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Shell boilers - Part 7 : Requirements for firing systems for liquid and gaseous fuels for the boilers

Großwasserraumkessel - Teil 7 : Anforderungen an Feuerungsanlagen für flüssige und gasförmige Brennstoffe für den Kessel

Chaudieres a tubes de fumée - Partie 7 : Exigences pour les équipements de chauffe pour combustibles gazeux et liquides de la chaudiere

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This European Standard was approved by CEN on 15 May 2002.

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This European Standard exists 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 Management Centre has the same status as the official versions.

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

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

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Contents

Foreword

This document (EN 12953-7:2002) has been prepared by Technical Committee CEN/TC 269 "Shell and water-tube boilers", the secretariat of which is held by DIN.

This European Standard 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 ZA, which is an integral part of this standard.

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of an identical text or by endorsement, at the latest by November 2002, and conflicting national standards shall be withdrawn at the latest by November 2002.

The European Standard EN 12953 concerning shell boilers consists of the following Parts:

— *Part 1: General.*

— *Part 2: Materials for pressure parts of boilers and accessories.*

— *Part 3: Design and calculation for pressure parts.*

— *Part 4: Workmanship and construction of pressure parts of the boiler.*

— *Part 5: Inspection during construction, documentation and marking of pressure parts of the boiler.*

— *Part 6: Requirements for equipment for the boiler.*

— *Part 7: Requirements for firing systems for liquid and gaseous fuels for the boiler.*

— *Part 8: Requirements for safeguards against excessive pressure.*

— *Part 9: Requirements for limiting devices of the boiler and accessories.*

— *Part 10: Requirements for boiler feedwater and boiler water quality.*

— *Part 11: Acceptance tests.*

— *Part 12: Requirements for firing systems for solid fuels for the boiler.*

— *Part 13: Operating instructions.*

CR 12953-14: Guidelines for the involvement of an inspection body independent of the manufacturer.

Although these Parts can be obtained separately, it should be recognized that the Parts are inter-dependent. As such, the design and manufacture of shell boilers requires the application of more than one Part in order for the requirements of the standard to be satisfactorily fulfilled.

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

1 Scope

This Part of this European Standard specifies requirements for firing systems for oil and gaseous fuels applicable to shell boilers, as defined in EN 12953-1, irrespective of the degree of supervision. For multifuel firing systems using separate or combined burners, these requirements apply to the oil and/or gas firing part involved.

This Part of this European Standard specifies the improved safety measures required when several fuels are burnt simultaneously.

2 Normative references

This European Standard incorporates, by dated or undated reference, provisions from other publications. These normative references are cited at the appropriate places in the text and the publications are listed hereafter. For dated references, subsequent amendments to or revisions of any of these publications apply to this European Standard only when incorporated in it by amendment or revision. For undated references, the latest edition of the publication referred to applies (including amendments).

EN 267, *Forced draught oil burners - Definitions, requirements, testing, marking*.

EN 676, *Automatic forced draught burners for gaseous fuels*.

EN 12953-1, *Shell boilers — Part 1: General.*

3 Terms and definitions

For the purposes of this Part of this European Standard, the following terms and definitions apply.

3.1
liquid fuels
light fuel oils, and heavy fuel oils which need preheating for proper atomisation

3.2
gaseous fuels
standardized quality differentiated mainly by their relative density

3.2.1
light gases
with relative density below 1,3 e.g. natural gas, coke-oven gas, blast-furnace gas

NOTE Natural gas in accordance with ISO 6976.

3.2.2
heavy gases
with relative densities exceeding 1,3 e.g. liquefied petroleum gases, the main components of which are propane and butane

3.3
burners
devices for the introduction of fuel and air into a combustion chamber at required velocities, turbulence and local fuel concentration to establish and maintain proper ignition and stable combustion of the fuel

3.4
burner management system
performs a predetermined sequence of actions and always operates in conjunction with a flame monitor that reacts to signals from control and safety devices, gives control commands, controls the start-up sequence, supervises the burner operation, and causes controlled shutdown and lockout

3.5
firing system
total equipment required for the combustion of fuels including the installations for the storage, preparation, and supply of fuels, the combustion air supply, the burner(s), the flue gas discharge, and all related control and monitoring devices

NOTE A flue gas re-circulation system can be installed as an integral part of the firing system.

3.6
firing system heat input
heat input into the combustion chamber, including the reserve required for load control at which the boiler can be safely operated

NOTE The mass flow of the fuel supplied multiplied by the net calorific value.

3.7
flame monitor
device which detects the presence or absence or break-away of the flame and transmits a signal to the control device, and generally, consists of a sensing device (if necessary with amplifier) and switching equipment

3.8
flue gas re-circulation
return of flue gas from downstream of the flame zone or from the flue gas exit by hydrodynamic pressure difference or a separate fan into the air register of the burner or directly into the combustion chamber

3.9
limiters
device that, on reaching a fixed value (e.g. pressure, temperature, flow, water level) is used to interrupt and lock-out the energy supply and requires manual unlocking before restart

3.10
lock-out
isolation of energy supply which requires a manual intervention to reinstate

NOTE See EN 676 for definition of non-volatile lock-out.

3.11
master fuel trip
device for rapid automatic shut-off of all fuel supplies to the boiler area in the event of danger which may act by automatic, manual or emergency switch initiation even if a possible electrical or mechanical fault occurs

3.12
firing rate of the burner
rate at which the burner may be operated

3.13
multi-fuel burners
burners in which more than one fuel is burned either simultaneously or separately

3.14
purging of the flue gas passes
forced flow of air through the combustion chamber, flue gas passes, and associated ducts which effectively removes any combustible products and replaces them with air

3.16
relative density
ratio of the density of the gas to the density of dry air under equal conditions of pressure and temperature

3.17
return-flow atomizer
oil burners where a portion of the quantity of oil supplied to the burner via the flow line does not flow from a burner gun into the combustion chamber, but flows backwards into the storage tank or the suction side of the pump via a separate return line, the output being adjusted by a control device in the return line

4 Fuel supply

4.1 Fuel transfer and preparation

4.1.1 The fuel supply line shall be equipped with a master fuel trip which shall be positioned in a safe location. It shall cut off the fuel supply to the boiler room or the boiler area and can be operated manually or by remote control, or by an emergency switch.

4.1.2 Some liquid fuels such as heavy fuel oil shall be preheating to achieve the viscosity required for proper atomisation.

Any heat source that can be cut off immediately if required, and the rating of which can be automatically controlled, can be used for oil preheating. Open flames shall not be permitted. The fuel oil temperature shall not attain the fuel oil flash point at atmosphere pressure.

Each fuel oil preheating system shall be automatically temperature controlled. A temperature indicator shall be fitted downstream of the preheating system. A suitable cut-out for the heating source shall be provided to prevent overheating of the oil. In addition, a minimum temperature limiting device shall also be provided to ensure adequate atomisation.

For pressurized preheaters, the requirements for pressure vessels shall be applied, including overpressure protection. Any escaping oil shall be safely discharged.

4.2 Fuel lines

4.2.1 Fuel lines, including gaskets and valves shall be designed and laid out to withstand the mechanical, chemical and thermal loads to which they are exposed in service. Only fire resistant piping material shall be permitted. Isolation valves shall be provided between the burner and the fuel lines.

4.2.2 The fuel lines shall be tight and properly fixed. In systems subjected to vibrations the resulting stresses shall be minimized to avoid leakage.

4.2.3 Flexible lines may be used for connecting the burner to the fixed piping. For fuel oil in the preheated state, only jacketed metallic hoses shall be permitted. Isolated valves shall be installed.

Flexible lines may be used instead of compensators at protected locations. For oil, these lines should be jacketed metallic hoses, otherwise they need a protective device consisting of e.g. a double line with an oil monitor which switches off the oil supply pump in case of an oil leakage. For gas, these lines shall be corrugated steel pipes.

All flexible lines shall be as short as possible and be installed with adequate bending radii. The flexible lines and the connections shall carry the manufacturer's symbols and indication of the nominal carry pressure. The design pressure shall be at least 1,5 times the maximum allowable pressure. The lines shall be protected against unacceptable external heating.

4.2.4 To protect fuel lines against unacceptable high pressure, automatic control and safety devices shall be provided. For oil lines, pressure relief valves shall be installed. Protection of oil pumps and the effect of pressure rise in lines between closed shut-off devices due to heating shall also be taken into consideration. For gas lines the necessary protection against overpressure shall be performed by a safety shut-off valve plus a pressure relief valve.

4.2.5 On completion of the installation, all fuel piping including valves and other equipment within the fuel lines up to the burner nozzles shall be cleaned to remove any weld spatter, corrosion products and foreign matter. The type and performance of the cleaning process shall also be recorded. As an alternative, commissioning filters shall be fitted and these shall be replaced after a period of time.

4.2.6 For gas lines, leakage testing shall be performed using air or inert gas at 1,5 times the maximum allowable pressure.

Oil lines shall be strength tested after leakage testing by applying a pressure of 1,3 times the maximum allowable pressure with a minimum of 5 bar gauge.

4.2.7 Gas escape lines for intermediate venting and for purging or charging shall be arranged such, that the escaping gas is safely discharged. The joining together of these lines shall only be permitted if no dangerous operating conditions are expected. When necessary, gas escape lines shall be equipped with draining facilities and also connections for test devices.

4.3 Safety shut-off devices (Safety trip valves)

4.3.1 In addition to the requirements in accordance with EN 676 or EN 267, the fuel supply shall not be released during the start-up operation until the minimum preheating temperature required for the oil has been reached.

4.3.2 In addition to the requirements in accordance with EN 676 or EN 267, the automatic safety shut-off devices shall be operated such that they do not release the fuel supply to the burners during the start-up operation, and cut it off during operation whenever,

1) the flue gas damper, if fitted, is not proven to be fully open;

2) where applicable, the ratio of flue gas recirculation flow/burner firing rate is unacceptable;

3) the flue gas recirculation fan, if fitted, fails;

4) the emergency switch is actuated;

5) any of the limiters responds (e.g. for water level, temperature).

4.3.3 As soon as the causes of 4.3.1 as well as 1) to 3) of 4.3.2 have been removed, the burners may automatically restart by following the regular start-up programme if this shall be permitted for the plant.

Where the conditions 4) to 5) of 4.3.2 apply, lock-out shall always occurs. Restarting shall only be possible by manual intervention.

5 Air supply, air/fuel ratio

5.1 Unrestricted air supply to the boiler and boiler house shall be ensured.

5.2 Where there are several burners with a common fan, each shall be equipped with a pressure gauge or flow meter in the air supply line. This shall not apply to burners with a common wind box.

5.3 In the case of firing systems with several burners to which combustion air is supplied by a common control device, each burner shall be equipped with a shut-off device (e.g. damper) in the air duct except when all burners fire in forced unison.

Shut-off devices in the air line to the burner shall be protected against unintentional mal-adjustment. Open and start positions shall be checked.

In the case of interruption of fuel supply to the burner, this shut-off device shall also cut off the air supply automatically (if necessary, only to provide a minimum opening). This shall ensure sufficient air supply for the burners still in operation in the case of failure and shutdown of a burner. The position of the shut-off device shall be identifiable.

6 Firing system

6.1 Burners

6.1.1 The requirements of EN 267 or EN 676 shall apply. The burner shall be suitable for the respective boiler. It may consist of a single burner or a multiple burner arrangement.

6.1.2 Burners shall be individually tested, at the latest during commissioning, or following any modification, and shall include:

a) verification of completeness of equipment according to the requirements of this standard;

b) functional testing of all safety-related equipment;

c) verification of maximum and minimum firing rate, including injection of additives, if used;

d) verification of flame stability during burner start-up, at the conditions given in c) above, with the flue gas recirculation, if any, and in the case of changes in firing rate, taking coincident combustion chamber pressures into consideration. In all these cases, the flame shall be stable without significant pulsations;

e) proof that the required characteristic values relevant to combustion, such as CO_2 - or O_2 - or CO -content by volume, are obtained at the conditions given in c) and at intermediate firing rates, if applicable. In addition for oil burners, unburnt particles (smoke) shall be checked.

6.1.3 They are equipped with automatic ignition, flame monitoring and safety control devices. Ignition, flame monitoring, and switch-on/of operation is effected without intervention by operating personnel.

6.1.4 The burner firing rate is controlled automatically.

6.2 Inspection openings

To permit visual observation of igniter and burner flames, inspection openings shall be provided at locations in the combustion chamber or the burner(s). If escape of hot gases is possible, protection for personnel shall be provided.

6.3 Purging, start-up and shutdown

Prior to any firing system start-up, the flue gas passes shall be effectively purged. The combustion chamber and the flue gas passes shall be of such a design as to ensure effective purging. The boiler manufacturer's operating instructions shall be followed.

6.4 Common stack for several firing systems

Unless the possibility of igniting an explosive mixture exists, boiler exhausts may be combined.

6.5 Fuels

Where several fuels are burnt simultaneously, improved safety measures can be necessary, especially in respect to limitation of heat input into the firing system and proper air supply to the individual fuels.

Fuels deviating from standardized commercially available types can require extra safety measures.