BRITISH STANDARD

BS EN
12953-12:2003

Shell boilers —

Part 12: Requirements for grate firing systems for solid fuels for the boiler

The European Standard EN 12953-12:2003 has the status of a British Standard

ICS 27.060.30; 27.100

BSI
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National foreword

This British Standard is the official English language version of EN 12953-12:2003.

When reference to this part of the European Standard has been published in the Official Journal of the European Communities (OJ), compliance with it will confer a presumption of conformity with the essential safety requirements of the Pressure Equipment Directive covered by this part of the standard.

The UK participation in its preparation was entrusted to Technical Committee PVE/16, Shell 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.

A list of organizations represented on this committee can be obtained on request to its secretary.

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Chaudières à tubes de fumée - Partie 12: Exigences pour les équipements de chauffe à grille pour combustibles solides de la chaudière

Großwasserraumkessel - Teil 12: Anforderungen an Rostfeuerungsanlagen 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 12953-12:2003 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of an identical text or by endorsement, at the latest by March 2004, and conflicting national standards shall be withdrawn at the latest by March 2004.

This document 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) (Pressure Equipment Directive 97/23/EC) [1].

For relationship with EU Directive(s), see informative annex ZA, which is an integral part of this document.

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 boilers*
- *Part 8: Requirements for safeguards against excessive pressure*
- *Part 9: Requirements for limiting devices of the boiler and accessories*
- *Part 10: Requirements for feedwater and boiler water quality*
- *Part 11: Acceptance tests*
- *Part 12: Requirements for grate firing systems for solid fuels for the boiler*
- *Part 13: Operating instructions*

CR 12953 Part 14: *Guideline for the involvement of an inspection body independent of the manufacturer (TR)*

Although these Parts may be obtained separately, it should be recognized that the Parts are interdependent. As such, the design and manufacture of shell boilers requires the application of more than one Part in order for the requirements of the European Standard to be satisfactorily fulfilled.

The annex A of this European Standard is informative.

This document includes a Bibliography.

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, Hungary, Iceland, Ireland, Italy, Luxembourg, Malta, Netherlands, Norway, Portugal, Slovakia, Spain, Sweden, Switzerland and the United Kingdom.

1 Scope

1.1 Firing systems

This part of this European Standard specifies the requirements for internal or external grate firing systems commencing at the fuel bunkers and ending at the ash extraction plant. For combination of various firing systems, the individual requirements of each system also apply.

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

1.2 Fuels

The 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. petrol coke peat, oil shale);

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

— 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 of these groups (see 4.1.7), or fuels of unconventional or unknown quality can 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 should be documented by the manufacturer.

Fuels on which the design is based should be *specified* in the operating instructions (see 11.2). This should 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 Operational equipment

The requirements for operational equipment in clauses 4 to 10 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.

Annex A contains the operational requirements for permanent supervision.

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 fuels for the boiler.*

EN 12953-7, *Shell boilers — Part 7: Requirements for firing systems for liquid and gaseous fuels for the boiler.*

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

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
back-up firing system
separate firing system to maintain safe ignition and stable combustion. The lighting-up equipment can be used for this purpose

3.2
basic fire
layer of glowing fuel, fire bed or flame of the fed fuel. The basic fire can also perform the duty of the lighting-up equipment, or the back-up firing system (mostly air)

3.3
carrier gas
transport medium for pneumatic conveying

3.4
combustion air
total air supplied to the firing system for combustion

3.5
firing systems
can be distinguished in accordance with the type and structure of the fuel, the feeding procedure and the process of combustion. Fuel and air can be introduced in the combustion chamber in different ways to establish and maintain proper ignition and stable combustion. Combustion of the fuel is performed on grates

3.6
fuel bin
silo

dust-tight container for temporary storage of combustible solids in the boiler room

3.7
fuel bunker
open storage of solid fuel

3.8
fuel feeding system
device to transport fuel into the combustion chamber

NOTE This can be effected directly by feeders through ports in the furnace walls, by means of chutes or through the bottom grate

3.9
fuel handling plant
installation for conveying, mixing and distributing solid fuels to the individual fuel bunkers or fuel bins

3.10
grate firing system
fuel is burnt in a layer supported by a system of firebars which may have a cooling system

NOTE The firebars should be so spaced as to admit the undergrate combustion air supply in proper distribution. Other means of admitting and distributing the combustion air supply can be provided.

3.11
indicator
measuring instrument which indicates a variable value (e.g. pressure, temperature, flow, level). It can be equipped with an annunciator

3.12
lighting-up equipment
facility to achieve safe ignition of the feed fuel

3.13
limiter
transducer, which, on reaching a fixed limit value (e.g. pressure, temperature, flow, level) is used to interrupt and lockout the energy supply and It requires manual unlocking before restart

3.14
lockout
interruption of the energy supply. Manual unlocking is required before restart

3.15
master fuel trip
device located at a safe place for rapid automatic shutoff of all fuel supplies to the grate and electrical igniters in the event of danger

3.16
maximum continuous rating (MCR)
allowable heat output

steam boiler or hot water heat output that can be generated during continuous operation and at which the steam or hot water generator may be operated, taking the specified steam condition or hot water condition (water mass flow times the difference between outlet and inlet enthalpy) into consideration

3.17
monitor
transducer that senses the reaching of a fixed limit value and initiates an alarm and/or a shut-down. The output signal only reverses if the causing value has changed at a defined range

3.18
purging of the flue gas passes
flow of air through combustion chamber, flue gas passes, and associated ducts including flue-gas treatment systems, which effectively removes any gaseous combustibles and replace them with air

3.19
start-up condition
the plant can be started

- **cold** (temperature of ceramic lining is at ambient value);
- **hot** (temperature of ceramic lining is above the minimum ignition temperature of the basic fuel); or
- **warm** (temperature of ceramic lining in between the ambient and minimum ignition temperature)

4 Fuel bunkers 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 the fuel shall be arranged such that sufficient flow of the fuel and additives is ensured.

4.1.3 The fuel storage capacity shall be determined in accordance with the fuels used.

NOTE It is recommended that the storage of fuel within the boiler room itself is minimized.

4.1.4 Measures to prevent fire, explosion and injuries to personnel shall be provided for volatile fuels and those capable of pyrolysis in the absence of external heating. As an example 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.

4.1.5 Sludge storage in bins shall be preferred to storage in bunkers (see 4.4.1).

4.1.6 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).

4.1.7 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.

4.1.8 If there is a risk of blockage of conveying systems or firing systems by coarse lumps of fuel, foreign matter and tramp metal, then means for the removal of those objects shall be provided, preferably before entering the bunker.

4.1.9 Dangerous areas accessible to personnel shall be marked with warning signs.

4.1.10 Outdoor storage facilities and fuel bearing components as well as buildings for indoor installation shall be equipped with a lightning protective system in accordance with relevant European Standards.

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 normal operation and the storage facility is ready to accept the fuel.

4.2.2 Precautions shall be taken for the protection of personnel against injury from moving components. Sufficient time shall be provided between the 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 4.1.5 or 4.1.6, subsequent conveyance shall be performed in a closed system, which shall be gas-tight if operated under internal pressure.

4.2.4 Piping used for conveyance shall be designed with a high resistance to wear.

4.2.5 For 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.

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

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

4.3 Fuel bunkers

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

4.3.2 To avoid ingress of hot air/gas into the bunker, a minimum level of fuel shall be maintained and monitored in the bunker, or other suitable measures shall be taken, see also 6.1 and 6.4.

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

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

4.3.5 Fuel bunkers shall be equipped with fire fighting or fire preventing equipment. Fire fighting by sprinkler systems is allowed but the use of concentrated water jets is prohibited. 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 specified in 5.4 and 6.2.2 of EN 12952-9:2002 apply accordingly.

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

4.4.3 If combustible gas emanation from the fuel cannot be prevented, silos shall be equipped with suitable gas monitoring and safe venting devices, otherwise an explosion-proof silo or inert gas protection shall be provided.

4.4.4 Fuels as specified in 4.1.4 require bins to be equipped with a stationary nonfreezing fire extinguishing system to enable fire to be fought without opening access doors. The extinguishing compound shall be evenly sprayed and well distributed 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.

5 Fuel treatment

5.1 General

5.1.1 The equipment shall be designed so as 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 minimize sites in the plant where combustible dust or fuel may become lodged.

5.1.3 Facilities shall be provided for purging and clearing components which are hot during operation. 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 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

5.2.1 If size reduction of the fuel is performed by crushers in the boiler house with the application of hot gas as the carrier gas for combined grinding and drying process, the necessary explosion prevention measures shall be given.

5.2.2 For eventual intermediate storage after size reduction, 4.4 applies.

5.3 Drying of the fuel

When drying fuel prior to combustion, the maximum permissible temperature in accordance with 4.4.2 shall be monitored. The vapours shall be discharged in order to prevent the risk of explosion. For the combined crushing and drying process, 5.2.1 shall apply.

6 Fuel feeding

6.1 Shutoff device shall be installed within the fuel feeding system. This shutoff device shall be closed automatically if the minimum height of the fuel column is lost when mechanical feeding.

Shut off devices need not to be installed if it can be ensured that negative pressure is maintained in the fuel feeding system or a minimum column of fuel (4.3.2) is maintained in the fuel bunker.

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

6.3 The feeding of fuel shall be cut off in the event of loss of control power (see 9.2.2), 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).

6.4 Fuel feeding systems shall be provided with appropriate sealing which prevents the back flow of hot gases from the boiler, flash-back by flame, or flying sparks or backfire. Egress of hot gases into the boiler house shall be prevented.

6.5 Depending on the type of fuel, fire fighting equipment shall be installed. This equipment shall be activated, when set temperature 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.

7 Explosion prevention measures

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

A 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 if an ignition source exists. For primary prevention of explosions, at least one of these conditions shall be safely excluded at all time.

Individual components of a firing system require specific protective measures. By 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 is given below in Table 7-1:

Table 7-1 — 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), 4.1.4 to 4.1.7
Fuel bunkers	4.3.3
Fuel bins	5.4.2, 5.4.5, 5.4.6, 6.2.2 of EN 12952-9:2002, and 4.4.3
Fuel treatment plant	5.1.2 to 5.1.4
Size reduction of fuel	5.3, 6, 8.7.2.2 and 8.7.4 of EN 12952-9:2002
Drying of fuel	5.3
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 underbed and overfire air supply which are regulated by manually or automatically controlled dampers, the air distribution shall be monitored.

8.1.4 A shut-off device shall be installed within the combustion air supply line. Shut-off devices in the air ducts shall be protected against unintentional maladjustment.

8.1.5 Unrestricted air intake shall be ensured.

8.1.6 The fan shall be monitored by the air flow and one of the following criteria:

a) speed of rotation of the forced draught fan;

b) pressure downstream of the forced draught fan

c) air flow indicator

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

8.2 Combustion air/fuel ratio

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

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

8.2.3 An air/fuel ratio lower than that allowable shall be annunciated.

8.2.4 In the case of an air/fuel ratio lower than required for safety reasons, 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:

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

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

c) monitoring of the flue gas discharge temperature;

d) limiter for the flue gas discharge temperature when exceeding 300 °C.

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) power circuit breaker of the induced draught fan motor.

9 Firing system

9.1 General

9.1.1 The firing system shall be suitable for the respective steam boiler or hot water generator. It may consist of a grate system which may include a burner system. The firing system shall perform with stable combustion in the operating range it is designed for.

9.1.2 Maximum continuous rating of a solid fuel water-cooled furnace integrated to a shell boiler shall be based on the mass of the supplied fuel, with the moisture content of the fuel within limits specified by the manufacturer.

9.1.3 The firing system shall be equipped with monitoring equipment, if necessary. The lighting-up procedure shall be described in the operating instructions in accordance with 11.2.

9.1.4 Firing systems shall be designed such that it is only possible to feed the main fuel if it is safely ignited, e.g. by

— an ignition device, or

— a sufficient basic fire.

This shall apply for all operating conditions.

9.1.5 The requirements for purging, lighting-up and start-up shall be in accordance with 9.4.2, 9.4.3 and 9.4.4 and depend on the plant type (grate system) and plant status (cold, warm, or hot start-up).

In pressurized firing systems, protection of the inspection opening(s) shall be provided against the escape of pressurised hot gases.

9.1.6 The controlled injection of combustion residues or other matter into the firing system shall only be permitted when the firing system has been specifically designed to permit this and when the system is operating under normal conditions.

9.2 Control and monitoring

9.2.1 When the O_2 content falls to an unacceptable level (resulting in high CO content) an alarm shall be activated.

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 standards, e.g. EN 298 [2].

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 master fuel trip 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 11.2.

9.4.2 Purging of the flue gas passes

9.4.2.1 The combustion chamber, the flue gas passes and the flue gas treatment system shall be designed such that effective purging can be achieved.

9.4.2.2 When purging during shut-down or lockout initiated by a monitor or a limiter, the combustion fans shall be stopped, the recirculation flue-gas system shall be secured against over temperature and the flue-gas fan shall be reduced to provide a minimum under pressure in the furnace to avoid explosive gases.

9.4.2.3 Prior to any start-up, the flue gas passes shall be effectively purged. Information to ensure that purging is conducted safely (e.g. in using ID fan only) shall be included in the operating instructions, see 11.2.

Purging is permissible only if there is no danger of ignition sources being present in the volume to be purged.

To avoid ignition sources in an electrostatic precipitator, the precipitator voltage shall be brought down to half the normal value during the purging operation.

Where a hot catalyst or flue gas reheating system might be an ignition source, they shall be by-passed.

Fuel shall not be supplied to the combustion chamber during purging.

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

a) The design and mode of operation of the firing system excludes any dangerous accumulation of ignitable gas mixtures in the combustion chamber (For the waiving of purging prior to the lighting-up of burners operated with oil or gas see 6.3 of EN 12953-7:2002.);

b) Safe ignition of the fuel and the combustible gases is ensured in accordance with 9.1.3;

c) Special measures are taken to ensure that after shut-off of the firing system no fuel can enter the combustion chamber during outage.

d) Start up after shut down from a monitor reaching a fixed value when monitor out put signals have been reversed and changed at a defined range

9.4.3 Lighting-up

9.4.3.1 If lighting-up equipment is installed, it shall be designed to operate safely.

9.4.3.2 If the lighting-up equipment is operated with oil or gas, it shall comply with EN 12953-7.

9.4.3.3 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.

9.4.3.4 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 filling level, e.g. in the case of firing systems with a chute.

9.4.4 Start-up

9.4.4.1 The main fuel supply to the combustion chamber shall not be released or shall be shut-off automatically during start-up when any of the following criteria occur:

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 (8.3.2), or the combustion chamber pressure is higher than acceptable (9.2.1);

c) combustion air is not being supplied (8.1.6);

d) safe ignition is not ensured in accordance with 9.1.4;

e) sufficient purging has not been carried out;

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) of 9.4.4.1 have been cleared, restarting may be effected. In the case of conditions g) to h) of 9.4.4.1 restarting shall only be possible by manual intervention.

9.4.4.3 After start-up of the firing system, the lighting-up equipment shall be kept in operation until stable combustion is ensured. This shall be considered to be ensured if a stable basic fire or the ignition temperature is attained.

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

9.4.4.4 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 11.2.2).

9.4.5 Shutting down

9.4.5.1 Any of the following criteria occurring during operation (see clause 6) shall initiate an interruption of the air and 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 above this high limit (9.2.1);

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

d) the off switches are actuated;

e) the emergency switch is actuated;

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

9.4.5.2 When the boiler firing system is shut down all fuel reduction systems in accordance with 5.2 which feed the boiler shall also be shut down.

9.4.5.3 When shutting down the firing system by normal operational procedures or by a shutting down in accordance with 9.4.5.1, the water volume stored in the steam boiler or hot water generator shall not be evaporated to an inadmissible extent. Excessive heat shall be discharged without overheating the steam boiler or hot water generator system.

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 furnace of the connected systems shall be prevented e.g. by isolating dampers.

10 Ash handling and extraction

10.1 Ash extraction devices shall be designed to avoid hazards to personnel.

10.2 The ingress of hot flue gas from a combustion chamber into ash bunkers shall be avoided.

10.3 Submerged scraper conveyors shall be retractable, or the hopper of the combustion chamber shall be provided with shutoff devices.

11 Operation and maintenance

11.1 General

For guidance on operation and maintenance in the areas of fuel handling, ash handling and the emergency operation of the firing system, see annex A.

11.2 Operating instructions

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

The operating manual, and any supplementing operating instructions issued by the operator's management, shall be made available in the control room.

11.2.2 These documents shall at least include:

a) data on the allowable types and structures of the fuel;

b) arrangement drawings, P-I diagram and component lists of the firing system and it's ancillaries;

c) test instructions for limiters;

d) plant maintenance requirements;

e) instructions for lighting-up, start-up, operational, shutdown and lockout procedures of the firing system and it's ancillaries including the required purging and the sequence for start-up and shut down

f) allowable limits of combustion air/fuel ratio (see 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.

11.2.3 For operational safety requirements and for maintenance instructions, see annex A.

11.2.4 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 on grate firing systems

A.1 General

For firing systems for solid fuels on 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 11.2.

A.3 Fuel handling

a) The fuel handling plant area shall only be entered by authorized personnel.

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

c) 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.

A.4 Emergency operation

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

a) 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

b) Areas marked in accordance with 11.2.4 shall only be entered by personnel wearing appropriate protective equipment.

c) 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 clause 6 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 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 etc.

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)

Relationship between this European Standard and the Essential Requirements of EU Directive 97/23/EC

This European standard has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association (EFTA) to provide a means of conforming to Essential Requirements of the New Approach Directive 97/23/EC (Pressure Equipment Directive, PED).

Once this standard is cited in the Official Journal of the European Communities under that Directive and has been implemented as a national standard in at least one Member State, compliance with the clauses of this standard given in table ZA confers, within the limits of the scope of this standard, a presumption of conformity with the corresponding Essential Requirements of that Directive and associated EFTA regulations.

Table ZA — Correspondence between this European Standard and Directive 97/23/EC

Clause(s)/subclause(s) of this EN	Essential requirements (ERs) of Directive 97/23/EC	Qualifying remarks/Notes
6.2, 6.3	Fired pressure equipment — Minimizing risk from overheating	5 - 2nd para 5.1
8, 9, 6.4	Protection to restrict operating parameters	5 e, 5 d
11	operating	3.4

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

Bibliography

[1] Directive 97/23/EC of the European Parliament and of the Council of 29 May 1997 on the approximation of the laws of the Member States concerning pressure equipment; OJEC, L 181

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

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