

© Copyright SEK Svensk Elstandard. Reproduction in any form without permission is prohibited.

Vägledning för vattenkraftmaskiner – Montagemetoder och toleranser – Del 5: Bulbturbiner och generatorer

*Guidance for installation procedures and tolerances of hydroelectric machines –
Part 5: Bulb turbines and generators*

Som svensk standard gäller europastandarden EN IEC 63132-5:2023. Den svenska standarden innehåller den officiella engelska språkversionen av EN IEC 63132-5:2023.

Nationellt förord

Europastandarden EN IEC 63132-5:2023

består av:

- **europastandardens ikraftsättningsdokument**, utarbetat inom CENELEC
- **IEC 63132-5, First edition, 2023 - Guidance for installation procedures and tolerances of hydroelectric machines – Part 5: Bulb turbines and generators**

utarbetad inom International Electrotechnical Commission, IEC.

ICS 27.140.00

Denna standard är fastställd av SEK Svensk Elstandard,
som också kan lämna upplysningar om **sakinnehållet** i standarden.
Postadress: Box 1284, 164 29 KISTA
Telefon: 08 - 444 14 00.
E-post: sek@elstandard.se. Internet: www.elstandard.se

Standarder underlättar utvecklingen och höjer elsäkerheten

Det finns många fördelar med att ha gemensamma tekniska regler för bl a mätning, säkerhet och provning och för utförande, skötsel och dokumentation av elprodukter och elanläggningar.

Genom att utforma sådana standarder blir säkerhetsfordringar tydliga och utvecklingskostnaderna rimliga samtidigt som marknadens acceptans för produkten eller tjänsten ökar.

Många standarder inom elområdet beskriver tekniska lösningar och metoder som åstadkommer den elsäkerhet som föreskrivs av svenska myndigheter och av EU.

SEK är Sveriges röst i standardiseringsarbetet inom elområdet

SEK Svensk Elstandard svarar för standardiseringen inom elområdet i Sverige och samordnar svensk medverkan i internationell och europeisk standardisering. SEK är en ideell organisation med frivilligt deltagande från svenska myndigheter, företag och organisationer som vill medverka till och påverka utformningen av tekniska regler inom elektrotekniken.

SEK samordnar svenska intressenters medverkan i SEKs tekniska kommittéer och stödjer svenska experters medverkan i internationella och europeiska projekt.

Stora delar av arbetet sker internationellt

Utformningen av standarder sker i allt väsentligt i internationellt och europeiskt samarbete. SEK är svensk nationalkommitté av International Electrotechnical Commission (IEC) och Comité Européen de Normalisation Electrotechnique (CENELEC).

Standardiseringsarbetet inom SEK är organiserat i referensgrupper bestående av ett antal tekniska kommittéer som speglar hur arbetet inom IEC och CENELEC är organiserat.

Arbetet i de tekniska kommittéerna är öppet för alla svenska organisationer, företag, institutioner, myndigheter och statliga verk. Den årliga avgiften för deltagandet och intäkter från försäljning finansierar SEKs standardiseringsverksamhet och medlemsavgift till IEC och CENELEC.

Var med och påverka!

Den som deltar i SEKs tekniska kommittéarbete har möjlighet att påverka framtida standarder och får tidig tillgång till information och dokumentation om utvecklingen inom sitt teknikområde. Arbetet och kontakterna med kollegor, kunder och konkurrenter kan gynnsamt påverka enskilda företags affärsutveckling och bidrar till deltagarnas egen kompetensutveckling.

Du som vill dra nytta av dessa möjligheter är välkommen att kontakta SEKs kansli för mer information.

SEK Svensk Elstandard

Box 1284
164 29 Kista
Tel 08-444 14 00
www.elstandard.se

ICS 27.140

English Version

**Guidance for installation procedures and tolerances of
hydroelectric machines - Part 5: Bulb turbines and generators
(IEC 63132-5:2023)**

Lignes directrices des procédures et tolérances
d'installation des machines hydroélectriques - 5: Turbines et
alternateurs de type bulbe
(IEC 63132-5:2023)

Leitfaden für Installations-Prozeduren und -Toleranzen von
hydroelektrischen Maschinen - Teil 5
(IEC 63132-5:2023)

This European Standard was approved by CENELEC on 2023-05-19. 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 CEN-CENELEC Management Centre or to any 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 CENELEC member into its own language and notified to the CEN-CENELEC Management Centre has the same status as the official versions.

CENELEC members are the national electrotechnical committees of Austria, Belgium, Bulgaria, Croatia, Cyprus, the Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, the Netherlands, Norway, Poland, Portugal, Republic of North Macedonia, Romania, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Türkiye and the United Kingdom.



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

European foreword

The text of document 4/456/FDIS, future edition 1 of IEC 63132-5, prepared by IEC/TC 4 "Hydraulic turbines" was submitted to the IEC-CENELEC parallel vote and approved by CENELEC as EN IEC 63132-5:2023.

The following dates are fixed:

- latest date by which the document has to be implemented at national level by publication of an identical national standard or by endorsement (dop) 2024-02-19
- latest date by which the national standards conflicting with the document have to be withdrawn (dow) 2026-05-19

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CENELEC shall not be held responsible for identifying any or all such patent rights.

Any feedback and questions on this document should be directed to the users' national committee. A complete listing of these bodies can be found on the CENELEC website.

Endorsement notice

The text of the International Standard IEC 63132-5:2023 was approved by CENELEC as a European Standard without any modification.

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

IEC 63132-1 NOTE Approved as EN IEC 63132-1

IEC 63132-2 NOTE Approved as EN IEC 63132-2

INTERNATIONAL STANDARD

NORME INTERNATIONALE



**Guidance for installation procedures and tolerances of hydroelectric machines –
Part 5: Bulb turbines and generators**

**Lignes directrices des procédures et tolérances d'installation des machines
hydroélectriques –
Partie 5: Turbines et alternateurs de type bulbe**

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

COMMISSION
ELECTROTECHNIQUE
INTERNATIONALE

ICS 27.140

ISBN 978-2-8322-6742-4

**Warning! Make sure that you obtained this publication from an authorized distributor.
Attention! Veuillez vous assurer que vous avez obtenu cette publication via un distributeur agréé.**

CONTENTS

FOREWORD.....	4
1 Scope.....	6
2 Normative references	6
3 Terms and definitions	6
4 Installation flowchart.....	6
4.1 Turbine and generator embedded parts.....	6
4.2 Turbine and generator mechanical parts	7
5 Steps.....	9
5.1 Turbine and generator embedded parts.....	9
5.1.1 Step 1: Benchmarks set-up.....	9
5.1.2 Step 2: Powerhouse primary stage concrete with anchor plates and embedded pipes	9
5.1.3 Step 3: Anchor plates, embedded pipes and workspace verification.....	9
5.1.4 Step 4: Handing over to installation	10
5.1.5 Step 5: Draft tube installation.....	10
5.1.6 Step 6: Secondary embedded pipes installation around the draft tube	12
5.1.7 Step 7: Handing over to concreting phase.....	12
5.1.8 Step 8: Draft tube embedment	13
5.1.9 Step 9: Concrete voids testing	13
5.1.10 Step 10: Draft tube grout injection	14
5.1.11 Step 11: Handing over to installation	14
5.1.12 Step 12: Draft tube dimensional inspection after embedment.....	14
5.1.13 Step 13: Installation of turbine housing	15
5.1.14 Step 14: Installation of pier nose liner.....	17
5.1.15 Step 15: Installation of generator foundation base	17
5.1.16 Step 16: Installation of generator hatch cover frame	18
5.1.17 Step 17: Secondary embedded pipes installation around the turbine housing.....	18
5.1.18 Step 18: Handing over to concreting phase.....	18
5.1.19 Step 19: Embedment of turbine housing, pier nose, generator foundation base plate and hatch cover frame.....	18
5.1.20 Step 20: Handing over to installation	19
5.1.21 Step 21: Corrosion protection for embedded parts	19
5.1.22 Step 22: Turbine and generator embedded parts complete	19
5.1.23 Step 23: Turbine and generator mechanical parts installation	19
5.2 Turbine and generator mechanical parts	20
5.2.1 Step 1: Turbine and generator embedded parts complete	20
5.2.2 Step 2: Handing over to installation	20
5.2.3 Step 3: Dimensional inspection of turbine housing after embedment.....	20
5.2.4 Step 4-1: Distributor assembly.....	20
5.2.5 Step 4: Distributor installation.....	21
5.2.6 Step 5: Lowering and storing of lower half of discharge ring	21
5.2.7 Step 6-1: Pre-assembly of shaft and bearings.....	21
5.2.8 Step 6: Shaft installation.....	21
5.2.9 Step 7: Shaft free	22
5.2.10 Step 8: Combined bearing installation.....	23
5.2.11 Step 9: Guide vane servomotor and counterweight installation	23

5.2.12	Step 10-1: Turbine runner assembly	24
5.2.13	Step 10: Runner installation.....	24
5.2.14	Step 11: Guide vane apparatus final adjustment	25
5.2.15	Step 12: Lowering and storing of bulb nose	26
5.2.16	Step 13-1: Rotor assembly	26
5.2.17	Step 13: Rotor installation	27
5.2.18	Step 14: Discharge ring installation	27
5.2.19	Step 15: Shaft alignment	28
5.2.20	Step 16-1: Stator assembly.....	29
5.2.21	Step 16: Stator installation.....	29
5.2.22	Step 17: Shaft seal installation	30
5.2.23	Step 18: Runner blade operating pipes installation	30
5.2.24	Step 19: Runner oil supply head and extension shaft installation	30
5.2.25	Step 20: Runner cone installation	31
5.2.26	Step 21: Bulb nose installation.....	31
5.2.27	Step 22: Generator supports installation	31
5.2.28	Step 23: Access shaft installation and hatch cover closing.....	31
5.2.29	Step 24: Remaining turbine parts installation completion	32
5.2.30	Step 25: Final installation and cabling generator.....	32
5.2.31	Step 26: Generator auxiliary systems installation.....	32
5.2.32	Step 27: Turbine auxiliary systems installation.....	33
5.2.33	Step 28: Cleaning, painting and inspection before initial tests.....	33
5.2.34	Step 29: Turbine and generator mechanical parts complete	33
5.2.35	Step 30: Commissioning	33
	Bibliography.....	34
	Figure 1 – Generic installation flowchart – Bulb turbine and generator embedded parts	7
	Figure 2 – Generic installation flowchart – Bulb turbine and generator mechanical parts.....	8
	Figure 3 – Draft tube liner installation	12
	Figure 4 – Draft tube liner embedment plan	13
	Figure 5 – Radial tilting of turbine housing flange.....	16
	Figure 6 – Turbine housing installation	17
	Figure 7 – Shaft free	23
	Figure 8 – Guide vane apparatus final adjustment	26
	Figure 9 – Discharge ring installation	28
	Table 1 – Draft tube installation tolerances	11
	Table 2 – Turbine housing installation tolerances.....	15
	Table 3 – Shaft free verifications.....	22
	Table 4 – Guide vane apparatus adjustment tolerances	25
	Table 5 – Discharge ring measurement.....	28
	Table 6 – Stator installation measurement	29

INTERNATIONAL ELECTROTECHNICAL COMMISSION

**GUIDANCE FOR INSTALLATION PROCEDURES AND
TOLERANCES OF HYDROELECTRIC MACHINES –**
Part 5: Bulb turbines and generators**FOREWORD**

- 1) The International Electrotechnical Commission (IEC) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of IEC is to promote international co-operation on all questions concerning standardization in the electrical and electronic fields. To this end and in addition to other activities, IEC publishes International Standards, Technical Specifications, Technical Reports, Publicly Available Specifications (PAS) and Guides (hereafter referred to as "IEC Publication(s)"). Their preparation is entrusted to technical committees; any IEC National Committee interested in the subject dealt with may participate in this preparatory work. International, governmental and non-governmental organizations liaising with the IEC also participate in this preparation. IEC collaborates closely with the International Organization for Standardization (ISO) in accordance with conditions determined by agreement between the two organizations.
- 2) The formal decisions or agreements of IEC on technical matters express, as nearly as possible, an international consensus of opinion on the relevant subjects since each technical committee has representation from all interested IEC National Committees.
- 3) IEC Publications have the form of recommendations for international use and are accepted by IEC National Committees in that sense. While all reasonable efforts are made to ensure that the technical content of IEC Publications is accurate, IEC cannot be held responsible for the way in which they are used or for any misinterpretation by any end user.
- 4) In order to promote international uniformity, IEC National Committees undertake to apply IEC Publications transparently to the maximum extent possible in their national and regional publications. Any divergence between any IEC Publication and the corresponding national or regional publication shall be clearly indicated in the latter.
- 5) IEC itself does not provide any attestation of conformity. Independent certification bodies provide conformity assessment services and, in some areas, access to IEC marks of conformity. IEC is not responsible for any services carried out by independent certification bodies.
- 6) All users should ensure that they have the latest edition of this publication.
- 7) No liability shall attach to IEC or its directors, employees, servants or agents including individual experts and members of its technical committees and IEC National Committees for any personal injury, property damage or other damage of any nature whatsoever, whether direct or indirect, or for costs (including legal fees) and expenses arising out of the publication, use of, or reliance upon, this IEC Publication or any other IEC Publications.
- 8) Attention is drawn to the Normative references cited in this publication. Use of the referenced publications is indispensable for the correct application of this publication.
- 9) Attention is drawn to the possibility that some of the elements of this IEC Publication may be the subject of patent rights. IEC shall not be held responsible for identifying any or all such patent rights.

IEC 63132-5 has been prepared by IEC technical committee 4: Hydraulic turbines. It is an International Standard.

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

Draft	Report on voting
4/456/FDIS	4/462/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.

A list of all parts in the IEC 63132 series, published under the general title *Guidance for installation procedures and tolerances of hydroelectric machines*, can be found on the IEC website.

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.

IMPORTANT – The "colour inside" logo on the cover page of this document indicates that it contains colours which are considered to be useful for the correct understanding of its contents. Users should therefore print this document using a colour printer.

GUIDANCE FOR INSTALLATION PROCEDURES AND TOLERANCES OF HYDROELECTRIC MACHINES –

Part 5: Bulb turbines and generators

1 Scope

The purpose of this document is to establish, in a general way, suitable procedures and tolerances for the installation of bulb turbine and generator. This document presents a typical assembly and whenever the words “turbine” and “generator” are used in this part, it refers to bulb turbine and generator. There are many possible ways to assemble a unit. The size of the machine, the design of the machine, the layout of the powerhouse, the sequence of concreting or the delivery schedule of the components are some of the elements that could result in additional steps, or the elimination of some steps and/or assembly sequences.

It is understood that a publication of this type will be binding only if, and to the extent that, both contracting parties have agreed upon it.

The document excludes matters of purely commercial interest, except those inextricably bound up with the conduct of installation. It also excludes specifications of the civil works but this aspect of the work should be taken into consideration during the assembly of the units.

Wherever the document specifies that documents, drawings or information are supplied by a manufacturer (or by manufacturers), each individual manufacturer will furnish the appropriate information for their own supply only.

2 Normative references

There are no normative references in this document.