
Guide for procurement of power station equipment - Part 6-3: Turbine auxiliaries - Condenser plant

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Leitfaden für die Beschaffung von Ausrüstungen für Kraftwerke -- Teil 6-3: Turbinenhilfseinrichtungen - Kondensationsanlagen

Guide pour l'acquisition d'équipements destinés aux centrales de production d'électricité -- Partie 6-3: Auxiliaires de turbine - Installation de condensation

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Turbine auxiliaries - Condenser plant

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centrales de production d'électricité - Partie 6-3: Auxiliaires
de turbine - Installation de condensation

Leitfaden für die Beschaffung von Ausrüstungen für
Kraftwerke - Teil 6-3: Turbinenhilfseinrichtungen -
Kondensationsanlage

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

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.

CEN/CENELEC members are the national standards bodies and national electrotechnical committees, respectively, of Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and United Kingdom.



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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of an identical text or by endorsement, at the latest by July 1998, and conflicting national standards shall be withdrawn at the latest by July 1998.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 **condenser plants** 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 cooled surface and direct contact **condensers** acting as a steam sink for main or auxiliary turbines in power stations (parts in brackets marked with * apply to direct contact **condensers** only);
- **condenser auxiliary equipment**.

Air blast or air-cooled type **condensers** (ACCs) are not covered by this Guide.

*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 the turbine, **cooling water** system, regenerating feed heating system, district heating and steam generating plant;
- 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 condensers:** Condensers act as the steam sink for main and/or auxiliary turbines. They can be water cooled surface or direct contact **condensers**. The **condenser** consists of the **shell**, **tube bundles**, **condenser neck**, internal support structure, **hotwell**, **water boxes**, (spray nozzles*) and **air extraction system**.
- 3.2.2 water box:** Water boxes are the cooling water side pressure parts distributing the cooling water to and from the **condenser** tubes.
- 3.2.3 cooling water:** Water which enters the **condenser** at the **cooling water** inlet nozzles and to which the **rejected heat** is transferred. It leaves the **condenser** via the **cooling water** outlet nozzles.
- 3.2.4 rejected heat:** Heat flux which is removed from the **condenser** by the **cooling water**. The **rejected heat** is the sum of the heat fluxes entering the **condenser** as exhaust steam and other steam and condensates dumped to the **condenser** minus the heat fluxes removed by the main condensate and condensates extracted from the **condenser**. (For direct contact **condensers** the **rejected heat** is the heat flux removed from the **condenser** by the temperature rise of the injected **cooling water** flow.*)
- 3.2.5 tube bundles:** The **tube bundles** include the heat exchanging tubes, the **tube sheets**, the **support plates** and the **air coolers**.
- 3.2.6 air cooler:** The coldest location of the **condenser bundle** where non-condensable gases are at maximum concentration and can be effectively extracted.
- 3.2.7 condenser neck:** Connection of the **condenser** to the turbine exhaust.
- 3.2.8 condenser surface:** Total outside surface of the tubes between the inside surfaces of the **tube sheets**. This surface area is used for the heat transfer calculation.
- 3.2.9 shell:** Steam side pressure part, containing the **tube bundles**. The **condenser neck** and the **hotwell** are integral parts of the **condenser shell**.
- 3.2.10 tube sheets:** Perforated plates to which the tubes are attached.
- 3.2.11 support plates:** Perforated plates, spaced between the **tube sheets**, in which the **condenser** tubes are guided to prevent vibration. The **support plates** can be main **support plates** which are a part of the structure of the **shell** or intermediate **support plates** which prevent vibration only.
- 3.2.12 hotwell:** Bottom of the **condenser shell** or a vessel attached to the bottom of the **condenser** where the condensate is collected and drained from the **condenser**. The **hotwell** may have baffles to direct the condensate flow and form loop seals for multi-pressure **condensers**.
- 3.2.13 entering steam and drains:** Any steam and water entering the **condenser** on the **shell** side.

- 3.2.14 back pressure:** Pressure in the **condenser** measured at a specified plane above the **tube bundle**.
- 3.2.15 condensate oxygen content:** Mass fraction of oxygen contained in the condensate extracted from the **hotwell**.
- 3.2.16 condensate subcooling:** Difference between the temperature of the condensate measured at the **hotwell** outlet and the saturation temperature at **back pressure**.
- 3.2.17 cooling water inlet temperature:** Average temperature of the **cooling water** measured at the **cooling water** inlet nozzle.
- 3.2.18 cooling water outlet temperature:** Average temperature of the **cooling water** measured at the **cooling water** outlet nozzle.
- 3.2.19 water side pressure drop:** Measured pressure drop of the **cooling water** between the inlet and outlet nozzles.
- 3.2.20 cooling water mass flow rate:** Measured or calculated mass flow rate of **cooling water** passing through the **condenser** tubes.
- 3.2.21 cooling water quality:** Content of salt (salinity) and suspended and soluble matter in the **cooling water**.
- 3.2.22 cooling water flow conditions:** State of **cooling water** at the **condenser** inlet. This comprises the inlet pressure, the **inlet temperature**, the **quality** and the **mass flow rate** of the **cooling water**.
- 3.2.23 air leakage:** Mass flow rate of air entering the **condenser shell**.
- 3.2.24 tube side velocity:** **Cooling water** velocity in the tubes calculated from the **cooling water mass flow rate** at the average temperature of the **cooling water** (arithmetic average of the **inlet** and **outlet temperature**).
- 3.2.25 air extraction and evacuation system:** The **air extraction system** is a system to remove the non condensable gases from the **air cooler** (air removal system*); it consists of the pipework within and outside of the **condenser**, vacuum pumps and/or ejectors and air treatment system. The **evacuation system** is a system to remove the air from the **condenser** and connected plant at start-up. These two systems can be totally or partially common.
- 3.2.26 (cooling water spray system:** System of pipework equipped with nozzles through which the **cooling water** is injected into the direct contact **condenser**.*)
- 3.2.27 water box priming system:** System to remove air from the **water boxes** at start-up and in operation.
- 3.2.28 tube cleaning system:** System to clean the **condenser** tubes on the **cooling water** side.
- 3.2.29 debris filter system:** System installed at the **water box** inlet nozzle to remove smaller debris from the **cooling water**. The removed debris is fed to the **cooling water** leaving the **condenser**.
- 3.2.30 condenser plant:** All plant components within the scope of delivery of the **condenser**. Along with the **auxiliary equipment** belonging to the **condenser**, the **condenser plant** should represent a fully functional steam sink plant.
- 3.2.31 auxiliary plant and equipment:** Machines, equipment, accessories, and items required for establishing the functional capability of the **condenser plant**, except for site facilities.
- 3.2.32 operating conditions:** Physical conditions imposed on the **condenser** by the flow conditions of exhaust steam, **cooling water**, drains and steam and condensate dumps.

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.

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**.