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Guide for procurement of power station equipment
Part 2-6: Electrical equipment - Generators

Guide pour l'acquisition d'équipements destinés aux centrales de production d'électricité
Partie 2-6: Equipements électriques - Alternateurs

Leitfaden für die Beschaffung von Ausrüstungen für Kraftwerke
Teil 2-6: Elektrische Ausrüstung - Generatoren

This European Standard was approved by CEN and CENELEC on 2000-02-01.

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

CEN and 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 the British Standards Institution.

The text of the draft was submitted to the formal vote and was approved by CEN and CENELEC as EN 45510-2-6 on 2000-02-01.

The following dates were fixed:

- *latest date by which the EN has to be implemented at national level by publication of an identical national standard or by endorsement* (dop) 2001-01-01
- *latest date by which the national standards conflicting with the EN have to be withdrawn* (dow) 2003-01-01

Annexes designated "informative" are given for information only. In this standard, annexes A, B and C are informative.

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

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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.

1 Scope

This standard gives guidance on writing the technical ***specification*** *for the procurement of* turbine-driven generators and their auxiliaries *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.*

The generators may be air, hydrogen, or liquid-cooled. The excitation system may be of the static or rotating rectifier type fed by a static or rotating power supply.

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.

European Standards

EN ISO 9001	*Quality systems - Model for quality assurance in design, development, production, installation and servicing*
EN ISO 9002	*Quality systems - Model for quality assurance in production, installation and servicing*
EN 60034-1	Rotating electrical machinery - Part 1 : Rating and performances
EN 60034-3	Rotating electrical machinery - Part 3: Specific requirements for turbine-type synchronous machines.

International Standards

IEC 60050-191	*International electrotechnical vocabulary* Chapter 191: Dependability and Quality of Services
IEC 60842	Guide for application and operation of turbine-type synchronous machines using hydrogen as a coolant

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 **normal operation:** All operating conditions frequently encountered. These include rated operating conditions, maximum and minimum operating conditions, partial load, normal transients (start-up, shut-down, load changes), shut-down and stand-by situations.

3.2.2 **abnormal conditions** (of operation): Operating conditions of low occurrence (only for limited period of time) or low cumulative duration. These include situations in which limits of normal situations are exceeded, situations of tests, etc.

3.2.3 **accidental operating conditions:** Operating conditions of very low occurrence (typically only a few times during equipment lifetime). After such a condition has occurred, equipment inspection may be required. These include human errors, loss of power supply, overvoltages, earthquake, etc.

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 stator, rotor or their windings are significant components.

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:

- power plant type (electrical power generation, combined heat and power generation, industrial power plant, nuclear or fossil fired plant);
- new construction or refurbishment or spare equipment;
- prototype or additional unit;
- mode of operation, eg. base load, average load, peak load, synchronous compensation.

*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.*

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:

- the gas requirements (purity, pressures, flowrates, etc.),
- cooling water requirements (flowrates, chemistry, filtration, etc.),
- lubricating oil and seal oil.

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:
- turbine (if not included in a common contract),
- foundations,
- busbars,
- protection system,
- hydrogen storage or production facility,
- purging gas storage,
- start-up equipment for gas turbine unit (if not included in a common contract),
- neutral earthing resistor,
- control and instrumentation system.

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.*

5 Extent of supply

*The **specification** should define the extent of supply of all the **equipment**.*

This may include:-
the generator and the auxiliaries needed to operate the set (pumps, motors, pipes, valves, detection and measurement instruments), together with the associated instrumentation, protection and control devices.

The following items are normally included in the supply:
- generator,
- exciter power supply system,
- excitation current rectifying system,
- voltage regulation system,
- coolers,
- auxiliary systems, eg. coolant, seal-oil, H_2 and CO_2, lubrication (if not included in turbine supply), etc.
- instrumentation.

Additional equipment may include:
- neutral connection,
- main connection to step-up generator transformer, (if not included in generator switchgear supply),
- start-up device for gas turbine driven generator,
- measurement transformers, eg. for protections, etc.,
- equipment for supply and treatment of cooling and drainage fluids (where appropriate),
- electrical generator protection system.

These lists are not intended to be comprehensive.