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Water-tube boilers and auxiliary installations - Part 16: Requirements for grate and fluidized-bed firing systems for solid fuels for the boiler

Wasserrohrkessel und Anlagenkomponenten - Teil 16: Anforderungen an Rost- und Wirbelschichtfeuerungsanlagen für feste Brennstoffe für den Kessel

Chaudieres a tubes d'eau et installations auxiliaires - Partie 16: Exigences pour les équipements de chauffe a lit fluidisé et a grille pour combustibles solides de la chaudiere

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Water-tube boilers and auxiliary installations - Part 16: Requirements for grate and fluidized-bed firing systems for solid fuels for the boiler

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This European Standard was approved by CEN on 4 November 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.

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Contents

Foreword

This document (EN 12952-16:2002) 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 shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by June 2003, and conflicting national standards shall be withdrawn at the latest by June 2003.

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 EU Directive 97/23/EC [1].

For relationship with EU Directive 97/23/EC, see informative Annex ZA, which is an integral part of this document.

The European Standard EN 12952 concerning water-tube boilers and auxiliary installations 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: In-service boiler life expectancy calculations*
— *Part 5: Workmanship and construction of pressure parts of the boiler*
— *Part 6: Inspection during construction, documentation and marking of pressure parts of the boiler*
— *Part 7: Requirements for equipment for the boiler*
— *Part 8: Requirements for firing systems for liquid and gaseous fuels for the boiler*
— *Part 9: Requirements for firing systems for pulverized solid fuels for the boiler*
— *Part 10: Requirements for safeguards against excessive pressure*
— *Part 11: Requirements for limiting devices of the boiler and accessories*
— *Part 12: Requirements for feedwater and boiler water quality*
— *Part 13: Requirements for flue gas cleaning systems*
— *Part 14: Requirements for flue gas DENOX-systems*
— *Part 15: Acceptance tests*
— *Part 16: Requirements for grate and fluidized-bed firing systems for solid fuels for the boiler*

CR 12952-17, *Water-tube boilers and auxiliary installations — Part 17: Guideline for the involvement of an inspection body independent of the manufacturer.*

Although these parts may be obtained separately, it should be recognized that the parts are inter-dependent. As such, the design and manufacture of water-tube boilers requires the application of more than one part in order for the requirements of the European Standard to be satisfactorily fulfilled.

NOTE Parts 4 and 15 are not applicable during the design, construction and installation stages.

Annex A of this European Standard is informative.

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

1.1 Firing systems

This Part of this European Standard applies to atmospheric fluidized-bed and grate firing systems of steam boilers and hot water generators. These systems commence at the fuel bunkers and end at the ash extraction plant. For combination of various firing systems, the individual requirements of each system apply, especially those included in EN 12952-8 and EN 12952-9.

If several fuels are burnt simultaneously or if a fuel quality varies considerably (e.g. moisture content), additional safety measures may be necessary, especially with respect to limitation of the fuel flow into the firing system and ensuring proper air supply to the individual fuels.

Pressurized firing systems may require enhanced safety measures, which are not given in this European Standard.

1.2 Fuels

This European Standard covers the use of solid fuels. Pulverized fuel fired in an entrained air flow (burner) system is covered by EN 12952-9.

Solid fuels covered are:

— all coal qualities, e.g. lignite or brown coal, sub-bituminous or hard brown coal, bituminous coal or hard coal, pitch coal, anthracite, coke, coal culm, coal sludge;

— other fossil solid fuels (e.g. peat, oil shale);

— biomass solid fuels (e.g. wood, wood wastes [bark], pellets, energy plants [miscanthus], harvest wastes [straw] and briquettes);

— municipal waste solid fuels (e. g. garbage, sewage sludge, refuse derived fuels [RDF]);

— industrial waste solid fuels (e. g. petrol coke, soot, tyres, paper wastes, coated wood chips, spent wood, animal product wastes).

Fuel blends from two or more groups, or fuels of unconventional or unknown quality may require special safety measures which can be proved either by practical experience gained from comparable fuels, or by suitable tests, e.g. in accordance with EN 26184-1. Such measures specified and documented by the manufacturer.

Fuels on which the design is documented in the operating instructions (see 11.2). This include the fuel data for 100 % input of the basic fuel and the data for any supplementary fuels together with their maximum thermal input percentage.

1.3 Operation

The requirements for operational equipment in clauses 4 to 11 apply to steam boilers and hot water generators with permanent supervision by properly trained personnel familiar with the special conditions of the firing systems and the type of fuel.

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 12952-8:2002, *Water-tube boilers and auxiliary installations - Part 8: Requirements for firing systems for liquid and gaseous fuels for the boiler.*

EN 12952-9:2002, *Water-tube boilers and auxiliary installations - Part 9: Requirements for firing systems for pulverized solid fuel for the boiler.*

prEN 50156-1, *Electrical equipment for furnaces and ancillary equipment — Part 1: Requirements for application, design and installation.*

3 Terms and definitions

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

3.1
annunciator
device to sense a non-standard or abnormal condition and initiate a visual and/or audible signal

3.2
back-up firing system
separate firing system to maintain safe ignition and stable combustion

3.3
basic fire
in the case of grate firing systems the layer of glowing fuel, fire bed, or flame of the fed fuel

NOTE The basic fire ensures safe ignition.

3.4
carrier gas
transport medium for pneumatic conveying

3.5
combustion air
total air supplied to the firing system for combustion

3.6
combustion process monitoring device
device which detects the presence of the fire, or the conditions required for a stable combustion process

3.7
firing system heat input
heat input into the combustion chamber. This normally is calculated as the mass flow of the fuel multiplied by its net calorific value

3.8
firing systems
the total equipment required for the combustion of fuels, including the installations for the storage in the boiler house, preparation and supply of fuels, the combustion air supply, the grate or fluidized bed, the flue gas discharge, and all related control and monitoring devices

3.9
fluidized-bed combustion firing systems (FBC)
fuel is burnt in its fluidized state together with an inert component

3.10
fuel bin
silo
dust-tight and air-tight container for storage of fuels

3.11
fuel bunker
container for the storage of solid fuel

3.12
fuel feeding system
device to transport fuel into the combustion chamber

NOTE This can be effected e.g. by feeders through ports in the furnace walls, by means of chutes or lances, through the bottom grate or fluidizing gas distributor, or indirectly into the ash recirculation or combustion air supply.

3.13
fuel handling plant
installation for conveying, mixing and distributing solid fuels to the individual fuel bunkers or fuel bins

3.14
grate firing system
fuel is burnt in a layer supported by a system e.g. firebars, which can have a cooling system

3.15
indicator
measuring instrument which indicates a variable value (e. g. pressure, temperature, flow, level)

NOTE It can be equipped with an annunciator.

3.16
lighting-up equipment
facility to achieve safe ignition of the feed fuel

3.17
limiter
transducer, which, on reaching a fixed limit value (e. g. pressure, temperature, flow, level) is used to interrupt and lock-out the energy supply. It requires manual unlocking before restart

3.18
lockout
interruption of the energy supply. Manual unlocking is required before restart

3.19
minimum fluidized-bed temperature
lowest temperature of the fluidized material at which it can be safely burnt

3.20
minimum heat input of the firing system
minimum heat input at which the firing system can be safely operated

3.21
monitor
transducer which on reaching of a fixed limit value and initiates an alarm and/or a cut-out. The output signal only reverses if the causing value has changed at a defined range

3.22
purging of the flue gas passes
flow including air through the combustion chamber, flue gas passes, treatment systems and associated ducts which effectively removes any gaseous combustibles

3.23
cold start-up condition
plant started when the temperature of ceramic lining and bed material is at ambient value

4 Fuel storage facilities with conveying plant

4.1 General

4.1.1 All facilities shall be designed so as to withstand mechanical and thermal stresses. Fuel shall not be heated to an unacceptable level. Sites where fuel may accumulate shall be avoided.

4.1.2 Conveyance, temporary storage, and extraction of fuel shall be arranged such that blockage is avoided.

4.1.3 Fuels liable to volatise or pyrolysis in the absence of external heating require measures to prevent fire, explosion and injuries to personnel.

NOTE Wet sludges can have an inherent explosion risk due to the release of volatiles (e.g. methane) when stored. Dried sludges have a fire and dust explosion risk comparable to that of pulverized fuels. Sludge storage in bins is preferable to bunker storage (see 4.4.1).

4.1.4 The storage of fuels supplied in small grain sized particles or fibres which can be stirred up and become airborne shall only be permitted in bins (silos).

4.1.5 If different types of fuels are used, dangerous operating conditions due to blending shall be excluded, e.g. by the use of separate bunkers or bins and separate feeding systems.

4.1.6 If there is a risk of blockage of conveying systems or firing systems by coarse fuel lumps, foreign matter, and tramp metal, it shall be removed, preferably before entering the bunker.

4.2 Conveying plant

4.2.1 Several continuous conveyors arranged in series to form one conveying line shall be interlocked such that the normal operation of any conveyor is possible only if the downstream conveyors are in operation and the storage facility is ready to accept the fuel.

4.2.2 Automatic facilities for open mechanical conveyance and distribution of fuel shall only start after visual and/or audible warning signals have been given.

Precautions shall be taken for the protection of personnel against injury from moving components. Sufficient time shall be provided between a warning signal and starting of the plant.

4.2.3 If the type and format of the fuel requires bins (silos) for temporary storage in accordance with 4.1.3 or 4.1.4, subsequent conveyance shall be performed in a closed system, which shall be air-tight if operated under internal pressure.

4.2.4 For pneumatic conveyance of fuel in closed pipes, deposition shall be prevented by sufficient velocity of the carrier gas depending on the type and format of the fuel.

4.2.5 All piping system components of a pneumatic conveying system shall be capable of being purged of fuel.

4.2.6 Feeding of fuel into the pneumatic conveying line shall be interlocked in such a way that feeding is possible only if sufficient carrier gas is supplied. Suitable monitoring devices, e.g. monitors for flow or pressure of the carrier gas shall be provided.

4.2.7 If the carrier gas is exhausted to the atmosphere via a dust separator, the outlet shall be protected against contact with ignition sources, or sparks.

4.2.8 If multiple lines are installed, devices shall be provided to isolate idle conveying lines from the downstream storage facility or the furnace.

4.2.9 If fuels are conveyed hydraulically by pumps, 4.2.3 to 4.2.5 shall apply.

4.3 Fuel bunkers

4.3.1 With exception of bunkers emptied by cranes, fuel bunkers shall be built to achieve uniform discharge by the selection of proper shape and design, in order to ensure a continuous uniform fuel flow and to avoid segregation.

4.3.2 To avoid ingress of hot air/gas into the bunker, a minimum fuel level shall be maintained and monitored in the bunker, or other suitable measures shall be taken.

4.3.3 The inner surface of the fuel bunker roof shall be designed to prevent the accumulation of dust and gas in dead pockets.

4.3.4 Bunker charging openings shall be guarded to prevent personnel from falling in.

4.3.5 Fuel bunkers shall be equipped with fire fighting or fire prevention equipment. Coal bunkers may be emptied by use of emergency chutes.

4.4 Fuel bins

4.4.1 Some fuels according to their type and format shall be stored in dust-tight bins (silos). The requirements for pulverized fuel bins defined in EN 12952-9:2002, 5.4 and 6.2.2 shall apply.

4.4.2 The permissible maximum storage temperature shall be specified for each single fuel and fuel blends and shall be monitored during the storage, if there is a risk of self ignition.

4.4.3 If emanation of combustible gas from the fuel cannot be prevented, bins shall be equipped with suitable gas monitoring and safe venting devices, or an explosion-proof bin or inertgas protection shall be provided.

4.4.4 Fuels described in 4.1.4 shall be stored in bins equipped with a stationary non-freezing fire extinguishing system to enable fire to be fought without opening access doors. The extinguishing compound shall be evenly sprayed across the entire cross sectional area of the bin. Spray nozzles shall be protected against blockage by the ingress of dust. Where stationary spray-type extinguishing systems are operated automatically, manual initiation shall be possible.

4.4.5 Outdoor bins and fuel bearing components as well as buildings for indoor installation shall be equipped with a lightning protective system (according to relevant standards e.g. prEN 61024-1).

5 Fuel treatment

5.1 General

5.1.1 The equipment shall be designed to withstand mechanical and thermal stresses. It shall be so arranged as to be readily accessible to enable cleaning operations to be carried out. The total system shall be gas tight if operated under internal pressure.

5.1.2 Practicable steps shall be taken to avoid sites in the plant where combustible dust or fuel may become lodged.

5.1.3 If there is a possibility of settlement of combustible dust on components that have become hot during operation, facilities shall be provided for purging and cleaning after shut-down.

5.1.4 Mechanical equipment for fuel treatment shall be designed and operated such that no unacceptable heating of the fuel occurs.

5.1.5 The system shall include indicators and annunciators which will provide the operator with adequate information about significant operating conditions, both normal and abnormal.

5.1.6 To avoid the build up of electrostatic charges, all components shall be earthed unless forced and faultless earthing is inherent in the design.

5.2 Size reduction of the fuel

If size reduction of the fuel is performed by mills or crushers in the boiler house with the application of hot gas as the carrier gas for combined grinding and drying process, the requirements for mills and the necessary explosion prevention measures given in EN 12952-9:2002, 5.3, clause 6, and 8.7.4 shall apply.

5.3 Drying of the fuel

When drying fuel prior to combustion, the permissible maximum temperature in accordance with 4.4.2 shall be monitored. The vapours shall be discharged in order to prevent the risk of explosion. For combined grinding and drying process see 5.2.

6 Fuel feeding

6.1 Fuel feeding systems shall be designed to withstand mechanical and thermal stresses.

6.2 Fuel feeders shall be designed to provide a continuous fuel flow.

6.3 A shut-off device shall be installed within the fuel feeding system. This shut-off device shall be closed automatically:

— if the minimum fuel level is lost when mechanical feeding;

— if the minimum supply pressure is lost when pneumatic or hydraulic feeding.

Shut-off devices need not to be installed if a rotary vane feeder is installed or if it can be ensured that negative pressure is maintained in the fuel feeding system or a minimum fuel level (see 4.3.2) is maintained in the fuel bunker.

6.4 It shall be ensured that after shut-off of the firing system and during outage, no fuel can enter the furnace.

6.5 The feeding of fuel shall be cut off in the event of control power loss (see 9.2.4), under the start-up conditions in accordance with 9.4.4.1 a), or under shutting-down conditions in accordance with 9.4.5.1 a).

6.6 Fuel feeding systems shall be made such that flash-back by flame, or flying sparks and backfire, or egress of hot gases is prevented.

6.7 Depending on the type of fuel, fire fighting equipment shall be installed. An alarm shall be activated, when a set value has been exceeded in the fuel supply equipment. Equipment for monitoring and fire fighting shall be placed in such a way that a fire can be extinguished quickly. The equipment shall be easy to test.

6.8 Pneumatic fuel feeding shall be performed either indirectly by carrier gas separation (see 4.2.8), or directly into the furnace.

If the carrier gas fails to be supplied (see 4.2.7) the shutoff device in the carrier gas supply line shall close. The position of the shutoff device shall be visible from outside the supply system.