temperature boilers (LTB) and condensing boilers (CB)** **178**
Annex U (normative) **Use of test gases** **180**
Annex V (informative) **Alternative method for heat output as enthalpy difference** **181**

Annex AA (informative) **Product Information related to Eco-design Regulation and Labelling Regulation** **184**

Annex AB (informative) **Variations in gas quality** **188**

Annex AC (normative) **Non-exhaustive list of materials used in contact with drinking water** **193**

Annex ZA (informative) **Left empty on purpose** **195**

Annex ZB (informative) Clauses of this European Standard addressing the methods for the verification of the efficiency of the EU Directive 92/42/EEC, relating to the efficiency of new hot boilers with an output of 4 – 400 kW **196**

Annex ZC (informative) **Relationship between this European Standard and the ecodesign requirements of Commission Regulation (EU) No 813/2013 L 239/136 aimed to be covered** **197**

Annex ZD (info rmative) **Relationship between this European Standard and the energy labelling requirements of Commission Delegated Regulation (EU) No 811/2013 L 239/1 aimed to be covered** **200**

Annex ZE (informative) **Relationship between this European Standard and the essential requirements of Regulation (EU) 2016/426 of the European Parliament and of the Council of 9 March 2016 on appliances burning gaseous fuels and repealing Directive 2009/142/EC aimed to be covered** **203**

Bibliography **213**