



SLOVENSKI STANDARD SIST EN IEC 60545:2021

01-oktober-2021

Smernica za zagon in delovanje vodnih turbin, črpalnih turbin in akumulacijskih črpalk (IEC 60545:2021)

Guideline for commissioning and operation of hydraulic turbines, pump-turbines and storage pumps (IEC 60545:2021)

Richtlinien für die Inbetriebnahme und den Betrieb von Wasserturbinen, Pumpturbinen und Speicherpumpen (IEC 60545:2021)

Lignes directrices pour la mise en service et l'exploitation des turbines hydrauliques, des pompes-turbines et des pompes d'accumulation (IEC 60545:2021)

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EUROPEAN STANDARD

EN IEC 60545

NORME EUROPÉENNE

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Guidelines for commissioning and operation of hydraulic turbines, pump-turbines and storage pumps (IEC 60545:2021)

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(IEC 60545:2021)

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(IEC 60545:2021)

This European Standard was approved by CENELEC on 2021-07-28. 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.

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European Committee for Electrotechnical Standardization
Comité Européen de Normalisation Electrotechnique
Europäisches Komitee für Elektrotechnische Normung

CEN-CENELEC Management Centre: Rue de la Science 23, B-1040 Brussels

EN IEC 60545:2021 (E)**European foreword**

The text of document 4/407/FDIS, future edition 2 of IEC 60545, prepared by IEC/TC 4 “Hydraulic turbines” was submitted to the IEC-CENELEC parallel vote and approved by CENELEC as EN IEC 60545:2021.

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- latest date by which the national standards conflicting with the document have to be withdrawn (dow) 2024-07-28

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In the official version, for Bibliography, the following notes have to be added for the standards indicated:

IEC 60041	NOTE	Harmonized as EN 60041
IEC 60204-1:2016	NOTE	Harmonized as EN 60204-1:2018 (modified)
IEC 60308	NOTE	Harmonized as EN 60308
IEC 60609-1:2004	NOTE	Harmonized as EN 60609-1:2005 (not modified)
IEC 62006	NOTE	Harmonized as EN 62006
IEC 62256:2017	NOTE	Harmonized as EN 62256:2017 (not modified)
IEC 62364:2019	NOTE	Harmonized as EN IEC 62364:2019 (not modified)
IEC 63132 (series)	NOTE	Harmonized as EN IEC 63132 (series)



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INTERNATIONAL STANDARD

NORME INTERNATIONALE



**Guidelines for commissioning and operation of hydraulic turbines,
pump-turbines and storage pumps**

**Lignes directrices pour la mise en service et l'exploitation des turbines
hydrauliques, des pompes-turbines et des pompes d'accumulation**

INTERNATIONAL
ELECTROTECHNICAL
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INTERNATIONAL ELECTROTECHNICAL COMMISSION

**GUIDELINES FOR COMMISSIONING AND OPERATION OF HYDRAULIC
TURBINES, PUMP-TURBINES AND STORAGE PUMPS**

FOREWORD

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International Standard IEC 60545 has been prepared by IEC technical committee 4: Hydraulic turbines.

This second edition cancels and replaces the first edition published in 1976 and the first edition of IEC 60805 published in 1985. This edition constitutes a technical revision.

This edition includes the following significant technical changes with respect to the previous edition:

- a) the focus is on the commissioning and operation of the hydraulic machine. Interfaces to the electric machine are mentioned only for a better understanding of the context;
- b) the definitions of tests for commissioning and adjustable speed are updated to state of the art;
- c) the record sheets 'measurements during erection' are excluded (see IEC 63132 (all parts));
- d) the maintenance is excluded (see IEC 62256).

The text of this International Standard is based on the following documents:

FDIS	Report on voting
4/407/FDIS	4/420/RVD

Full information on the voting for its approval can be found in the report on voting indicated in the above table.

The language used for the development of this International Standard is English.

This document was drafted in accordance with ISO/IEC Directives, Part 2, and developed in accordance with ISO/IEC Directives, Part 1 and ISO/IEC Directives, IEC Supplement, available at www.iec.ch/members_experts/refdocs. The main document types developed by IEC are described in greater detail at www.iec.ch/standardsdev/publications.

The committee has decided that the contents of this document will remain unchanged until the stability date indicated on the IEC website under webstore.iec.ch in the data related to the specific document. At this date, the document will be

- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
- amended.

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GUIDELINES FOR COMMISSIONING AND OPERATION OF HYDRAULIC TURBINES, PUMP-TURBINES AND STORAGE PUMPS

1 Scope

The purpose of this document is to establish, in a general way, suitable procedures for commissioning and operation of hydraulic machines and associated equipment, and to indicate how such machines and equipment should be commissioned and operated.

Commissioning and operation of the associated equipment are not described in detail in this document but is considered in the commissioning and operation procedure as a separate step.

Machines of up to about 15 MW and reference diameters of about 3 m are generally covered by IEC 62006.

It is understood that a guideline of this type will be binding only if the contracting parties have agreed upon it.

The guidelines exclude matters of purely commercial interest, except those inextricably connected with the conduct of commissioning and operation.

The guidelines are not concerned with waterways, gates, drainage pumps, cooling-water equipment, generators, motor-generators, electrical equipment (e.g. circuit breakers, transformers) etc., except where they cannot be separated from the hydraulic machinery and its equipment.

Wherever the guidelines specify that documents, drawings or information are supplied by a supplier (or by suppliers), each individual supplier should furnish the appropriate information for its own supply only.

2 Normative references

There are no normative references in this document.

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- IEC Electropedia: available at <http://www.electropedia.org/>
- ISO Online browsing platform: available at <http://www.iso.org/obp>

3.1 Machine and equipment

3.1.1

hydraulic machinery

turbines, storage pumps, pump-turbines, valves, guide and thrust bearings used in hydroelectric power and pumped storage stations

Note 1 to entry: The term hydraulic machinery includes hydraulic torque converter and all type of main inlet valves.

Note 2 to entry: Terms related to hydro turbine governing systems are not included; refer to IEC 60308.

[SOURCE: IEC TR 61364:1999, 3.1, modified – Addition of Note 1 to entry.]

3.1.2

hydraulic machine

hydraulic impulse and reaction turbines, storage pumps and pump-turbines

[SOURCE: IEC TR 61364:1999, 3.1]

3.1.3

turbine

machine for transforming hydraulic energy into mechanical energy

Note 1 to entry: The term turbine includes a pump-turbine functioning as a turbine.

Note 2 to entry: The term turbine does not include the inlet or outlet valves nor the associated generator or governor.

[SOURCE: IEC TR 61364:1999, 4.1, modified – Addition of Note 1 to entry.]

3.1.4

pump

machine for transforming mechanical energy into hydraulic energy in order to store water that will be used later on to produce electric energy

Note 1 to entry: The term pump includes a storage pump and a pump-turbine functioning as a pump.

Note 2 to entry: The term pump does not include the inlet or outlet valves nor the associated motor.

[SOURCE: IEC TR 61364:1999, 4.1, modified – Replacement of "storage pump" with "pump" in the main term, and addition of Note 1 to entry.]

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3.1.5

starting device

starting equipment for a motor-generator or motor

EXAMPLE 1 pony motor

EXAMPLE 2 starting turbine

EXAMPLE 3 frequency converter

EXAMPLE 4 hydraulic torque converter

EXAMPLE 5 back to back

Note 1 to entry: Each example is representing a different method to start the hydraulic machine functioning as a pump.

3.1.6

opening device

guide vanes or the turbine needle of impulse turbines and its driving components (governing systems)

3.1.7

electrical machine

generators and motor-generators of synchronous type including the excitation equipment as well as of the asynchronous type

3.1.8

associated equipment

all additional machinery which is necessary to allow operation of the hydraulic machine (if applicable)

EXAMPLE 1 inlet and outlet gates or valves, draft tube gates, cylindrical valves (ring gates)

EXAMPLE 2 pressure relief valves

EXAMPLE 3 couplings

EXAMPLE 4 gear drives

EXAMPLE 5 brake system

EXAMPLE 6 water depression system

EXAMPLE 7 air supply system

EXAMPLE 8 cooling-water systems

EXAMPLE 9 drainage systems

EXAMPLE 10 dewatering systems

EXAMPLE 11 oil supply systems

3.2 Tests, periods, operating modes

3.2.1

commissioning

testing of new or rehabilitated equipment to check its conformity with contractual specifications, as well as operation of the equipment until formally accepted by the purchaser

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3.2.2

operation

utilization of the equipment to convert energy, or a state of readiness for such production

3.2.3

maintenance

activity performed on equipment in order to keep it in a state of optimum operating condition

3.2.4

pre-start test

test between completion of erection of the equipment and initial run

3.2.5

initial run

first movement of rotating parts after erection

3.2.6

test run

operation to obtain one set of data for a specific test

3.2.7

test operation

utilization of the equipment for testing purposes

3.2.8**test operation period**

test period following initial run and followed by test service

Note 1 to entry: It includes no-load runs for checking power plant equipment, as well as load runs in turbine and pumping operation, load rejections and energy supply interruption pump-turbine tests.

3.2.9**no-load test**

operation of the machine without connection to the electrical grid

3.2.10**no-discharge test**

operation of the machine in pump-mode with the high pressure side valve closed

3.2.11**test service period**

operation of the equipment for an agreed period

Note 1 to entry: During this test, the supplier is generally responsible.

3.2.12**commercial service**

operation of the equipment, under the operator's responsibility

3.2.13**commercial service period**

period starting after acceptance and including service periods, as well as periods when the equipment can be out of operation for maintenance, inspection, repairs, etc.

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3.2.14**guarantee period**

time, extending through an agreed part of the commercial service period, during which the supplier has commercial obligations to correct defects in his equipment in order to bring it into conformity with the contract

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Note 1 to entry: For this purpose, tests in accordance with the appropriate parts of 6.3.1.5 are performed.

3.2.15**inspection**

check on the condition of equipment

3.2.16**repair**

restoration after wear or damage

3.2.17**modification**

change intended to improve performance

3.2.18**rehabilitation**

restoration of equipment capacity and/or equipment efficiency to near to "as-new" levels; extension of equipment life by re-establishing mechanical integrity

[SOURCE: IEC 62256:2017, Clause 3]

3.2.19 supplier

entity (for example manufacturer, contractor, installer, integrator) who provides equipment or services associated with the machine

Note 1 to entry: The user organization can also act in the capacity of a supplier to itself.

[SOURCE: IEC 60204-1:2016, 3.1.62, modified – Addition of Note 1 to entry.]

3.2.20 operator

entity (for example owner of the equipment or entity contracted by him) who is responsible for operation of the equipment

4 Information on operating conditions

4.1 General

This clause describes the information which should be given by the supplier(s) to the operator.

A fundamental requirement for proper operation and maintenance is a satisfactory knowledge of the machine and its accessories by the operator.

The supplier shall deliver to the operator all necessary documents, instructions and information. They shall include as a minimum:

- general drawings (e.g. general arrangement of the hydraulic machine, power house, ...);
- material lists, descriptions and test certificates for main parts;
- function diagrams;
- instructions for operation (especially the range of operation), inspection and maintenance of the supplied equipment;
- assembly and dismantling instructions;
- safety instructions;
- list of spare parts, as stated in the contract;
- constraints.

These documents, even not final (but updated and finalised after test period), shall be given to the operator as soon as required and, in any case, before the initial run to be reviewed by the operator.

The operator shall define additional constraints (e.g. regarding shipping on rivers, slope stability, public safety, ...).

4.2 Documents, data and instructions

The documents submitted by the supplier shall include the following data, some of which can be amended according to experience gathered during commissioning:

- 1) The characteristic diagrams relating to heads, flow, power, opening (e.g. guide vane or needle), speed, tailwater elevations, and operating limits; also, where applicable, runner blade or deflector position. Examples of such diagrams are the pump characteristic and the turbine hill chart.
- 2) Statement of similitude of model and prototype, depending on the contract.
- 3) Operation and safety instructions on inlet and outlet gates or valves of the machine and pressure relief valves. The interlocking between the valves and gates shall be considered.