



# SLOVENSKI STANDARD

## SIST EN 60041:2001

01-marec-2001

Nadomešča:  
SIST IEC 60041:1999

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**Terenski prevzemni preskusi za ugotavljanje zmogljivosti vodnih turbin, akumulacijskih črpalk in črpalnih turbin (IEC 60041:1991, spremenjen)**

Field acceptance tests to determine the hydraulic performance of hydraulic turbines, storage pumps and pump-turbines

Abnahmeversuche zur Bestimmung der hydraulischen Eigenschaften von Wasserturbinen, Speicherpumpen und Pumpturbinen

Essais de réception sur place des turbines hydrauliques, pompes d'accumulation et pompes-turbines, en vue de la détermination de leurs performances hydrauliques

**Ta slovenski standard je istoveten z: EN 60041:1994**

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**ICS:**

27.140      Vodna energija      Hydraulic energy engineering

**SIST EN 60041:2001**      en

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EUROPEAN STANDARD

EN 60041

NORME EUROPEENNE

EUROPÄISCHE NORM

September 1994

ICS 23.080;23.100.10

Descriptors: Turbine, hydraulic turbomachine, pump, pump-turbine, acceptance test, field test, hydraulic characteristics, measurement, test conditions, calculation

## ENGLISH VERSION

Field acceptance tests to determine the hydraulic performance of hydraulic turbines; storage pumps and pump-turbines  
(IEC 41:1991, modified)

Essais de réception sur place des turbines hydrauliques, pompes d'accumulation et pompes-turbines, en vue de la détermination de leurs performances hydrauliques  
(CEI 41:1991, modifiée)

Abnahmeversuche zur Bestimmung der hydraulischen Eigenschaften von Wasserturbinen, Speicherpumpen und Pumpturbinen

(IEC 41:1991, modifiziert)

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This European Standard was approved by CENELEC on 1994-03-08. 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 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 Central Secretariat has the same status as the official versions.

CENELEC members are the national electrotechnical committees of Austria, Belgium, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and United Kingdom.

## CENELEC

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

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

### Foreword

The CENELEC questionnaire procedure, performed for finding out whether or not the International Standard IEC 41:1991 could be accepted without textual changes, has shown that one common modification was necessary for the acceptance as European Standard.

The reference document together with the common modifications prepared by the French National Committee was submitted to the CENELEC members for formal vote and was approved by CENELEC as EN 60041 on 1994-03-08.

The following dates were fixed:

- latest date of publication of an identical national standard (dop) 1995-03-15
- latest date of withdrawal of conflicting national standards (dow) 1995-03-15

Annexes designated "normative" are part of the body of the standard.  
In this standard, annex ZA is normative.

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## iTeh STANDARD PREVIEW Endorsement notice (standards.iteh.ai)

The text of the International Standard IEC 41:1991 was approved by CENELEC as a European Standard with an agreed common modification as given below.

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COMMON MODIFICATION

<u>Clause</u>	<u>Modification</u>
1	<b>Scope and object</b> (see editorial corrections)
1.3	<i>Types of machines</i>

Add between the two present paragraphs:

This standard applies to machines with unit power greater than 5 MW or with reference diameter greater than 3 m. Although the complex and detailed procedure involved is not generally justified for machines with smaller power and size, nevertheless this standard may be used for such machines by agreement between purchaser and supplier.

The following editorial corrections apply to the English text of IEC 41:1991:

<u>(Sub)clause</u>	<u>Correction</u>
Page 13	<p>Add the first figure "1" to each of the clause and subclause numbers to read as follows:</p> <p><b>1 Scope and object</b>  <b>1.1 Scope</b>            1.1.1 This ...            1.1.2 Model ..;            1.1.3 Tests ...  <b>1.2 Object</b>            1.3 <i>Type of machines</i></p>
2.3.1.7	<p>Replace the symbols as follows:</p> <p>- not to be exceeded <math>\text{//////}</math>            - to be reached <math>\bigcirc</math> or <math>\text{//////}</math></p>
2.3.6.4	Delete the – (minus) sign in the formula of $\bar{g}$ .
2.3.7 Figure 5b	<p><b>iTeh STANDARD PREVIEW</b> (standards.iteh.ai)</p> <p>Group the equations for <math>Z_1</math> and <math>Z_2</math> to avoid creating the impression that each one is devoted to only half of the figure.</p>
Figure 5c	<p>ADD Figure 5c  <a href="https://standards.iteh.ai/catalog/standards/sist/2d822d7c-0e22-4580-8664-b98367c307cb/sist-en-60041-1991">https://standards.iteh.ai/catalog/standards/sist/2d822d7c-0e22-4580-8664-b98367c307cb/sist-en-60041-1991</a>            Add "<math>z_1 = z_2</math>" at the right of the figure.</p>
10.2.3.2	Replace "Annexes F and G of ISO 3354" by "Annexes H and J of ISO 3354".
10.2.5.6	In the definition of "m", replace "the coefficient" by "a coefficient".
11.2.2.3 Figure 34b	<p>Replace the last but one equation by:  <math>Z_{B'} = z_{B'} - z_B</math></p>
11.2.5.2.2 Figure 37	Group the equations for $Z_1$ and $Z_2$ to avoid creating the impression that each one is devoted to only half of the figure.
Figure 38	Add " $z_1 = z_2$ " at the right of the figure.
11.4.3 Figure 42	Replace " $d = 3 \text{ mm à } 6 \text{ mm}$ " by " $d = 3 \text{ mm to } 6 \text{ mm}$ ".
11.4.6.2 Figure 45	In the formula for $\rho_M$ , replace " $\Delta\Delta p$ " by " $\Delta p$ ".
12.1.1.1.2	In the formula for $\cos \varphi_s$ replace " $P_{as}(2w)$ " by " $P_{as(2w)}$ ".

<u>(Sub)clause</u>	<u>Correction</u>
14.3.4	Replace "ou" by "or" between the two formulas.
15.2.1.1	In the first paragraph, replace "and $n$ theoretically" by "and exponent $n$ is theoretically".
Appendix C C2	In the first paragraph after the table, replace " $\bar{Y}$ " and " $\bar{Y}_r$ " by " $Y_r$ ".

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## Annex ZA (normative)

Other international publications quoted in this standard  
with the references of the relevant European publications

This European Standard incorporates by dated or undated reference, provisions from other publications. These normative references are cited at 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 European Standard only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies.

NOTE: When the international publication has been modified by CENELEC common modifications, indicated by (mod), the relevant EN/HD applies.

IEC Publication	Date	Title	EN/HD	Date
34-2	1972	Rotating electrical machines Part 2: Methods for determining losses and efficiency of rotating electrical machinery from tests (excluding machines for traction vehicles)	HD 53.2 S1	1982
34-2A	1974	First supplement: Measurements of losses by the calorimetric method		
185 (mod)	1987	Current transformers	HD 553 S2 <sup>1)</sup>	1993
186 (mod)	1987	Voltage transformers	HD 554 S1 <sup>2)</sup>	1992
193 A1	1965 1977	International code for model acceptance test of hydraulic turbines	-	-
193A	1972	First supplement to IEC 193	-	-
308	1970	International code for testing of speed governing systems for hydraulic turbines	-	-
497	1976	International code for model acceptance tests of storage pumps	-	-
545	1976	Guide for commissioning, operation and maintenance of hydraulic turbines	-	-
609	1978	Cavitation pitting evaluation in hydraulic turbines, storage pumps and pump-turbines	-	-
805	1985	Guide for commissioning, operation and maintenance of storage pumps and of pump-turbines operating as pumps	-	-

1) HD 553 S2 includes A1:1988 to IEC 185

2) HD 554 S1 includes A1:1988 to IEC 186

ISO publications

31-3	1978	Quantities and units of mechanics (Amendment 01:1985)
748	1979	Liquid flow measurements in open channels - Velocity-area methods
1438-1	1980	Water flow measurement in open channels using weirs and Venturi flumes Part 1: Thin plate weirs
2186	1973	Fluid flow in closed conduits - Connections for pressure signal transmissions between primary and secondary elements
2533	1975	Standard Atmosphere (Addendum 01:1985)
2537	1988	Liquid flow measurement in open channels - Rotating element current-meters
2975		Measurement of water flow in closed conduits - Tracer methods
2975-1	1974	Part I: General
2975-2	1975	Part II: Constant rate injection method using non-radioactive tracers
2975-3	1976	Part III: Constant rate injection method using radioactive tracers
2975-6	1977	Part VI: Transit time method using non-radioactive tracers
2975-7	1977	Part VII: Transit time method using radioactive tracers
3354	1988	Measurement of clean water flow in closed conduits - Velocity area method using current-meters in full conduits and under regular flow conditions
3455	1976	Liquid flow measurement in open channels - Calibration of rotating-element current-meters in straight open tanks
3966	1977	Measurement of fluid flow in closed conduits - Velocity area method using Pitot static tubes
4373	1979	Measurement of liquid flow in open channels - Water level measuring devices
5167	1980	Measurement of fluid flow by means of orifice plates, nozzles and Venturi tubes inserted in circular cross-section conduits running full
5168	1978	Measurement of fluid flow - Estimation of uncertainty of flow-rate measurement
7066		Assessment of uncertainty in the calibration and use of flow measurement devices
7066-1	1989	Part 1: Linear calibration relationships
7066-2	1988	Part 2: Non-linear calibration relationships



# INTERNATIONAL STANDARD

# IEC 60041

Third edition  
1991-11

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**Field acceptance tests to determine the  
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Commission Electrotechnique Internationale  
International Electrotechnical Commission  
Международная Электротехническая Комиссия

PRICE CODE

**XK**

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