SLOVENSKI STANDARD
oSIST prEN IEC 61116:2024

01-december-2024

Vodilo za elektromehansko opremo malih hidroelektrarn

Electromechanical equipment guide for small hydroelectric installations

Anleitung für die elektromechanische Ausrüstung von kleinen Wasserkraftanlagen

Guide pour l'équipement électromécanique des petits aménagements hydro-électriques

Ta slovenski standard je istoveten z: **prEN IEC 61116:2024**

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SECRETARIAT:	SECRETARY:
Canada	Mrs Christine Geraghty
OF INTEREST TO THE FOLLOWING COMMITTEES:	HORIZONTAL FUNCTION(S):
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TITLE:

Electromechanical equipment guide for small hydroelectric installations

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NOTE FROM TC/SC OFFICERS:

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

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ELECTROMECHANICAL EQUIPMENT GUIDANCE FOR SMALL HYDROELECTRIC INSTALLATIONS

FOREWORD

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IEC 61116 has been prepared by IEC technical committee 4: Hydraulic turbines. It is an International Standard.

This second edition cancels and replaces the first edition published in 1992. This edition constitutes a technical revision.

This edition has been subject to a thorough review and incorporates many comments received at the various revision stages.

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

Draft	Report on voting
XX/XX/FDIS	XX/XX/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/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- withdrawn,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.

ELECTROMECHANICAL EQUIPMENT GUIDANCE FOR SMALL HYDROELECTRIC INSTALLATIONS

1 Scope

This document is used as a guidance that applies to hydroelectric installations containing impulse or reaction turbines with unit power up to about 15 MW and reference diameter of about 3 m. These figures do not represent absolute limits.

This document deals only with the direct relations between the purchaser or the consulting engineer and the supplier. It does not deal with civil works, administrative conditions or commercial conditions.

This document is intended to be used by all concerned in the installation of electromechanical equipment for small hydroelectric plants.

This document, based essentially on practical information, aims specifically at supplying the purchaser of the equipment with information which will assist him with the following:

– preparation of the call for tenders;
– evaluation of the tenders;
– contact with the supplier during the design and manufacture of equipment;
– quality control during the manufacture and shop-testing;
– follow-up of site erection;
– commissioning;
– acceptance tests;
– operation and maintenance.

The document comprises the following:

a) general requirements for the electromechanical equipment of small hydroelectric installations;
b) technical specifications for the electromechanical equipment, excluding its dimensioning and standardization;
c) requirements for acceptance, operation and maintenance.

Bearing in mind the type of installation considered, the necessary documents are intended to be as simple as possible but to satisfactorily define the particular operation conditions. Over-specification is harmful to the economy of the project.

This document does not cover the initial stage of investigations, that is to say the preliminary study and feasibility study. Neither does it deal with the economic study concerning the supply and demand of energy.

To conclude, the document does not replace the necessary engineering studies for the selection, design, manufacture, installation and testing of the equipment. It is intended only to make the purchaser aware of the important points and data to be furnished, specified and kept in due consideration in the construction of small hydroelectric plants.

2 Normative references

There are no normative references in this document.

3 Terms, definitions, symbols and units

3.1 General

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:

• ISO Online browsing platform: available at https://www.iso.org/obp

• IEC Electropedia: available at https://www.electropedia.org

3.2 General terminology

3.2.1
power station
An installation whose purpose is to generate electricity and which includes civil engineering works, energy conversion equipment and all the necessary ancillary equipment.

[SOURCE: IEC 60050-602:1983, 602-01-01]

3.2.2
hydroelectric installation
An ordered arrangement of civil engineering structures, machinery and plant designed chiefly to convert the gravitational potential energy of water into electricity.

[SOURCE: IEC 60050-602:1983, 602-01-03]

3.2.3
hydroelectric power station
A power station in which the gravitational energy of water is converted into electricity.

[SOURCE: IEC 60050-602:1983, 602-01-04]

3.2.4
run-of-river power station
A hydroelectric power station which uses the river flow as it occurs, the filling period of its own reservoir by the cumulative water flows being practically negligible.

[SOURCE: IEC 60050-602:1983, 602-01-05]

3.2.5
reservoir power station
A hydroelectric power station in which the filling period of the reservoir based on the cumulative water flows is longer than several weeks.

Note 1 to entry: A reservoir power station generally permits the cumulative water flows to be stored during the high water periods to enable the turbine to operate during later high load periods.

[SOURCE: IEC 60050-602:1983, 602-01-07]

3.2.6
gross head of a hydroelectric power station
The difference in height between the headwater and tailwater levels under specified conditions.

[SOURCE: IEC 60050-602:1983, 602-01-11, modified – Replacement of “water intake and tail-race” with “headwater and tailwater”.]

3.2.7
net head of a hydroelectric power station
The gross head of a hydroelectric power station less a height equivalent to the hydraulic losses excluding those in the turbines.

[SOURCE: IEC 60050-602:1983, 602-01-12]

3.2.8
generating set
A group of rotating machines transforming mechanical or thermal energy into electricity.

[SOURCE: IEC 60050-602:1983, 602-02-01]

3.2.9
hydroelectric set
A generating set consisting of a hydraulic turbine mechanically connected to an electrical generator.

[SOURCE: IEC 60050-602:1983, 602-02-03]

3.2.10
dam
A structure to retain water inflows for specific uses.

[SOURCE: IEC 60050-602:1983, 602-02-05]

3.2.11
penstock
A pipeline bringing water under pressure to the turbine.

[SOURCE: IEC 60050-602:1983, 602-02-09]

3.2.12
surge tank; surge shaft
An open-surface reservoir of water decreasing the effects of shock pressure waves in the penstock.

[SOURCE: IEC 60050-602:1983, 602-02-10]

3.2.13
impulse type turbine
A turbine in which a fluid acts chiefly by its kinetic energy.

[SOURCE: IEC 60050-602:1983, 602-02-11]

3.2.14
reaction type turbine
A turbine in which a fluid acts both by its kinetic energy and by its pressure.

[SOURCE: IEC 60050-602:1983, 602-02-12]

3.2.15
Pelton turbine
A hydraulic impulse type turbine usually operated from a high head source with small flow rate.

[SOURCE: IEC 60050-602:1983, 602-02-13]

3.2.16
Francis turbine
A hydraulic reaction type turbine with fixed runner blades usually operated from a medium or low head source with medium flow rate.

[SOURCE: IEC 60050-602:1983, 602-02-14]

3.2.17
Kaplan turbine
An axial hydraulic reaction type turbine with adjustable runner blades operated with a high flow rate.

[SOURCE: IEC 60050-602:1983, 602-02-15]

3.2.18
bulb-type unit
A hydroelectric set with its casing containing the generator and turbine immersed in the water flow.

[SOURCE: IEC 60050-602:1983, 602-02-16]

3.2.19
propeller turbine
A Kaplan type turbine with non-adjustable runner blades suitable for non-varying head sources.

[SOURCE: IEC 60050-602:1983, 602-02-17]

3.2.20
unit generator transformer
set transformer
A transformer connected to the generator terminals through which output power of the generator set is transmitted to the system.

[SOURCE: IEC 60050-602:1983, 602-02-31]

3.2.21
auxiliary transformer of a unit [of a powerstation]
A transformer supplying auxiliaries of a unit [of a power station].

[SOURCE: IEC 60050-602:1983, 602-02-32(33)]

3.2.22
gross output of a set
The electrical power produced at the terminals of the main and auxiliary generators of the set.

[SOURCE: IEC 60050-602:1983, 602-03-04]

3.2.23
gross output of a power station
The electrical power produced at the terminals of the main and auxiliary generators of a power station.

[SOURCE: IEC 60050-602:1983, 602-03-05]

3.2.24
net output of a set
The gross output less the power consumedby the associated auxiliaries.

[SOURCE: IEC 60050-602:1983, 602-03-06]

3.2.25
net output of a power station
The gross output less the power consumed by the associated auxiliaries and less the losses in the associated transformers.

[SOURCE: IEC 60050-602:1983, 602-03-07]

3.2.26
power demand from the system
The power which has to be supplied to the system in order to meet the demand.

[SOURCE: IEC 60050-602:1983, 602-03-13]

3.3 Units

The International System of Units (SI, see ISO 80000-4) has been used throughout this document.

All terms are given in SI Base Units or derived coherent units (for example N instead of $kg \cdot m \cdot s^{-2}$). The basic equations are valid using these Units. This has to be taken into account

if other than coherent SI-Units are used for certain data (for example kilowatt or megawatt instead of watt for power, kilopascal or bar instead of pascal for pressure, min^{-1} instead of s^{-1} for rotational speed, etc.). Temperatures may be given in degrees Celsius because thermodynamic (absolute) temperatures (in Kelvins) are rarely required.

Any other system of units may be used, but only if agreed to in writing by the contracting parties.

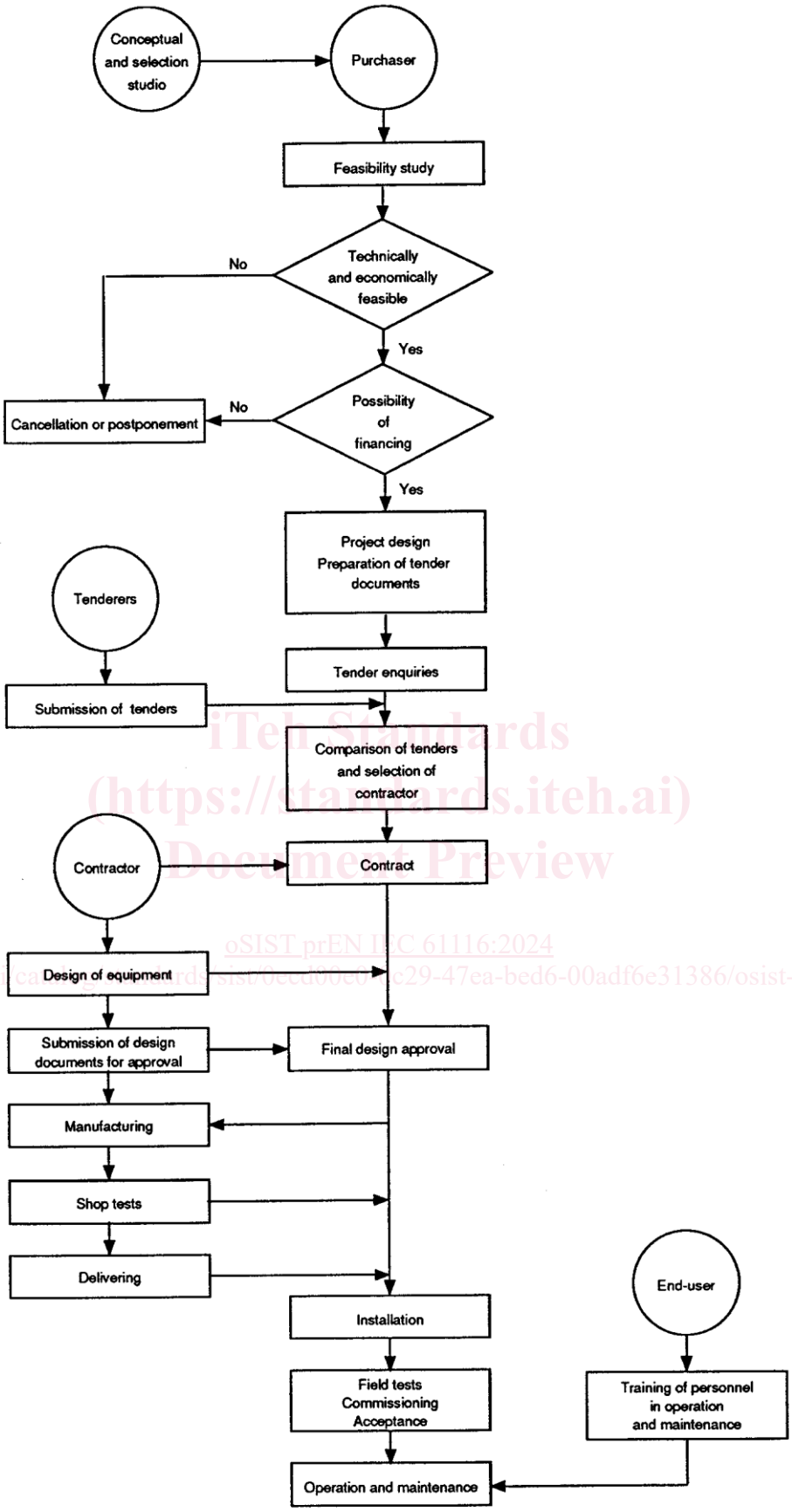
4 Methodology

In the interests of clarity, the sequence of the necessary steps for the construction of a small hydroelectric power plant is represented diagrammatically in Figure 1.

It principally covers the preparation of technical specifications, the examination of tenders, the manufacture, and finally the commercial operation and maintenance of equipment.

This sequence also shows the relationship between the different phases and areas of responsibility of all the parties concerned (consulting engineer, chief resident engineer, and users).

If the purchaser does not have in-house engineering capabilities or the services of a consulting engineer he may call for, to facilitate relations with contractors, a "turn-key" supply, or have at least a leading contractor responsible for the supply of all or part of the electromechanical equipment (e.g. the turbine/generator package, or a "water-to-wire" package).



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349 **Figure 1 – Example of sequence of events**

5 Description of installation and operating conditions of power station

The following data is generally required by the equipment supplier and should appear in the enquiry. In some cases, all these data are not always readily available. Nevertheless, it must be emphasized that the more information that is given the better will the project be understood and therefore the better the technical solution which will result.

5.1 Site conditions

5.1.1 Supply a topographic survey (plan and profile) giving the altitude of the points indicated and the position desired for the main works (see Figure 2), water intake, reservoir, channel, surge tank or head pond, penstock, power plant, headwater, tailwater and their main characteristics (sections, lengths, materials of the channels and penstocks, etc.). Indicate the foundation conditions (sand, rock, soft ground, etc.).

a)