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**Guide for procurement of power station equipment - Part 6-7: Turbine auxiliaries - Moisture separator reheaters**

Guide for procurement of power station equipment -- Part 6-7: Turbine auxiliaries - Moisture separator reheaters

Leitfaden für die Beschaffung von Ausrüstungen für Kraftwerke -- Teil 6-7: Turbinenhilfseinrichtungen - Wasserabscheider/Zwischenüberhitzer

Guide pour l'acquisition d'équipements destinés aux centrales de production d'électricité -- Partie 6-7: Auxiliaires de turbine - Séparateurs-surchauffeurs

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27.100	Elektrarne na splošno	Power stations in general

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## Guide for procurement of power station equipment - Part 6-7: Turbine auxiliaries - Moisture separator reheaters

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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.



**CEN Central Secretariat:**  
rue de Stassart, 36 B-1050 Brussels

**CENELEC Central Secretariat:**  
rue de Stassart, 35 B-1050 Brussels

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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 (JTJFPE) 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<sub>x</sub>) 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<sub>x</sub>) 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 **moisture separator reheaters** 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:

- **moisture separator reheaters** as a vessel containing the **moisture separator** and the **reheater bundles**;
- **moisture separator** as a vessel containing the **moisture separators**;
- **high velocity moisture separators** as a part of the crossunder or crossover line;
- **reheaters** as a vessel containing the **reheater bundles**;
- **moisture separators** (for replacement installation);
- **reheater bundles** (for replacement installation);
- **moisture separator reheater** auxiliary equipment (drains, vents and **heating steam** systems).

This Guide does not cover:

- pipework from and to the turbines and for drain and vent systems;
- drain pumps.

*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, regenerative feed heating system, condenser 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)
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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 moisture separator reheaters (MSR):** For the purpose of this guide **moisture separator reheaters** means moisture separating and reheating devices either combined in a single vessel or in separate vessels with interconnecting pipework.
- 3.2.2 moisture separator:** Device in which the majority of the wetness of the **cycle steam** is removed mechanically. It consists of the steam distribution system and the moisture separating elements.
- 3.2.3 high velocity moisture separator:** Moisture separating device in which the steam is mechanically dried at a velocity close to the turbine exhaust pipe velocity.
- 3.2.4 reheater:** Tube bundle type heat exchanger in which the **residual wetness** in the exhaust steam from the **moisture separator** is evaporated and the dry steam is then superheated by condensing steam of higher pressure.
- 3.2.5 reheater bundle:** The tubes, **steam chambers**, **tube sheet**, **support plates** and support structure.
- 3.2.6 steam chamber (headers):** Heating **steam** side pressure part of the **reheater bundles** with internal devices to distribute the **heating steam** to the tubes and to collect and drain the **heating steam condensate** and separate **heating steam passes**.
- 3.2.7 tube sheets:** Perforated plates welded to the **steam chamber** into which tubes are expanded and/or welded.
- 3.2.8 support plates:** Perforated plates or support grids in which the **reheater** tubes are supported to prevent vibration. They are an integral part of the **bundle** support structure.
- 3.2.9 total surface:** Total outside surface of all tubes in the **reheater bundle** including:
- the **active tube surface**;
  - the tube surface within the **tube sheets**;
  - the surface not affected by the **cycle steam**.

- 3.2.10 active surface:** Effective surface area used for the heat transfer calculations and that portion of the **total surface** which is in contact with flowing **cycle steam**.
- 3.2.11 drain tanks:** Tanks which are separate or attached to the shell, to collect and drain condensate from the **moisture separator** or **reheater**.
- 3.2.12 heating stages:** Reheating can be performed in one or two stages. In general the first stage is heated by extraction steam and the second by live steam.
- 3.2.13 heating steam passes:** A **heating steam pass** is a section of the tube **bundle** where the **heating steam** flows without a change of flow direction. The first **pass** starts at the **heating steam** inlet. After a change of the **heating steam** flow direction (in a U-bend or in the **steam chamber**) a new **pass** commences.
- 3.2.14 heating steam:** Steam which is used in the **reheater** to reheat the **cycle steam**. The **heating steam** can be live steam or extraction steam.
- 3.2.15 cycle steam:** Wet steam leaving the turbine to be dried and reheated.
- 3.2.16 purging steam:** Excess steam at the end of a **pass** which has not condensed during the reheating process. **Purging steam** used internally for heating the next pass is also called scavenging steam or internal **purging steam**. **Purging steam** leaving the last **pass** is also called vent steam.
- 3.2.17 heating steam condensate:** Condensed part of the **heating steam** which is drained from the **reheater**.
- 3.2.18 inlet moisture content:** Mass flow rate fraction of the condensate in the wet steam flow entering the **moisture separator**.
- 3.2.19 inlet steam quality:** Mass flow rate fraction of the steam in the wet steam flow entering the **moisture separator**.
- 3.2.20 cycle steam condensate (moisture separator drain):** Moisture removed from the **cycle steam** which is drained from the **moisture separator**.
- 3.2.21 residual wetness:** That part of the moisture not removed from the **cycle steam** at the outlet of the **moisture separator**.
- 3.2.22 cycle steam inlet temperature:** Average temperature of the steam entering the **reheater bundle**.
- 3.2.23 cycle steam outlet temperature:** Average temperature of the steam leaving the **reheater bundle**, measured at defined location(s).
- 3.2.24 heating steam inlet pressure:** Pressure of the **heating steam** at the inlet nozzle of the **reheater bundle**.
- 3.2.25 heating steam outlet pressure:** Pressure of the **heating steam** at the outlet nozzle of the **reheater bundle**.
- 3.2.26 terminal temperature difference (TTD):** Difference between the saturation temperature at **heating steam inlet pressure** and the **cycle steam outlet temperature**.
- 3.2.27 heating steam condensate outlet temperature:** Temperature of the **heating steam condensate** at the outlet nozzle of the **reheater**.
- 3.2.28 shell side pressure drop:** Pressure drop of the **cycle steam** measured between two defined locations while passing through the **moisture separator** and the **reheater bundle**. Generally it is the pressure difference between the **cycle steam** inlet and outlet nozzle of the **moisture separator reheater bundle**.
- 3.2.29 tube side pressure drop:** Pressure drop of the **heating steam** measured between two defined locations while passing through all **passes** of the **reheater bundle**. Generally it is the pressure difference between the **heating steam** inlet and outlet nozzle of the **reheater bundle**.
- 3.2.30 operating conditions:** Physical conditions imposed on the **MSR** by the cycle and by the heating flow conditions.

### 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).

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## 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.