



SLOVENSKI STANDARD
SIST EN 15378:2007
01-december-2007

Grelni sistemi v stavbah - Nadzor kurilnih naprav in grelnih sistemov

Heating systems in buildings - Inspection of boilers and heating systems

Heizungssysteme in Gebäuden - Inspektion von Kesseln und Heizungssystemen

Systemes de chauffage dans les bâtiments - Inspection des chaudières et des installations de chauffage

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Ta slovenski standard je istoveten z: EN 15378:2007

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ICS:

91.140.10	Sistemi centralnega ogrevanja	Central heating systems
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English Version

Heating systems in buildings - Inspection of boilers and heating systems

Systèmes de chauffage dans les bâtiments - Inspection des chaudières et des systèmes de chauffage

Heizungssysteme in Gebäuden - Inspektion von Kesseln und Heizungssystemen

This European Standard was approved by CEN on 28 July 2007.

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EUROPEAN COMMITTEE FOR STANDARDIZATION
COMITÉ EUROPÉEN DE NORMALISATION
EUROPÄISCHES KOMITEE FÜR NORMUNG

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Foreword

This document (EN 15378:2007) has been prepared by Technical Committee CEN/TC 228 "Heating systems in buildings", the secretariat of which is held by DS.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by March 2008, and conflicting national standards shall be withdrawn at the latest by March 2008.

This document has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association (Mandate M/343), and supports essential requirements of EU Directive 2002/91/EC on the energy performance of buildings (EPBD). It forms part of a series of standards aimed at European harmonisation of the methodology for calculation of the energy performance of buildings. An overview of the whole set of standards is given in prCEN/TR 15615.

The subjects covered by CEN/TC 228 are the following:

- design of heating systems (water based, electrical etc.);
- installation of heating systems;
- commissioning of heating systems;
- instructions for operation, maintenance and use of heating systems;
- methods for calculation of the design heat loss and heat loads;
- methods for calculation of the energy performance of heating systems.

Heating systems also include the effect of attached systems such as hot water production systems.

All these standards are systems standards, i.e. they are based on requirements addressed to the system as a whole and not dealing with requirements to the products within the system.

Where possible, reference is made to other European or International Standards a.o. product standards. However, use of products complying with relevant product standards is no guarantee of compliance with the system requirements.

The requirements are mainly expressed as functional requirements, i.e. requirements dealing with the function of the system and not specifying shape, material, dimensions or the like.

The guidelines describe ways to meet the requirements, but other ways to fulfil the functional requirements might be used if fulfilment can be proved.

Heating systems differ among the member countries due to climate, traditions and national regulations. In some cases requirements are given as classes so national or individual needs may be accommodated.

In cases where the standards contradict with national regulations, the latter should be followed.

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Bulgaria, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland and United Kingdom.

Introduction

This European Standard specifies procedures and optional measurement methods to be used for the inspection and assessment of energy performance of boilers and heating systems, in order to provide advice to users on the replacement of boilers, other modifications to the heating system and on alternative solutions as required by article 8 of Council Directive 2002/91/EC.

This European Standard includes, either in the normative text or in the informative annexes:

- inspection procedures;
- measurement procedures;
- calculation equations;
- sample reports;
- advice criteria.

Procedures and methodologies defined in this European Standard are not intended to provide a full energy audit of the heating system. They are intended to:

- support identification of areas of possible improvements;
- define criteria to produce reliable advice on possible improvements of the energy performance of boilers and heating systems through replacement of components or other measures.

Any replacement of appliances or modification of the heating system following advice should be designed according to appropriate methodologies. This may require additional input and investigation for detailed design and final check of economical effectiveness.

Clauses 5 and 6 separately describe basic inspection procedures related to:

- regular inspection of boilers;
- one-off inspection of the entire heating system.

This European Standard introduces inspection classes by which different levels of inspection accuracy and detailed inspection requirements can be determined, because:

- the same inspection procedure and level of details cannot reasonably be required for any kind and/or any size of boilers/heating systems;
- there are currently significant differences among member states with respect to:
 - heating systems typologies;
 - legal and/or standard requirements;
 - maintenance and inspection practices.

Alternative and/or optional partial inspection procedures and measurement methods for boilers and for other sub-systems of the heating system are described in the relevant annexes.

Inclusion of/omission of/alternatives to individual inspection items, as well as border lines between classes, are specified through tables given in national annexes. If no specific national annex is available, default tables and inspection classes are given in Annex A. Tables in the national annexes may refer either to methodologies given in the annexes to this European Standard or to suitable existing national standards.

This European Standard has been drafted to support inspection required by Council Directive 02/91/CE, that is “*Regular inspection of boilers fired by non-renewable gaseous, liquid or solid fuel*” and “*One-off inspection of heating systems with boilers that are more than 15 years old*”. This does not exclude the possibility to use this European Standard for other types of generation devices (e.g. warm air heaters, heat pumps, thermal solar, CHP) and for domestic hot water systems, if appropriate additional classes are defined in the national annexes.

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1 Scope

This European Standard specifies inspection procedures and optional measurement methods for the assessment of energy performance of existing boilers and heating systems.

Boiler types covered by this European Standard are:

- boilers for heating, domestic hot water or both;
- gas, liquid or solid fuel fired boilers.

Parts of heating systems covered by this European Standard are:

- boilers, including generation control;
- other generation devices;
- domestic hot water production facilities;
- heating distribution network, including associated components and controls;
- heat emitters, including components and controls;
- space heating control system;
- storage and associated components;
- domestic hot water control system.

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This standard covers issues related to energy conservation and environmental performance.

2 Normative references

Not applicable.

3 Terms and definitions, symbols and units

3.1 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

3.1.1

space heating

process of heat supply for thermal comfort

3.1.2

domestic hot water heating

process of heat supply to raise the temperature of the cold water to the intended delivery temperature

3.1.3

gross calorific value

quantity of heat released by a unit quantity of fuel when it is burned completely with oxygen at a constant pressure equal to 101 320 Pa, and when the products of combustion are returned to ambient temperature

NOTE 1 This quantity includes the latent heat of condensation of any water vapour contained in the fuel and of the water vapour formed by the combustion of any hydrogen contained in the fuel.

NOTE 2 According to ISO 13602-2, the gross calorific value is preferred to the net calorific value.

NOTE 3 The net calorific value does not take into account the latent heat of condensation.

3.1.4

net calorific value

gross calorific value minus latent heat of condensation of the water vapour in the products of combustion at ambient temperature

3.1.5

external temperature

temperature of external air

NOTE 1 For transmission heat transfer calculations, the radiant temperature of the external environment is supposed equal to the external air temperature; long-wave transmission to the sky is calculated separately.

NOTE 2 The measurement of external air temperature is defined in EN ISO 15927-1.

3.1.6

boiler

gas, liquid or solid fuelled appliance designed to provide hot water for space heating. It may (but need not) be designed to provide domestic hot water heating as well

3.1.7

combustion power

product of the fuel flow rate and the net calorific power of the fuel

3.1.8

condensing boiler

boiler designed to make use of the latent heat released by condensation of water vapour in the combustion flue products. The boiler needs to allow the condensate to leave the heat exchanger in liquid form by way of a condensate drain

NOTE Boilers not so designed, or boilers without the means to remove the condensate in liquid form, are termed 'non-condensing' boilers.

3.1.9

on/off boiler

boiler without the capability to vary the fuel burning rate while maintaining continuous burner firing. This includes boilers with alternative burning rates set once only at the time of installation, referred to as range rating

3.1.10

multistage boiler

boiler with the capability to vary the fuel burning rate stepwise while maintaining continuous burner firing

3.1.11

modulating boiler

boiler with the capability to vary continuously (from a set minimum to a set maximum) the fuel burning rate while maintaining continuous burner firing

3.1.12

energy carrier

substance or phenomenon that can be used to produce mechanical work or heat, or to operate chemical or physical processes

[ISO 13600:1997]

NOTE The energy content of fuels is given by their gross calorific value.

3.1.13

energyware

tradeable commodity used mainly to produce mechanical work or heat, or to operate chemical or physical processes, and listed in ISO 13600:1997, Annex A

NOTE Energywares form a proper subset of energy carriers. The set of energy carriers is open.

3.1.14

delivered energy

energy content, expressed per energy carrier, supplied to the building through the system boundary, to satisfy the uses taken into account (e.g. heating, cooling, ventilation, domestic hot water, lighting, appliances) or to produce electricity

NOTE 1 For active solar and wind energy systems, the incident solar radiation on solar panels or the kinetic energy of wind is not part of the energy balance of the building. Only the energy delivered by the generation devices and the auxiliary energy needed to supply the energy from the source (e.g. solar panel) to the building are taken into account in the energy balance and hence in the delivered energy.

NOTE 2 Delivered energy can be calculated for defined energy uses or it can be measured.

NOTE 3 It is decided on a national level whether or not renewable energy produced on site constitutes part of delivered energy.

3.1.15

operational rating

energy rating based on measured amounts of delivered and exported energy

NOTE The measured rating is the weighted sum of all energy carriers used by the building, as measured by meters or other means. It is a measure of the in-use performance of the building. This is particularly relevant to certification of actual energy performance.

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3.2 Symbols and units

For the purposes of this document, the following symbols and units (Table 1) and indices (Table 2) apply.

Table 1 — Symbols and units

Symbol	Name of quantity	Unit
A	area	m ²
c	coefficient	various
c	specific heat capacity	J/kg·K or Wh/kg·K ^a
DD	degree-days	°C·day
E	energy in general, except quantity of heat, mechanical work and auxiliary (electrical) energy	J or Wh ^a
f	factor	-
h	surface coefficient of heat transfer	W/(m ² ·K)
h	latent heat	J/kg or Wh/kg ^a
H	calorific value	J/mass unit or Wh/mass unit ^{a,b}
k	factor	-
m	mass	kg
P	power in general, including electrical power	W
Q	quantity of heat	J or Wh ^a
t	time, period of time	s or h ^a
V	volume	m ³
V'	volume flow	m ³ /s or m ³ /h ^a
W	auxiliary (electrical) energy, mechanical work	J or Wh ^a
x	relative humidity	%
X	volume fraction	%
α	loss factor	%
β	load factor	-
Δ	prefix for difference	-
η	efficiency factor	%
θ	Celsius temperature	°C
ξ	absolute humidity	kg/Nm ³
ρ	density	kg/m ³
Φ	heat flow rate, thermal power	W
^a	If the unit seconds (s) is used for time, the unit for energy shall be J; if the unit hours (h) is used for time, the unit for energy shall be Wh.	
^b	Mass unit for fuel may be Stm ³ , Nm ³ or kg.	

Table 2 — Indices

air	air	floor	near the floor	O2	oxygen
auxh	auxiliary heater	fr	flow to return	off	off
avg	average	gas	gas	on	on
ceil	near the ceiling	ge	generator envelope	P0	stand-by
ch	chimney	gen	generation	pmp	circulation pump
cmb	combustion	gnr	generator	r	return
CO	carbon monoxide	H2O	water vapour	rd	reading
CO2	carbon dioxide	i	net (calorific value)	ref	reference
cond	condensation	i	running index	s	gross (calorific value)
corr	corrected	ini	initial	sat	saturation
del	delivered	int	internal	sens	sensible
des	design	j	running index	st	stoichiometric
dry	dry gases	lf	liquid fuel	str	stratification
e	external	ls	loss	test	in test conditions
el	electrical	m	average	vol	volumetric
f	fuel	meas	measured	w	water
fg	flue gas	mid	at 1,5 m height	x	net or gross
fin	final	min	minimum	θ	temperature

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4 Principle of the method

4.1 Boiler regular inspection

Regular boiler inspection procedures and methods are intended to:

- verify if the boiler is set, operated and maintained correctly with regard to energy efficiency;
- estimate actual boiler energy performance;
- when required, support advice on possible boiler energy performance improvements.

NOTE Council Directive 2002/91/CE does not require advice following boiler regular inspection.

4.2 Heating system one-off inspection

One-off heating system inspection procedures and methods are intended to:

- verify if the heating systems is set, equipped, operated and maintained correctly with regard to energy efficiency;
- estimate actual heating system energy performance;
- support advice on possible heating system energy performance improvements.

Inspection procedures and optional measurement methods (if any) are specified separately for each sub-system of the heating system.

4.3 Inspection classes

Boiler and heating system inspection classes shall be specified according to one or more of the following parameters:

- fuel type;
- nominal boiler power input or output;
- boiler type;
- heated space area or volume;
- type of heat distribution;
- type of heat emitters;
- other relevant properties.

Optional inspection items and/or measurement methods are applied according to the inspection class.

NOTE 1 If intermediate inspection results provide evidence of significant possible improvements, the inspector should recommend more accurate inspection as appropriate and effective to support specific advice.

For each inspection class, required and/or alternative inspection items and/or procedures shall be specified through tables where:

- each row corresponds to a specific inspection item and/or partial inspection procedure and/or methodology;
- each column corresponds to an inspection class;
- each cell specifies whether or not the specific inspection item and/or partial inspection procedure and/or methodology (row) is required for the inspection class (column), according to Table A.1.

Two basic types of tables may be used to specify details of inspection classes:

- list of information required about the inspected boiler / heating system / sub-system of the heating system (typically a choice between alternatives, e.g. YES/NO) are specified through tables like Table A.2;
- list of properties to be estimated or measured and required alternative procedures or methods to be applied (e.g. efficiencies may be obtained from measurements, maintenance records or estimation through tables) are specified through tables like Table A.3.

For each inspection item and/or optional procedure, the table shall state whether or not the inspection item is required to comply with the inspection class. If the inspection item is required to comply with the inspection class, the table shall further state:

- whether or not the specific procedure is suitable to comply with the inspection class (there might be more than one possibility with preference, if any, stated in notes to the table);
- whether or not the specific procedure is sufficient to comply with the inspection class;
- whether the specific procedure is more than required to comply with the inspection class;

NOTE 2 This option provides the information that the specific inspection item or optional procedure is more detailed than what is required to comply with the inspection class.