
Guide for procurement of power station equipment - Part 6-2: Turbine auxiliaries - Feedwater heaters

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Leitfaden für die Beschaffung von Ausrüstungen für Kraftwerke -- Teil 6-2: Turbinenhilfseinrichtungen - Speisewasservorwärmer

Guide pour l'acquisition d'équipements destinés aux centrales de production d'électricité -- Partie 6-2: Auxiliaires de turbine - Réchauffeurs d'eau d'alimentation

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This European Standard was approved by CEN/CENELEC on 11 December 1997.

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Contents

Page

Foreword	4
1 Scope	6
2 Normative references	7
3 Definitions	7
3.1 Organisational terms.....	7
3.2 Technical terms	7
3.3 General terms.....	8
4 Brief overall project description	8
4.1 Role and organisation of purchaser.....	8
4.2 Site location.....	9
4.3 Equipment task.....	9
4.4 Equipment to be purchased	9
4.5 Control and instrumentation	9
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	11
7.1 Operating environment	11
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	14
9.1 Duty.....	14
9.2 Performance	14
9.3 Equipment margins.....	14
9.4 Availability	14
9.5 Levels of component redundancy	14
9.6 Further performance requirements.....	14
10 Design and fabrication	15
10.1 Specific equipment features.....	15
10.2 Design justification.....	16
10.3 Material selection.....	16
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	17
11.5 Special tools	18
11.6 Test equipment.....	18
11.7 Spare parts strategy.....	18

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SIST EN 45510-6-2:2000

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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	20
13.3 Further requirements	20
14 Evaluation criteria.....	20
14.1 General.....	20
14.2 Technical criteria	20
15 Quality measures.....	21
15.1 General.....	21
15.2 Approvals procedure	21
15.3 Inspection requirements.....	21
15.4 Non-conformity	21
16 Site factors	22
16.1 Access.....	22
16.2 Facilities	22
16.3 Site specific requirements.....	22
17 Verification of specified performance	23
17.1 General.....	23
17.2 Works tests.....	23
17.3 Test during installation and commissioning	23
17.4 Technical conditions for trial run	23
17.5 Functional and performance tests.....	24
Annex A (informative): Bibliography	25

<https://standards.iteh.ai/catalog/standards/sist/89c8f0f0-af03-471c-8c74-dcf5051be66/sist-en-45510-6-2-2000>

Foreword

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

This Guide for procurement has been prepared by the CEN/CENELEC Joint Task Force Power Engineering (JTFPE) of which the secretariat 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 July 1998, and conflicting national standards shall be withdrawn at the latest by July 1998.

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 - Uninterruptible power supplies

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

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

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**.*

Where paragraphs of "common clauses" are omitted, each paragraph omitted is indicated by the symbol *****.

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.

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.

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1 Scope

*This standard gives guidance on writing the technical **specification** for the procurement of **feedwater heaters** 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 surface **feedwater heaters** installed in power plants and used to heat the main condensate and feedwater to be supplied to the steam producing system.

Shell and tube type **feedwater heaters** are included in this guide, while direct contact **feedwater heaters** are covered by a separate guide (see EN 45510-6-1 "Guide for procurement of power station equipment - Part 6-1: Turbine auxiliaries - Deaerators").

Feedwater heaters may or may not have a separate or internal drain cooler or desuperheater.

The **feedwater heaters** heating the main condensate are low pressure (LP) and those heating the feedwater are high pressure (HP) **feedwater heaters**.

Depending on their installation and design they may belong to the following types:

- horizontal type;
- horizontal in the condenser exhaust neck;
- vertical **water box** up;
- vertical **water box** down;
- **feedwater heaters** with condensing zone only;
- two zone **feedwater heaters** (condensing and drain cooling or condensing and desuperheating zone);
- three zone **feedwater heaters** (desuperheating, condensing and drain cooling zones);
- duplex LP heaters;
- **header type feedwater heaters**;
- **tube sheet type feedwater heaters**;
- separate drain coolers;
- separate desuperheaters.

This Guide does not cover feedwater heating systems using waste heat taken from the exhaust of gas turbines or from the exhaust of a boiler or gland steam; generally, it only applies to systems which use extraction steam.

*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, such as other heaters, deaerator, condenser, steam generator, etc.;
- 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 50 (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 Annex A).

3.2 Technical terms

- 3.2.1 feedwater heater:** Equipment for heating the main condensate or feedwater by extraction steam.
- 3.2.2 water box or header:** Water side pressure part, except the **tube bundle**.
- 3.2.3 shell:** Steam side pressure part containing the **tube bundle**.
- 3.2.4 tube bundle:** The tube bundle includes the heat exchanging tubes, the **tube sheet** (headers), support plates and baffles.
- 3.2.5 tube sheet/header:** Perforated plate or cylinder into which the tubes of the **tube bundle** are expanded and/or welded.
- 3.2.6 total surface:** Total outside tube surface in the heater including:
- the effective tube surface;
 - the tube surface within the **tube sheet**;
 - the flooded surface;

- the inactive surface.

3.2.7 effective surface: The **effective surface** is that portion of the **total surface** considered for the calculation of the exchanged heat. It does not include the tube surface within the **tube sheet**, the surface which is flooded and/or the surface not exposed to steam or condensate on the **shell** side.

3.2.8 support structure: Assembly of support plates or grids, internal walls and baffles, supporting the tubes and forming the internal drain cooling and desuperheating zones.

3.2.9 sole plates: Plates supporting the **feedwater heater** feet or saddles.

3.2.10 entering drains and vents: Any liquid or steam which enters into the heater from higher pressure stages or sources and combines with the **shell** side condensate.

3.2.11 terminal temperature difference (TTD): Difference between saturation temperature of the steam entering the heater and the outlet temperature of the water to be heated.

3.2.12 approach: Difference between the **shell** side outlet temperature of the condensate from the drain cooler and the tube side feedwater inlet temperature.

3.2.13 tube side velocity: Water velocity through the tubes at average temperature (arithmetic average of the inlet and outlet temperature).

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: *Fulfillment 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.*

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 50 (191).*

3.3.11 reliability: *As defined in IEC 50 (191).*

3.3.12 maintainability: *As defined in IEC 50 (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 size of manholes;
- the material of tubes.

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

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