
Guide for procurement of power station equipment - Part 3-1: Boilers - Water tube boilers

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Leitfaden für die Beschaffung von Ausrüstungen für Kraftwerke -- Teil 3-1: Kessel - Wasserrohrkessel

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Guide pour l'acquisition d'équipements destinés aux centrales de production d'électricité -- Partie 3-1: Chaudières - Chaudières à tubes d'eau

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Chaudières - Chaudières à tubes d'eau

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Kraftwerke - Teil 3-1: Kessel - Wasserrohrkessel

This European Standard was approved by CEN/CENELEC on 1 October 1999.

CEN/CENELEC members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration. Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the Central Secretariat or to any CEN/CENELEC member.

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/CENELEC member into its own language and notified to the Central Secretariat has the same status as the official versions.

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Foreword

This European Standard has been prepared by Technical Committee CEN/CLC JTPFE "Joint Task Force Power Engineering", the secretariat of which is held by BSI.

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of an identical text or by endorsement, at the latest by April 2000, and conflicting national standards shall be withdrawn at the latest by April 2000.

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, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and the United Kingdom.

This standard takes the form of a recommendation and is therefore entitled a "Guide".

This Guide for procurement has been prepared under mandates given to CEN and CENELEC by the European Commission and the European Free Trade Association.

This Guide for procurement is a part of a series of Guides mandated to cover the procurement of power station plant and equipment in conformity with European Procurement Directives. The Guides are:

EN 45510 Guide for procurement of power station equipment

Part 1: Common Clauses

Part 2-1: Electrical equipment - Power transformers

Part 2-2: Electrical equipment - Uninterruptable power supplies

Part 2-3: Electrical equipment - Stationary batteries and chargers

Part 2-4: Electrical equipment - High power static converters

Part 2-5: Electrical equipment - Motors

Part 2-6: Electrical equipment - Generators

Part 2-7: Electrical equipment - Switchgears and controlgear

Part 2-8: Electrical equipment - Power cables

Part 2-9: Electrical equipment - Cabling systems

Part 3-1: Boilers - Water tube boilers

Part 3-2: Boilers - Shell boilers

Part 3-3: Boilers - Boilers with fluidized bed firing

Part 4-1: Boiler auxiliaries - Equipment for reduction of dust emissions

Part 4-2: Boiler auxiliaries - Gas-air, steam-air and gas-gas heaters

Part 4-3: Boiler auxiliaries - Draught plant

Part 4-4: Boiler auxiliaries - Fuel preparation equipment

Part 4-5: Boiler auxiliaries - Coal handling and bulk storage plant

Part 4-6: Boiler auxiliaries - Flue gas desulphurisation (De-SO₂) plant

Part 4-7: Boiler auxiliaries - Ash handling plant

Part 4-8: Boiler auxiliaries - Dust handling plant

Part 4-9: Boiler auxiliaries - Sootblowers

Part 4-10: Boiler auxiliaries - Flue gas denitrification (De-NO_x) plant

Part 5-1: Turbines - Steam turbines

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Part 5-2: Turbines - Gas turbines

Part 5-3: Turbines - Wind turbines

Part 5-4: Turbines - Hydraulic turbines, storage pumps and pump-turbines

Part 6-1: Turbine auxiliaries - Deaerators

Part 6-2: Turbine auxiliaries - Feedwater heaters

Part 6-3: Turbine auxiliaries - Condenser plant

Part 6-4: Turbine auxiliaries - Pumps

Part 6-5: Turbine auxiliaries - Dry cooling systems

Part 6-6: Turbine auxiliaries - Wet and wet/dry cooling towers

Part 6-7: Turbine auxiliaries - Moisture separator reheaters

Part 6-8: Turbine auxiliaries - Cranes

Part 6-9: Turbine auxiliaries - Cooling water systems

Part 7-1: Pipework and valves - High pressure piping systems

Part 7-2: Pipework and valves - Boiler and high pressure piping valves

Part 8-1: Control and instrumentation

*EN 45510 Part 1 contains those clauses common to all the above Guides giving the provisions of a non **equipment** specific nature for use in the procurement of power station plants. EN 45510 is the responsibility of JTFPE. The so called "common clauses", as appropriate, also appear in italics in the documents specific to particular **equipment**.*

Where minor changes have been made to sentences in the "common clauses" these are marked by a vertical line in the left margin.

In this Guide, words in bold type indicate that they have the meaning given in the definitions, clause 3.

In this Guide, words and sentences not in italics are specific to this Guide and refer to the particular **equipment** covered.

1 Scope

This standard gives guidance on writing the technical **specification** for the procurement of water tube **boilers** for use in electricity generating stations (power stations). This Guide for Procurement is not applicable to **equipment** for use in the nuclear reactor plant area of nuclear power stations. Other possible applications of such **equipment** have not been considered in the preparation of this Guide.

This Guide covers water tube boilers:

- using solid, liquid or gaseous fuels and for heat recovery
- with pulverised fuel, stoker or cyclone firing, gas or oil firing
- with once through or recirculation (natural or assisted) evaporators
- with balanced-draught or pressurised draught plant systems
- with specific direction of gas flow over the heating surface e. g. vertically upward, horizontal or a combination.

The **equipment** covered by this Guide is defined by its function rather than design type. Therefore, the guidance to the **specification** is stated in **performance** terms rather than being specified by a detailed description of the **equipment** to be supplied.

This Guide indicates to potential **purchasers** how their **specification** should be prepared so that :

- the **equipment** type and capacity interfaces correctly with other elements of the systems
- predicted **performance** is achieved
- ancillary **equipment** is properly sized
- **reliability, availability** and safety requirements are achieved
- proper consideration is given to the evaluation process and the quality measures to be applied.

This Guide does not determine the type of **specification** (e.g. detailed, performance, functional) or the extent of supply for any given contract which is normally decided on the basis of the **purchaser's** project strategy. It does not cover :

- any commercial, contractual or legal issues which are normally in separate parts of the **enquiry**
- any allocation of responsibilities which are determined by the contract.

This Guide does not prescribe the arrangement of the documents in the **enquiry**

NOTE: As a comprehensive European environmental policy is still under preparation, this Guide does not address the environmental implications of the **equipment**.

2 Normative references

This Guide for Procurement incorporates by dated or undated reference, provisions from other publications.

These normative references are cited in 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 Guide only when incorporated in it by amendment or revision. For undated references, the latest edition of the publication referred to applies.

EN ISO 9001	Quality systems - Model for quality assurance in design, development, production, installation and servicing (ISO 9001:1994)
EN ISO 9002	Quality systems - Model for quality assurance in production, installation and servicing (ISO 9002:1994)
IEC 60050-191	International electrotechnical vocabulary – Chapter 191 : Dependability and quality of service

3 Definitions

For the purposes of this Guide, the following definitions apply.

3.1 Organisational terms

3.1.1 purchaser : Recipient of a product and/or a service provided by a **supplier**.

3.1.2 supplier : Person or organisation that provides a product and/or a service to the **purchaser**.

3.1.3 specification : Document stating technical requirements of the **purchaser**. It may form part of an **enquiry** issued by a **purchaser**.

3.1.4 enquiry : Invitation to **tender** issued by a **purchaser**. It will normally include a **specification** together with the necessary contractual and commercial conditions.

3.1.5 tender : Offer made by a **tenderer** in response to an **enquiry**.

3.1.6 tenderer : Person or organisation submitting a **tender** for the **equipment** in response to the **enquiry**.

3.1.7 site : Place to which the **equipment** is to be delivered or where work is to be done by the **supplier**, together with so much of the area surrounding as the **supplier** may, with the consent of the **purchaser**, use for the purposes of the contract.

NOTE : Further definitions of useful organisational terms may be found in EN ISO 8402 (see Bibliography)

3.2 Technical terms

3.2.1 boiler : Steam generator with all connected components and systems forming a functional unit. The evaporator of the steam generator may be once through or recirculation (natural or assisted) and single or multiple stages of reheat may be included.

3.2.2 terminal conditions : Conditions imposed on the plant at the terminal points of the **boiler**. These may typically comprise:

- **feedwater conditions**
- spray water conditions
- **main steam conditions**
- **cold and hot reheat conditions**
- combustion air conditions
- flue gas conditions
- fuel conditions

3.2.3 specified or rated terminal conditions : Conditions, particularly steam/water conditions at the terminal points of the **boiler** to be achieved at **MCR** and other specified operating points.

3.2.4 design conditions : Values of conditions used in design calculations such as the design pressure and temperature for a pressure vessel.

3.2.5 steam conditions : Conditions which define the thermodynamic and chemical state of steam, normally pressure and temperature or dryness fraction.

3.2.6 main steam conditions : **Steam conditions** measured at inlet to boiler stop valve or at an agreed point.

3.2.7 hot reheat steam conditions : **Steam conditions** measured at outlet from hot reheat header or at an agreed point.

3.2.8 cold reheat steam conditions : **Steam conditions** measured at inlet to cold reheat header or at an agreed point

3.2.9 feedwater conditions : Feedwater conditions measured after feedwater non return valve or at an agreed point.

- 3.2.10 steam tables** : Tables or algebraic formulations of the values of the thermodynamic properties of steam and water
- 3.2.11 maximum continuous rating (MCR)** : Output at which the **boiler** may be operated for an unlimited time not exceeding the **design life** at the specified conditions.
- 3.2.12 maximum capability** : The maximum output that **boiler** can produce with special operation conditions e. g. with final feedwater heater isolated or with increased steam pressure.
- 3.2.13 boiler efficiency** : Ratio of useful heat output (e. g. in steam or hot water) to net heat input.
- 3.2.14 base load operation** : Operation of the **boiler** at **maximum continuous rating (MCR)** or a high fraction of this throughout a given period.
- 3.2.15 two shift operation** : Operation of the **boiler** at **MCR** or a high fraction of this for about 16 hours continuously out of 24 hours, the **boiler** being shut down for the remaining time.
- 3.2.16 one shift operation** : Operation of the **boiler** at **MCR** or a high fraction of this for about 8 hours continuously out of 24 hours, the **boiler** being shut down for the remaining time.
- 3.2.17 load cycling** : Transient operation of the **boiler** alternating between high and low levels of load, depending on a specified load programme.
- 3.2.18 peak load operation** : Operation of a **boiler** at **MCR** or a high fraction of this for short periods, typically 1 to 3 hours, at times of peak demand from a grid.
- 3.2.19 constant pressure operation** : Operation in which **boiler** outlet steam pressure is maintained constant over the load range.
- 3.2.20 sliding pressure operation** : Operation in which **boiler** outlet steam pressure is reduced as load is reduced.
- 3.2.21 automatic operation** : Operation under the influence of automatic systems. This also may include start-up and shut-down operation.
- 3.2.22 running hours** : Number of hours during which the **boiler** has been in operation (fired).
- 3.3 General terms**
- 3.3.1 equipment**: *Plant, component, system and/or associated auxiliaries and/or services to be provided in response to the enquiry.*
- 3.3.2 conformity** : *Fulfilment of specified requirements.*
- 3.3.3 performance** : *Obligations verified by specified tests.*
- 3.3.4 operating period** : *Time between planned outages or maintenance periods, during which the equipment is in operation and/or does not restrict operational requirements of the power station.*
- 3.3.5 life expectancy** : *Time period over which the equipment might be expected to operate with planned maintenance but without replacement of a significant component, for example, a steam header is a significant component.*
- 3.3.6 design life** : *Operating hours of the equipment on which design calculations are based.*
- 3.3.7 acceptability** : *Compliance with criteria defined by the purchaser for assessing the suitability of equipment.*
- 3.3.8 equipment margins** : *Allowance for design, fabrication or operating contingency defined in the specification. These are separate to those normally included by the supplier for his own purposes.*
- 3.3.9 proven equipment** : *Equipment which may be demonstrated to be similar to that offered and has operated for a sufficient time to have demonstrated performance and availability.*
- 3.3.10 availability** : *As defined in IEC 60050-191*
- 3.3.11 reliability** : *As defined in IEC 60050-191*
- 3.3.12 maintainability** : *As defined in IEC 60050-191*

4 Brief overall project description

4.1 Role and organisation of purchaser

The **enquiry** should define the **purchaser's** role in the project, including whether the **purchaser** will assume responsibility for the planning and technical coordination of the project, or whether other organisations will be appointed to carry out all or part of this function. The **enquiry** should define all organisational interfaces and the procedures to be employed for managing the contract and the **site**.

4.2 Site Location

The **specification** should describe the geographical location of the **site** which may include surveying points, the previous use of the **site** and any local features such as impact of industrial or military activities and planning restrictions.

Where applicable, the **specification** should indicate **site** datum on **specification** drawings and specify **site** and drawing orientation and define co-ordinate axes (x, y, z) and numbering order to ensure consistency between **suppliers** of connected **equipment**.

Where appropriate, the **specification** should define the permitted ground loading, dimensional and time restrictions on access routes up to but not including public roads or railways.

The **specification** should identify, where appropriate, the environment of the **site** in which the **equipment** will operate. The following factors may normally be included if appropriate :

- climatic : e.g. atmospheric pressure, annual variation of air and cooling water temperature, relative humidity, rain fall, icing, snow, wind velocity (normal and maximum) lightning
- geological : e.g. seismic conditions and characteristics of subsoil (e.g. caverns, gliding stratifications, load bearing capability of subsoils)
- geographic : e.g. - elevation, influence of local topography and structures
- hydrological : e.g. flooding and tides.

4.3 Equipment task

The **specification** should describe in general terms the function, task or role of the **equipment** to be purchased. e.g. whether it is part of a new power generation plant, a modification to an existing power generation plant, or replacement equipment.

Where appropriate, the **specification** should define the function and any known limitations, if any, in the **equipment** connected to that which is being supplied so that the **equipment** may avoid imposing adverse conditions or the **supplier** may suggest modifications to connected equipment which would ensure satisfactory operation.

4.4 Equipment to be purchased

The **specification** may define the **equipment** type or arrangement to be purchased.

For example:

- once through or drum type **boiler**
- type of firing - pulverised fuel, stoker, etc.
- single or multiple main auxiliaries
- arrangement of main steam outlets and reheat steam inlets and outlets.

The **specification** should define whether a complete **boiler** is to be supplied comprising, for example all the **equipment** from fuel supply point to discharge of flue gas to the chimney, from feed water supply to high pressure steam outlet and from reheated steam inlet to outlet or whether some equipment is to be purchased under separate contracts, for example, equipment for control of dust emissions, DeSO_x plant etc.

Before deciding to purchase equipment and services under contracts separate from the **boiler** contract, the **purchaser** should be satisfied that the performance of the equipment not provided within the **boiler** contract can

be unambiguously demonstrated and that the **supplier** can provide all the data necessary for the design of the separately purchased equipment and services. Where there is likely to be significant interaction between equipment, for example between burners and furnace, it may be preferable to purchase the equipment within the **boiler** contract.

*The **specification** may also define preferences for **equipment** types (or give information) regarding compatibility with existing equipment, if required.*

*The **specification** should define the intended methods or local practice for maintenance, inspection and operation.*

*The **specification** should define requirements with regard to the general appearance of the **equipment** (e.g. dimensions, shape or colour) to meet local planning requirements or specific criteria, where such requirements exist.*

NOTE : Attention is drawn to European, national and/or local legislation which may place restrictions in this area.

4.5 Control and instrumentation systems

*The **specification** should define the general requirements for the control and instrumentation systems, the level of operator intervention allowed or required, integration with other control systems, localised control loops, commonality and redundancy.*

NOTE : Guidance on the procurement of control and instrumentation systems for power stations, including advice on interfaces can be found in EN 45510-8-1.

4.6 Electrical supplies and other services

*The **specification** should define the electrical supplies available for the operation of the **equipment**, their voltages and frequencies, with their range of variation, phases available and, where appropriate, the acceptable values of maximum load (kW) and short circuit level at each voltage level and the harmonic content. Requirements for terminals and terminal boxes should be stated; these should be to a recognised European or international standard.*

*The **specification** should define the type and capacity of other services for the operation of the **equipment** such as compressed air, cooling air, cooling water, auxiliary steam, etc., available to the **supplier** (normally not available during the installation period).*

4.7 Other interfaces

*The **specification** should define the interfaces with existing ancillary or new ancillary equipment to be supplied under separate contracts which interact directly with the **equipment**, for example, steel structures, piping systems.*

The **specification** should state, if applicable, whether the **supplier** is to provide data or information to enable the **purchaser** to purchase equipment or services under separate contracts.

4.8 Project programme

*The **specification** should describe the overall programme and timescale in which the project is to be carried out. This may include the principal dates associated with tendering, placement of orders, access to **site**, start and completion of installation, commissioning, take-over and final acceptance.*

4.9 Equipment identification systems

*The **specification** may specify the equipment identification system for use during the operating life of the plant. If applicable to the project, a recognised European or international system should be used.*

The **specification** may also define the extent to which the identification system will be applied on labels, in documentation, on operator displays and within computer software and data bases.