BRITISH STANDARD

BS EN
12952-16:2002

Water-tube boilers and auxiliary installations —

Part 16: Requirements for grate and fluidized-bed firing systems for solid fuels for the boiler

The European Standard EN 12952-16:2002 has the status of a British Standard

ICS 27.040

BSI
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National foreword

This British Standard is the official English language version of EN 12952-16:2002.

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The UK participation in its preparation was entrusted to Technical Committee PVE/2, Water-tube boilers, which has the responsibility to:

— aid enquirers to understand the text;

— present to the responsible international/European committee any enquiries on the interpretation, or proposals for change, and keep the UK interests informed;

— monitor related international and European developments and promulgate them in the UK.

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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

Chaudières à tubes d'eau et installations auxiliaires - Partie 16: Exigences pour les équipements de chauffe à lit fluidisé et à grille pour combustibles solides de la chaudière

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

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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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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of an identical text or by endorsement, at the latest by June 2003, and conflicting national standards shall be withdrawn at the latest by June 2003.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.

The shut-off of fuel shall be effected by first stopping the feeding of fuel into the pneumatic line, and subsequently stopping the carrier gas supply.

6.9 Hydraulic feeding devices shall be designed such that they form a seal between the furnace and the feed lines (see 6.3).

6.10 For manual fuel feeding, double sealing shall be applied. The outer sealing shall be opened/closed during operation for feeding the fuel to the furnace.

For firing systems not exceeding a thermal capacity of 50 kW and with assured negative pressure of the flue gas, single sealing may be used for manual fuel feeding.

7 Explosion prevention measures

Combustible dusts have different propensities to ignite and can form explosive mixtures with air.

The hazard of combustible dust explosion exists, if the dust is dispersed in a confined space containing air or oxygen in concentrations within the upper and lower explosion limits, and an ignition source shall be present. For primary prevention of explosions, at least one of these conditions shall be safely excluded at all times.

Individual components of a firing system require specific protective measures. For preference, explosion protective measures shall be inherent in the design of the components, e.g. the avoidance of leakages, the prevention of deposits, and the exclusion of external heating. For easy reference, an overview of important prevention measures for the different operational areas shall be in accordance with Table 1.

Table 1 — Overview of important prevention measures for different operational areas

Operational area	For explosion prevention measures see clause(s)
Fuel properties	1.2 (see EN 26184-1), 4.1.3 to 4.1.5
Pneumatic fuel supply	4.2.5 to 4.2.8
Fuel bunkers	4.3.3
Fuel bins	EN 12952-9:2002, 5.4.2, 5.4.5, 5.4.6, 6.2.2 and 4.4.3
Fuel treatment plant	5.1.2 to 5.1.4
Size reduction of fuel	EN 12952-9:2002, 5.3, 6, 8.7.2.2 and 8.7.4
Drying of fuel	5.3
Fuel feeding	6.3 to 6.7
Combustion monitoring	9.2
Purging	9.4.2
Start-up, operation, and shutting down of the combustion process	9.4.3 to 9.4.5
All operating areas	A.6

8 Equipment for combustion air supply and flue gas discharge

8.1 Air supply

8.1.1 Air ducts shall be capable of withstanding the mechanical and thermal stresses occurring during operation, e.g. gauge and vacuum pressures resulting from closed dampers, implosions and rapid temperature changes.

8.1.2 Air ducts shall be gas-tight.

8.1.3 For firing systems with both controlled underbed and overfire air supply, the air distribution shall be indicated.

8.1.4 For fluidized-bed firing systems, a limiter shall be required which responds when the value of the air pressure drops to the lowest permissible value of fluidizing gas flow.

8.1.5 The combustion air supply system shall be established such that the combustion air influx can be stopped. This shall be achieved by cutting off the fans or, in the case of branched systems, by shut-off devices in the corresponding ducts. Shut-off devices in the air ducts shall be protected against unintentional maladjustment. Open, start-up and minimum flow positions shall be capable of being recognized, checked and monitored.

8.1.6 The combustion air, or forced draught fan shall be monitored by the combustion air flow and one of the following criteria:

a) speed of the forced draught fan;

b) pressure downstream of the forced draught fan;

c) differential pressure at the forced draught fan;

d) power input of the forced draught fan motor;

e) power circuit breaker of the forced draught fan motor.

8.2 Combustion air/fuel ratio

8.2.1 Fuel flow and combustion air flow shall be controlled automatically or manually in mutual dependence.

8.2.2 Allowable values, including their ratio and corresponding safety margins, shall be given in the operating instructions (see 11.2.2 f)) by the manufacturer of the firing system.

8.2.3 The air/fuel ratio shall be monitored, e.g. by flue gas analysis.

8.2.4 Deviations from the allowable values shall be annunciated both optically and acustically.

8.2.5 Where the safety relevant limit values are reached, the firing system shall be cut off manually or automatically.

8.3 Flue gas discharge

8.3.1 Flue gas discharge shall be monitored to ensure it is not unnecessarily restricted. This shall be performed by the following measures:

a) checking the position of the damper(s) during start-up;

b) monitoring of the induced draught fan operation and combustion chamber pressure.

If the relevant combustion chamber pressure is exceeded, the firing shall be cut off and locked-out.

8.3.2 The induced draught fan shall be monitored in accordance with 8.3.1 b) and one of the following criteria:

a) speed of the induced draught fan;

b) pressure upstream of the induced draught fan;

c) differential pressure at the induced draught fan;

d) power input to the induced draught fan motor;

e) power circuit breaker of the induced draught fan motor.

9 Firing system

9.1 General

9.1.1 The firing system shall consist of a grate system, or a fluidized-bed system, both of which may include additional burner systems. The firing system shall perform with stable combustion in the operating range it is designed for.

9.1.2 Firing systems shall be designed such that it is only possible to feed the fuel if it is safely ignited, by

— an ignition device, or

— a sufficient basic fire, or

— the minimum fluidized-bed temperature.

This shall apply for all operating conditions.

9.1.3 The separate feeding of combustion residues, other matter, or fuels other than the design fuels, shall only be performed under normal operation conditions of the firing system, e.g. greater than minimum heat input, sufficient residues removal. Unrestricted mass flow shall be avoided, e.g. by rotary feeder.

9.2 Monitoring and control

9.2.1 Grate firing systems shall be equipped with a limiter for furnace pressure and a flue gas condition indicator for oxygen.

Fluidized-bed firing systems shall be equipped with limiters for fluidization in accordance with 8.1.4, for the minimum fluidized bed temperature, for the furnace pressure, and with a flue gas condition indicator for oxygen. Where the characteristics of the fuel varies considerably, e.g. waste, the firing system shall be equipped with an additional indicator for CO.

9.2.2 For grate firing systems not exceeding a thermal capacity of 50 kW, indicators may replace limiters for furnace pressure.

9.2.3 The suitability of control devices and limiters relevant to safety shall be proved, e.g. by individual testing, or application of type tested equipment in accordance with appropriate European Standards.

9.2.4 In case of loss of the control power, fuel and air supply shall be transferred into a safe condition.

9.3 Electrical equipment

9.3.1 The electrical equipment of the firing system shall be provided in accordance with prEN 50156-1.

9.3.2 To effect a shutting down of the firing system separate from the automatic control, at least one emergency switch shall be installed at a readily accessible and safe location.

9.4 Safety precautions

9.4.1 General

The following safety functions covering lighting-up, starting up, operating, and shutting down of the firing system shall be described in detail in the operating instructions in accordance with clause 11.

9.4.2 Purging of the flue gas passes

9.4.2.1 The combustion chamber and the flue gas passes shall be designed such that effective purging can be achieved. By-passes shall be designed, if a hot catalyst or flue gas reheating system might be an ignition source.

9.4.2.2 Purging may be waived if one of the following conditions is given:

a) the design and mode of operation of the firing system shall exclude any dangerous accumulation of ignitable gas mixtures in the combustion chamber or in the fluegas passes, e.g. by continuous purging via natural draught or a monitored minimum air flow. (For the waiving of purging prior to the lighting-up of burners operated with oil or gas see EN 12952-8:2002, 6.5.);

b) safe ignition of the fuel and the combustible gases shall be ensured in accordance with 9.1.3;

c) special measures shall be taken to ensure that after shut-off of the firing system no fuel can enter the combustion chamber during outage (for oil or gas fired lighting up equipment see EN 12952-8:2002, 6.5). Any dangerous accumulation of ignitable gases from solid fuels shall be excluded.

9.4.3 Lighting-up

9.4.3.1 If the lighting-up equipment is operated with oil or gas, the installation and the procedure for purging and lighting-up shall comply with EN 12952-8. If it is operated with pulverized fuel it shall comply with EN 12952-9.

9.4.3.2 During lighting-up, the firing rate shall be limited so that no inadmissible high pressure excursions occur within the combustion chamber during the start-up operation.

9.4.3.3 To permit visual observation of the lighting-up procedure in grate firing systems, at least one inspection opening shall be provided at a suitable location to enable safe observation of the fire and the fuel layer on the grate. Protection of the inspection opening(s) shall be provided against the escape of pressurised hot gases.

9.4.4 Start-up

9.4.4.1 The fuel supply to the combustion chamber shall not be released or shall be shut-off automatically during start-up whenever:

a) the control power for the safety devices is not present or fails;

b) checking the position of the flue gas damper(s) has not been carried out, or the induced draught fan required for flue gas discharge is not in operation (see 8.3.1), or the combustion chamber pressure is higher than acceptable (see 9.2.1);

c) combustion air is not being supplied (see 8.1.5);

d) the gas flow for fluidizing is less than required for fluidized-bed firing systems in accordance with 8.1.4;

e) safe ignition is not ensured in accordance with 9.1.2;

f) off switches are actuated;

g) the emergency switch is actuated (see 9.3.2);

h) any of the limiters respond (e.g. for water level, temperature, furnace pressure).

9.4.4.2 As soon as the causes for conditions a) to f) have been cleared, restarting may be effected. In the case of conditions g) to h) restarting shall only be possible by manual intervention (lock-out).

9.4.4.3 If a fuel size reduction facility in accordance with 5.2 is operated in unison with the firing system, the starting-up of the mill or crusher shall comply with EN 12952-9.

9.4.4.4 After start-up of the firing system, the lighting-up equipment shall be kept in operation until stable combustion is ensured.

For grate firing systems, this is considered to be the case if sufficient basic fire or sufficient ignition temperature is attained. For fluidized-bed firing systems, this is considered to be the case if the required minimum fluidized-bed temperature is attained.

When stable combustion is ensured the lighting-up equipment shall be shut down gradually.

Before shutting off the lighting-up equipment, the flame respectively combustion process monitoring devices in accordance with 9.2.1 shall have been activated.

9.4.4.5 To maintain stable combustion, the lighting-up equipment or a back-up firing system may be used during operation in accordance with the requirements given by the manufacturer in the operating instructions (see 11.2).

9.4.5 Shutting down

9.4.5.1 Any of the following criteria occurring during operation (see 6.3) shall initiate an interruption of the fuel supply to the combustion chamber with subsequent closing of the air supply in accordance with 8.2:

a) the control power for the safety devices fails;

b) the induced draught fan fails (see 8.3.2), or the combustion chamber pressure is too high (see 9.2.1);

c) the combustion air fails to be supplied (see 8.1.6), or the combustion chamber pressure is too low (see 8.3.2);

d) the gas flow for fluidizing is less than that required by the fluidized-bed combustion systems in accordance with 8.1.4;

e) the off switches are actuated;

f) the emergency switch is actuated;

g) any of the limiters respond (e.g. water level, temperature, furnace pressure).

9.4.5.2 If a fuel size reduction facility in accordance with 5.2 is operated in unison with the firing system, the shutting down procedures shall be combined and shall comply with EN 12952-9.

9.4.5.3 The draught shall be maintained in order to have a sufficient flue gas flow to remove the unburned gases accumulated in the furnace.

9.5 Common stack for several firing systems

Flue gas flows from several firing systems shall only be joined in common ducts or stacks if an inadmissible pressure excursion resulting from the ignition of an explosive mixture is prevented. This requirement shall be met if the temperature of the flue gas is low enough to avoid self-ignition, and if the influence of external ignition sources is prevented. Unacceptable back pressure to the combustion chamber of the connected systems shall be prevented.

10 Ash handling and extraction

10.1 The equipment of fluidized-bed firing systems for the circulation and the outward transfer of hot fluidized-bed material shall be designed to give sufficient resistance to wear and heat (see also annex A).

10.2 Ash extraction devices shall be designed such that personnel can not be endangered.

10.3 It shall be ensured that hot flue gas from a combustion chamber cannot enter ash bunkers.

10.4 Submerged scraper conveyors shall be designed so that personnel cannot be endangered by the spilling of hot water or the ejection of steam.

11 Operating manual

11.1 The manufacturer or designer of the firing system shall provide an operating manual.

11.2 The operating manual shall include at least include:

a) data on the allowable types and characteristics (compositions) of the fuel;

b) schematic arrangement drawings, piping and instrumentation (P & I) diagrams and components list of the firing system and it's ancillaries;

c) test instructions for limiters;

d) plant maintenance requirements;

e) manual lighting-up, start-up, operational, shutdown and lock-out procedures of the firing system and it’s ancillaries, including the required purging and the sequence for start-up and shutdown procedures of the firing system and its ancillaries;

f) allowable limit values in accordance with 8.2.2;

g) measures to be taken in the case of operating problems or upset conditions or danger;

h) references to special hazards which may arise during plant operation.

11.3 Where ignition of the firing system is effected manually in situ, a permanent instruction plate shall be fixed at a readily visible location to indicate the required purging and the sequence for start-up and shut down.

Annex A
(informative)

Operational requirements for permanently supervised firing systems for solid fuels for fluidized-bed and grate firing systems

A.1 General

For firing systems for solid fuels for fluidized-bed and grate firing systems with permanent supervision, the following operational requirements shall be adhered to by the operating personnel:

A.2 Operation

The training of the operating personnel shall include reference to the special conditions of the firing system and the type of fuel. This shall include the requirements given in clauses 4 to 11 with particular reference to the individual details in the operating instructions provided in the manufacturer's operating manual and any supplementary instructions established by the operator’s management as mentioned in clause 11.

A.3 Fuel Handling

The fuel handling plant area shall only be entered by authorized personnel (see 4.1.3).

During operation of the fuel handling plant only authorized personnel shall enter the access and service area (see 4.1.4).

Maintenance work shall not be carried out whilst the fuel handling plant is in operation. With the exception of adjustment activities necessary during operation and only then provided special precautions have been taken.

At the sounding of or appearance of the warning signal, the dangerous area shall be evacuated immediately.

Areas of openings for charging bunkers not protected against the falling personnel shall only be entered by persons individually secured against falling.

A.4 Emergency operation

Changeover to emergency operation shall only be possible, if a key-operated switch is used.

An emergency operation during which the function of a safety device is bridged shall be only permissible if, during the entire period of emergency operation, the inoperative safety functions are replaced by continuous expert supervision.

A.5 Ash handling

For repair work on ash handling plant which is to be performed during the operation of a firing system, it shall be ensured that the connection to the firing system is effectively sealed and can be checked as such.

Areas marked in accordance with 10.4 shall only be entered by personnel wearing appropriate protective equipment.

Personnel engaged on ash removal duties shall be warned of impending or suspected unstable operating conditions.

A.6 Operation and maintenance

A.6.1 General

A.6.1.1 All operating areas shall as far as possible be kept clear of fuel and combustible dust. Deposits of combustible dust shall be removed in a manner which avoids any stirring-up of the dust.

A.6.1.2 Leakages from the installation, e.g. at flanged joints or wear locations, shall be remedied as soon as possible after their discovery.

A.6.1.3 The operating personnel and other personnel working temporarily in the operating areas of the firing system and its ancillaries, shall be informed of any existing hazards.

A.6.1.4 Operation of the firing system and it's ancillaries shall only be performed from safe locations.

A.6.1.5 Repair work within the area of the firing system and it's ancillaries, especially welding, cutting, and brazing shall only be performed by adhering to appropriate precautionary measures.

Work shall only be commenced after written permission from the personnel responsible for the firing system and it's ancillaries.

Precautionary measures taken to perform repair work shall only be modified or cancelled by the person responsible for establishing the precautionary measures.

A.6.1.6 Before commencing any work on firing systems and their ancillaries, shutoff devices in accordance with 6.3, or in accordance with to 6.6 where applicable shall be closed and locked.

A.6.1.7 Components, conveying equipment, and piping which have to be dismantled for performing repair work, shall be discharged and cleared as far as practicable prior to the work commencing.

Welding, cutting, and brazing of removable parts shall be performed outside the endangered areas.

A.6.1.8 Before opening doors or gates, a pressure balance shall be ensured. If moving parts may endanger personnel at work the shutdown and release of work shall be in accordance with existing written safety procedures.

A.6.1.9 When in the case of inspection, debugging, or repair work, handling of additives, fluidized-bed material, or hot combustion residues is necessary, special safety precautions shall be taken. Care shall be taken to protect personnel working in the endangered area, e.g. by use of personal protective clothing, respirators.

A.6.2 Operating instructions

The functional capability of the control, safety, and monitoring devices shall be checked at adequate time intervals. Defects on equipment having safety functions shall be remedied before operating the system further.

Annex ZA
(informative)

Clauses of this European Standard addressing essential requirements or other provisions of EU Directives

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 the Pressure Equipment Directive 97/23/EC.

WARNING: Other requirements and other EU Directives may be applicable to the product(s) falling within the scope of this standard.

Compliance with the clauses of this standard given in Table ZA.1 provide one means of conforming to the specific essential requirements of the Directive concerned and associated EFTA regulations.

Table ZA.1 — Comparison between EN 12952-16 and Pressure Equipment Directive 97/23/EC

EN 12952-16 harmonized clauses	Content	Pressure Equipment Directive 97/23/EC Annex I
4 to 10	Provisions against exceeding the allowable limits	2.10
11	Operating inspections	3.4
4 to 10	Fired pressure equipment Minimizing risk from overheating	5 — 2nd para

Bibliography

[1] EN 298, *Automatic gas burner control systems for gas burners and gas burning appliances with or without fans.*

[2] prEN 1268-1, *Safety devices for protection against excessive pressure - Part 1: Safety valves.*

[3] EN 26184-1, *Explosion protection systems — Part 1: Determination of explosion indices of combustible dusts in air (ISO 6184-1:1985).*

[4] Directive 97/23/EC of the European Parliament and of the Council of 29 May 1997 on the approximation of the laws of the Members States concerning pressure equipment, OJEC, L181.

[5] prEN 61024-1, *Protection of structures against fire, explosion and life hazards*.

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