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## Hydraulic turbines, storage pumps and pump-turbines – Rehabilitation and performance improvement

INTERNATIONAL  
ELECTROTECHNICAL  
COMMISSION

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ICS 27.140

ISBN 978-2-8322-4433-3

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## INTERNATIONAL ELECTROTECHNICAL COMMISSION

# HYDRAULIC TURBINES, STORAGE PUMPS AND PUMP-TURBINES – REHABILITATION AND PERFORMANCE IMPROVEMENT

## FOREWORD

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**This Redline version provides you with a quick and easy way to compare all the changes between this standard and its previous edition. A vertical bar appears in the margin wherever a change has been made. Additions are in green text, deletions are in strikethrough red text.**

International Standard IEC 62256 has been prepared by IEC technical committee 4: Hydraulic turbines.

This second edition cancels and replaces the first edition published in 2008. This edition constitutes a technical revision.

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

- Tables 2 to 23 modified, completed and moved to Annex A;
- 7.3.2:
  - subclauses moved with text changes;
  - new subclauses on temperature, noise, galvanic corrosion, galling and replacement of components without assessment;
- 7.3.3: complete new subclause on residual life;
- Tables 29 to 32 moved to Annex C;
- new Annex B with assessment examples.

The text of this standard is based on the following documents:

| FDIS       | Report on voting |
|------------|------------------|
| 4/323/FDIS | 4/326/RVD        |

Full information on the voting for the approval of this International Standard can be found in the report on voting indicated in the above table.

This document has been drafted in accordance with the ISO/IEC Directives, Part 2.

The committee has decided that the contents of this document will remain unchanged until the stability date indicated on the IEC website under "<http://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- withdrawn,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.

A bilingual version of this publication may be issued at a later date.

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## INTRODUCTION

Hydro plant owners make significant investments annually in rehabilitating plant equipment (turbines, generators, transformers, penstocks, gates etc.) and structures in order to improve the level of service to their customers and to optimize their revenue. In the absence of guidelines, owners may be spending needlessly, or may be taking unnecessary risks and thereby achieving results that are less than optimal. This document is intended to be a tool in the optimisation and decision process.

~~IEC TC 4 wishes to thank IEA for providing its document “Guidelines on Methodology for Hydroelectric Francis Turbine Upgrading by Runner Replacement” as a starting point for the writing of this document. IEC TC 4 appreciates this contribution and acknowledges that the IEA document provided a good foundation upon which to build this IEC document.~~

Edition 1 of this International Standard was based on the IEA document *Guidelines on Methodology for Hydroelectric Francis Turbine Upgrading by Runner Replacement*.

## HYDRAULIC TURBINES, STORAGE PUMPS AND PUMP-TURBINES – REHABILITATION AND PERFORMANCE IMPROVEMENT

### 1 ~~Scope and object~~

This document covers turbines, storage pumps and pump-turbines of all sizes and of the following types:

- Francis;
- Kaplan;
- propeller;
- Pelton (turbines only);
- bulb **turbines**.

This document also identifies without detailed discussion, other powerhouse equipment that could affect or be affected by a turbine, storage pump, or pump-turbine rehabilitation.

The object of this document is to assist in identifying, evaluating and executing rehabilitation and performance improvement projects for hydraulic turbines, storage pumps and pump-turbines. This document can be used by owners, consultants, and suppliers to define:

- needs and economics for rehabilitation and performance improvement;
- scope of work;
- specifications;
- evaluation of results.

This document is intended to be:

- an aid in the decision process;
- an extensive source of information on rehabilitation;
- an identification of the key milestones in the rehabilitation process;
- an identification of the points ~~that should~~ to be addressed in the decision processes.

This document is not intended to be a detailed engineering manual nor a maintenance document.

### 2 **Normative references**

There are no normative references in this document.



# INTERNATIONAL STANDARD

# NORME INTERNATIONALE



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**Hydraulic turbines, storage pumps and pump-turbines – Rehabilitation and performance improvement**

**Turbines hydrauliques, pompes d'accumulation et pompes-turbines –  
Réhabilitation et amélioration des performances**

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ISBN 978-2-8322-5201-7

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## INTERNATIONAL ELECTROTECHNICAL COMMISSION

# HYDRAULIC TURBINES, STORAGE PUMPS AND PUMP-TURBINES – REHABILITATION AND PERFORMANCE IMPROVEMENT

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International Standard IEC 62256 has been prepared by IEC technical committee 4: Hydraulic turbines.

This second edition cancels and replaces the first edition published in 2008. This edition constitutes a technical revision.

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

- Tables 2 to 23 modified, completed and moved to Annex A;
- 7.3.2:
  - subclauses moved with text changes;
  - new subclauses on temperature, noise, galvanic corrosion, galling and replacement of components without assessment;
- 7.3.3: complete new subclause on residual life;
- Tables 29 to 32 moved to Annex C;
- new Annex B with assessment examples.

This bilingual version (2017-12) corresponds to the monolingual English version, published in 2017-05.

The text of this standard is based on the following documents:

| FDIS       | Report on voting |
|------------|------------------|
| 4/323/FDIS | 4/326/RVD        |

Full information on the voting for the approval of this International Standard can be found in the report on voting indicated in the above table.

The French version of this standard has not been voted upon.

This document has been drafted in accordance with the ISO/IEC Directives, Part 2.

The committee has decided that the contents of this document will remain unchanged until the stability date indicated on the IEC website under "<http://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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## INTRODUCTION

Hydro plant owners make significant investments annually in rehabilitating plant equipment (turbines, generators, transformers, penstocks, gates etc.) and structures in order to improve the level of service to their customers and to optimize their revenue. In the absence of guidelines, owners may be spending needlessly, or may be taking unnecessary risks and thereby achieving results that are less than optimal. This document is intended to be a tool in the optimisation and decision process.

Edition 1 of this International Standard was based on the IEA document *Guidelines on Methodology for Hydroelectric Francis Turbine Upgrading by Runner Replacement*.

## HYDRAULIC TURBINES, STORAGE PUMPS AND PUMP-TURBINES – REHABILITATION AND PERFORMANCE IMPROVEMENT

### 1 Scope

This document covers turbines, storage pumps and pump-turbines of all sizes and of the following types:

- Francis;
- Kaplan;
- propeller;
- Pelton (turbines only);
- bulb turbines.

This document also identifies without detailed discussion, other powerhouse equipment that could affect or be affected by a turbine, storage pump, or pump-turbine rehabilitation.

The object of this document is to assist in identifying, evaluating and executing rehabilitation and performance improvement projects for hydraulic turbines, storage pumps and pump-turbines. This document can be used by owners, consultants, and suppliers to define:

- needs and economics for rehabilitation and performance improvement;
- scope of work;
- specifications;
- evaluation of results.

This document is intended to be:

- an aid in the decision process;
- an extensive source of information on rehabilitation;
- an identification of the key milestones in the rehabilitation process;
- an identification of the points to be addressed in the decision processes.

This document is not intended to be a detailed engineering manual nor a maintenance document.

### 2 Normative references

There are no normative references in this document.

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## COMMISSION ÉLECTROTECHNIQUE INTERNATIONALE

# TURBINES HYDRAULIQUES, POMPES D'ACCUMULATION ET POMPES-TURBINES – RÉHABILITATION ET AMÉLIORATION DES PERFORMANCES

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La Norme internationale IEC 62256 a été établie par le comité d'études 4 de l'IEC: Turbines hydrauliques.

Cette deuxième édition annule et remplace la première édition parue en 2008. Cette édition constitue une révision technique.

Cette édition inclut les modifications techniques majeures suivantes par rapport à l'édition précédente:

- modifications et amélioration des Tableaux 2 à 23 et déplacement de ceux-ci en Annexe A
- 7.3.2:
  - Sous-paragraphes modifiés et déplacés;

- nouveaux sous-paragraphe sur la température, la corrosion galvanique, le grippage et le remplacement de composants sans évaluation;
- 7.3.3 sur la durée de vie résiduelle: complètement nouveau;
- Tableaux 29 à 32 déplacés en Annexe C;
- nouvelle Annexe B avec exemples d'évaluation.

La présente version bilingue (2017-12) correspond à la version anglaise monolingue publiée en 2017-05.

Le texte anglais de cette norme est issu des documents 4/323/FDIS et 4/326/RVD.

Le rapport de vote 4/326/RVD donne toute information sur le vote ayant abouti à l'approbation de cette norme.

La version française de cette norme n'a pas été soumise au vote.

Cette publication a été rédigée selon les Directives ISO/IEC, Partie 2.

Le comité a décidé que le contenu de cette publication ne sera pas modifié avant la date de stabilité indiquée sur le site web de l'IEC sous "<http://webstore.iec.ch>" dans les données relatives à la publication recherchée. A cette date, la publication sera

- reconduite,
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## INTRODUCTION

Les propriétaires de centrales hydroélectriques consentent d'importants investissements chaque année pour réhabiliter des équipements (turbines, alternateurs, transformateurs, conduites forcées, vannes, etc.) et leurs structures afin d'améliorer le niveau de service apporté à leurs clients et optimiser leurs revenus. En l'absence de lignes directrices, les propriétaires peuvent subir des dépenses ou peuvent être exposés à des risques inutiles, et ainsi atteindre des résultats non optimaux. Le présent document constitue un outil dans le cadre du processus d'optimisation et de décision.

La première édition de cette Norme internationale s'appuyait sur la publication suivante de l'Agence Internationale de l'Energie (IEA): *Guidelines on Methodology for Hydroelectric Francis Turbine Upgrading by Runner Replacement* (disponible en anglais seulement).

## **TURBINES HYDRAULIQUES, POMPES D'ACCUMULATION ET POMPES-TURBINES – RÉHABILITATION ET AMÉLIORATION DES PERFORMANCES**

### **1 Domaine d'application**

Le domaine d'application du présent document comprend les turbines, les pompes d'accumulation et les pompes-turbines de toutes tailles et des types suivants:

- Francis;
- Kaplan;
- hélice;
- Pelton (turbines seulement);
- bulbe.

Le présent document identifie également, sans fournir d'éléments détaillés, les autres équipements des centrales qui pourraient affecter ou être affectés par la réhabilitation des turbines hydrauliques, des pompes d'accumulation ou des pompes-turbines.

Le présent document a pour objet de fournir une aide à l'identification, à l'évaluation et à l'exécution de projets de réhabilitation et d'amélioration des performances de turbines hydrauliques, de pompes d'accumulation et de pompes-turbines. Le présent document peut être utilisé par les propriétaires, les consultants et les fournisseurs pour définir:

- les besoins et les aspects financiers liés à la réhabilitation et à l'amélioration des performances;
- l'envergure des travaux;
- les spécifications;
- l'évaluation des résultats.

Le présent document se veut:

- une aide au processus de décision;
- une bonne source d'informations en matière de réhabilitation;
- un indicateur des étapes-clés du processus de réhabilitation;
- un indicateur des éléments qu'il convient de prendre en considération dans le processus de décision.

Le présent guide n'est pas un manuel d'ingénierie détaillé, ni un guide d'entretien.

### **2 Références normatives**

Le présent document ne contient aucune référence normative.