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Guide for procurement of power station equipment – Part 4: Boiler auxiliaries – Section 1: Equipment for reduction of dust emissions

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Swedish Standards corresponding to documents referred to in this Standard are listed in "Catalogue of Swedish Standards", issued by SIS. The Catalogue lists, with reference number and year of Swedish approval, International and European Standards approved as Swedish Standards as well as other Swedish Standards.

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**Guide for procurement of power station equipment - Part 4:
Boiler auxiliaries - Section 1: Equipment for reduction of dust
emissions**

Guide pour l'acquisition d'équipements destinés aux centrales de production d'électricité - Partie 4: Auxiliaires de chaudière - Equipement de réduction des émissions de poussières

Leitfaden für die Beschaffung von Ausrüstungen für Kraftwerke - Teil 4: Nebenanlagen - Hauptabschnitt 1: Anlagen zur Staubemissionsminderung

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Contents **Page**

Foreword	4
1 Scope	6
2 Normative references	6
3 Definitions	7
3.1 Organisational terms.....	7
3.2 Technical terms	7
3.3 General terms	8
4 Brief overall project description	9
4.1 Role and organisation of purchaser	9
4.2 Site location.....	9
4.3 Equipment task	9
4.4 Equipment to be purchased	9
4.5 Control and instrumentation	10
4.6 Electrical supplies and other services	10
4.7 Other interfaces	10
4.8 Project programme	10
4.9 Equipment identification systems.....	10
5 Extent of supply	10
6 Terminal points	11
7 Operational requirements	12
7.1 Operating environment	12
7.2 Manning levels	12
7.3 Normal operation	12
7.4 Operating hours	12
7.5 Start-up and shut-down.....	12
7.6 Abnormal conditions	12
7.7 Further operational requirements.....	13
8 Life expectancy	13
8.1 Design life	13
8.2 Components requiring periodic maintenance	13
9 Performance requirements	13
9.1 Duty.....	13
9.2 Performance	14
9.3 Equipment margins	14
9.4 Availability	15
9.5 Levels of component redundancy	15
9.6 Further performance requirements	15
10 Design and fabrication	15
10.1 Specific equipment features	15
10.2 Design justification	16
10.3 Material selection	17
10.4 Safety	17
10.5 Interchangeability	17
10.6 Fabrication methods	17
11 Maintenance requirements	17
11.1 Planned maintenance	17
11.2 Personnel safety	17
11.3 Requirements for access	17
11.4 Lifting requirements	18
11.5 Special tools.....	18

11.6 Test equipment	18
11.7 Spare parts strategy.....	18
11.8 Special precautions.....	18
12 Technical documentation requirements.....	18
12.1 Tender documentation.....	18
12.2 Contract documentation.....	19
13 Applicable legislation, regulations, standards and further requirements	19
13.1 Legislation and regulations	19
13.2 Standards.....	19
13.3 Further requirements	19
14 Evaluation criteria.....	19
14.1 General	19
14.2 Technical criteria.....	20
15 Quality measures	20
15.1 General	20
15.2 Approvals procedure.....	21
15.3 Inspection requirements.....	21
15.4 Non-conformity.....	21
16 Site factors	21
16.1 Access	21
16.2 Facilities	21
16.3 Site specific requirements.....	22
17 Verification of specified performance	22
17.1 General	22
17.2 Works tests.....	22
17.3 Test during installation and commissioning.....	22
17.4 Technical conditions for trial run	22
17.5 Functional and performance tests	23
Annex A (informative): Bibliography	24

Foreword

This European Standard has been prepared by Technical Committee CEN/CLC JTFPE "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 October 1999, and conflicting national standards shall be withdrawn at the latest by October 1999.

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 European Standard takes the form of a recommendation and is therefore entitled a "Guide".

*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 - Uninterruptible 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 - Switchgear and control gear

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-SO_x) 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

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 plant. 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**.*

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

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

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 **dust** emission reduction **equipment** 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:

- mechanical separators;
- bag filters;
- electrostatic precipitators.

The **performance** of **dust** collecting **equipment** depends on the physical and chemical properties of the flue gas and the particles in the flue gas. The choice of **equipment** is therefore dependent on these properties and the pollution regulations to be met.

Wet removal systems are not normally used to extract the large quantities of **dust** in electricity generating stations because of difficulties in the disposal of the sludge, treatment of the waste water and lowering of the flue gas discharge temperature. If they are offered, the extent of supply should normally include waste water treatment plant and proposals for reheating the flue gas.

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 an **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.

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 Annex A).

3.2 Technical terms

3.2.1 General

3.2.1.1 dust: all type of solid particles potentially emitted from the power station.

3.2.1.2 efficiency of dust removal:

$$\eta = \frac{\Delta m}{m_i}$$

Where: η is the **efficiency of dust removal** expressed as a percentage;

Δm is the mass of **dust** removed (during a period of time);

m_i is the mass of **dust** which enters the **equipment** (during the same period of time).

If **dust** concentrations are to be used instead of mass, the gas state is to be defined if it changes between inlet and outlet of the collector (i.e. gas temperature, pressure, wetness and reference oxygen conditions).

3.2.1.3 continuous maximum operating condition: Maximum condition at which the plant may be operated for a period not exceeding the specified **design life**. This is the operating condition under which the **performance** tests are usually conducted.

3.2.1.4 dust hopper: **Dust** collecting chamber from which the **dust** can be discharged under gravity into the conveying system.

3.2.1.5 flue gas: Mixture of gases resulting from the combustion process and other gases entering the induced draught system (i.e. air ingress or cross-leakage).

3.2.1.6 interlock: System of locks which ensures that operations associated with personnel safety are carried out in a defined sequence.

3.2.2 Bag filter

3.2.2.1 cloth: Textile or wire fabric - woven, knitted or felted.

3.2.2.2 cloth ratio: Equivalent to the face velocity obtained by dividing the actual gas volume flow by the area of **cloth** active in cleaning of gas.

3.2.2.3 compartment: Gas tight subdivision of the bag filter.

3.2.2.4 pulse jet cleaning: Pulse of high pressure gas of a short period producing reversed flow from the clean side of the bags of sufficient magnitude to release **dust** from the bags and allow it to fall into **the dust hoppers**. Flue gas flow does not have to be shut-off during pulsing.

3.2.2.5 reverse flow cleaning: Reverse clean gas flow to the bags is generally produced by an auxiliary fan and the **dust** is released from the bag and settled in the **dust hopper**. The flue gas flow has to be shut-off from the **compartment** to be cleaned.

3.2.2.6 shaker cleaning: Bags are shaken mechanically by a combination of horizontal and vertical motion of the framework in which rows of bags are fastened. The frequency of shake can be varied to achieve most effective cleaning.

3.2.3 Electrostatic precipitator

3.2.3.1 bus section: Smallest unit of a precipitator which can be electrically isolated.

3.2.3.2 cell: Section of a precipitator comprising **discharge electrodes** and **collecting electrodes** over the whole **flow** width and of length equal to one **collecting electrode**. This is sometimes referred to as one zone.

3.2.3.3 discharge electrode: Electrode at high voltage creating a strong electric field thus emitting electrons to charge the **dust** particles.

3.2.3.4 collecting electrode: Grounded collection plate to which charged **dust** particles are driven and collected.

3.2.3.5 electric power supply: Source of electricity (consisting for example of step-up transformer, a high voltage rectifier and the control system), energising one or several **bus sections**.

3.2.3.6 flow: Arrangement of **discharge electrodes** and **collecting electrodes** contained within an independent casing.

3.2.3.7 gas conditioning: Injection of additional compounds into the gas flow as for example, SO₃, NH₃, H₂O, lime etc. to improve **efficiency of dust removal**.

3.2.3.8 projected collecting surface area: Projected area of the **collecting electrode** (2 x height x length x number of gas passages).

3.2.3.9 rapper: Device to vibrate **discharge electrodes** and **collecting electrodes** of electrostatic precipitator in order to detach adhering **dust**.

3.2.3.10 dust resistivity: Defined by the Ohm's law (i.e. ratio of the electric field to the current per unit area).

3.3 General terms

3.3.1 equipment: *Plant, component, system and/or associated service to be provided in response to the enquiry.*

3.3.2 conformity: *Fulfilment of specified requirements by a product, process or service.*

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 discharge electrode 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 generating plant, a modification to an existing power generating plant, or replacement **equipment**.

Where appropriate, the **specification** should define the function and the 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:

- the type of **dust** removal system;
- the number of separate parallel **flow** paths;
- the number of **compartments**;
- the number of auxiliary fans to clean the bags.