

Hydraulic machines - Guidelines for dealing with hydro-abrasive erosion in kaplan, francis and pelton turbines

EESTI STANDARDI EESSÕNA

NATIONAL FOREWORD

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English Version

Hydraulic machines - Guidelines for dealing with hydro-abrasive erosion in kaplan, francis and pelton turbines (IEC 62364:2019)

Machines hydrauliques - Lignes directrices relatives au traitement de l'érosion hydro-abrasive des turbines kaplan, francis et pelton
(IEC 62364:2019)

Wasserturbinen - Leitfaden für den Umgang mit hydroabrasiver Erosion in Kaplan-, Francis und Pelton-Turbinen
(IEC 62364:2019)

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European foreword

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

| | | |
|------------------|------|----------------------------------|
| IEC 60193:1999 | NOTE | Harmonized as EN 60193:1999. |
| IEC 60609-2:1997 | NOTE | Harmonized as EN 60609-2:1999. |
| IEC 60041 | NOTE | Harmonized as EN 60041. |
| ISO 4288 | NOTE | Harmonized as EN ISO 4288. |
| ISO 2178 | NOTE | Harmonized as EN ISO 2178. |
| ISO 6507-1 | NOTE | Harmonized as EN ISO 6507-1. |
| ISO 14916:2017 | NOTE | Harmonized as EN ISO 14916:2017. |

CONTENTS

| | |
|---|----|
| FOREWORD..... | 5 |
| INTRODUCTION..... | 7 |
| 1 Scope..... | 8 |
| 2 Terms, definitions and symbols..... | 8 |
| 3 Prediction of hydro-abrasive erosion rate..... | 12 |
| 3.1 Model for hydro-abrasive erosion depth | 12 |
| 3.2 Reference model..... | 13 |
| 3.3 Simplified hydro-abrasive erosion evaluation | 14 |
| 4 Design..... | 15 |
| 4.1 General..... | 15 |
| 4.2 Selection of materials with high resistance to hydro-abrasive erosion and coating..... | 16 |
| 4.3 Stainless steel overlays | 16 |
| 4.4 Water conveyance system | 16 |
| 4.5 Valve | 17 |
| 4.5.1 General | 17 |
| 4.5.2 Protection (closing) of the gap between housing and trunnion..... | 17 |
| 4.5.3 Stops located outside the valve | 17 |
| 4.5.4 Proper capacity of inlet valve operator | 18 |
| 4.5.5 Increase bypass size to allow higher guide vane leakage | 18 |
| 4.5.6 Bypass system design | 18 |
| 4.6 Turbine | 18 |
| 4.6.1 General | 18 |
| 4.6.2 Hydraulic design..... | 18 |
| 4.6.3 Mechanical design..... | 20 |
| 5 Operation and maintenance..... | 26 |
| 5.1 Operation..... | 26 |
| 5.2 Spares and regular inspections | 28 |
| 5.3 Particle sampling and monitoring | 28 |
| 6 Materials with high resistance to hydro-abrasive erosion | 29 |
| 6.1 Guidelines concerning relative hydro-abrasive erosion resistance of materials including hydro-abrasive erosion resistant coatings | 29 |
| 6.1.1 General | 29 |
| 6.1.2 Discussion and conclusions | 30 |
| 6.2 Guidelines concerning maintainability of hydro-abrasive erosion resistant coating materials | 30 |
| 6.2.1 Definition of terms used in this subclause | 30 |
| 6.2.2 Time between overhaul for protective coatings | 30 |
| 6.2.3 Repair of protective coatings | 31 |
| 7 Guidelines on insertions into specifications..... | 32 |
| 7.1 General..... | 32 |
| 7.2 Properties of particles going through the turbine | 33 |
| 7.3 Size distribution of particles | 34 |
| Annex A (informative) <i>PL</i> calculation example..... | 35 |
| Annex B (informative) Measuring and recording hydro-abrasive erosion damages | 37 |
| B.1 Recording hydro-abrasive erosion damage | 37 |

| | | |
|--|---|----|
| B.2 | Pelton runner without coating..... | 37 |
| B.3 | Needle tip and mouth piece without coating | 38 |
| B.4 | Pelton runner with hardcoating..... | 38 |
| B.5 | Needle tip, seat ring and nozzle housing with coating | 38 |
| B.6 | Francis runner and stationary labyrinth without coating..... | 39 |
| B.7 | Francis runner with coating and stationary labyrinth..... | 39 |
| B.8 | Guide vanes and facing plates without coating..... | 39 |
| B.9 | Guide vanes and facing plates with coating..... | 40 |
| B.10 | Stay vanes..... | 40 |
| B.11 | Francis labyrinth seals uncoated..... | 40 |
| B.12 | Kaplan uncoated..... | 40 |
| B.13 | Kaplan coated..... | 41 |
| B.14 | Sample data sheets | 41 |
| B.15 | Inspection record, runner blade inlet..... | 42 |
| B.16 | Inspection record, runner blade outlet..... | 43 |
| B.17 | Inspection record, runner band | 44 |
| B.18 | Inspection record, guide vanes | 45 |
| B.19 | Inspection record, facing plates and covers | 46 |
| B.20 | Inspection record, upper stationary seal..... | 47 |
| B.21 | Inspection record, upper rotating seal | 48 |
| B.22 | Inspection record, lower stationary seal | 49 |
| B.23 | Inspection record, lower rotating seal..... | 50 |
| B.24 | Inspection record, runner bucket..... | 51 |
| B.25 | Inspection record, Pelton runner splitter..... | 52 |
| Annex C (informative) Monitoring of particle concentration and properties and water sampling procedure | | 53 |
| C.1 | General..... | 53 |
| C.2 | Sampling before building a power station..... | 53 |
| C.3 | Sampling in existing power stations | 54 |
| C.4 | Logging of samples..... | 54 |
| Annex D (informative) Procedures for analysis of particle concentration, size, hardness and shape | | 55 |
| D.1 | General..... | 55 |
| D.2 | Particle concentration | 55 |
| D.3 | Particle size distribution | 55 |
| D.4 | Mineralogical composition | 55 |
| D.5 | Particle geometry..... | 55 |
| Annex E (informative) Frequency of sediment sampling..... | | 58 |
| Annex F (informative) Typical criteria to determine overhaul time due to hydro-abrasive erosion | | 59 |
| F.1 | General..... | 59 |
| F.2 | Parameters which are observable while the unit is in operation..... | 59 |
| F.3 | Criteria that require internal inspection of the unit..... | 60 |
| Annex G (informative) Example to calculate the hydro-abrasive erosion depth..... | | 61 |
| Annex H (informative) Examples to calculate the TBO in the reference model..... | | 63 |
| Annex I (informative) Background for hydro-abrasive erosion depth model | | 66 |
| I.1 | Model background and derivation..... | 66 |
| I.2 | Introduction to the <i>PL</i> variable..... | 67 |
| I.3 | Calibration of the formula..... | 69 |

| | |
|---|----|
| Annex J (informative) Quality control of thermal sprayed WC-CoCr..... | 71 |
| J.1 Specification | 71 |
| J.2 Quality control | 71 |
| Bibliography..... | 72 |
| Figure 1 – Estimation of the characteristic velocities in guide vanes, W_{gv} , and runner, W_{run} , as a function of turbine specific speed | 13 |
| Figure 2 – Simplified evaluation of risk of hydro-abrasive erosion for first assessment..... | 15 |
| Figure 3 – Example of protection of transition area | 17 |
| Figure 4 – Runner blade overhang in refurbishment project | 19 |
| Figure 5 – Example of cavitation on runner band due to thicker blades | 20 |
| Figure 6 – Example of design of guide vane trunnion seals..... | 21 |
| Figure 7 – Example of fixing of facing plates from the dry side (bolt to the left) | 23 |
| Figure 8 – Head cover balancing pipes with bends..... | 24 |
| Figure 9 – Step labyrinth with optimized shape for hardcoating | 26 |
| Figure 10 – Sample plot of particle concentration versus time..... | 28 |
| Figure D.1 – Typical examples of particle geometry | 57 |
| Figure I.1 – Example of flow pattern in a Pelton injector at different load | 68 |
| Table 1 – Values of K_f and p for various components..... | 13 |
| Table 2 – Overview over the feasibility for repair C on site..... | 31 |
| Table 3 – Form for properties of particles going through the turbine..... | 33 |
| Table 4 – Form for size distribution of particles..... | 34 |
| Table A.1 – Example of documenting sample tests | 35 |
| Table A.2 – Example of documenting sample results | 36 |
| Table B.1 – Inspection record, runner blade inlet form | 42 |
| Table B.2 – Inspection record, runner blade outlet form | 43 |
| Table B.3 – Inspection record, runner band form..... | 44 |
| Table B.4 – Inspection record, guide vanes form..... | 45 |
| Table B.5 – Inspection record, facing plates and covers form..... | 46 |
| Table B.6 – Inspection record, upper stationary seal form..... | 47 |
| Table B.7 – Inspection record, upper rotating seal form | 48 |
| Table B.8 – Inspection record, lower stationary seal form | 49 |
| Table B.9 – Inspection record, lower rotating seal form..... | 50 |
| Table B.10 – Inspection record, runner bucket..... | 51 |
| Table B.11 – Inspection record, Pelton runner splitter | 52 |
| Table G.1 – Calculations..... | 62 |
| Table H.1 – Pelton turbine calculation example..... | 63 |
| Table H.2 – Francis turbine calculation example | 64 |
| Table I.1 – Analysis of the calibration constant K_f and p | 70 |
| Table J.1 – Recommended items to include in HVOF inspection | 71 |

INTERNATIONAL ELECTROTECHNICAL COMMISSION

**HYDRAULIC MACHINES –
GUIDELINES FOR DEALING WITH HYDRO-ABRASIVE
EROSION IN KAPLAN, FRANCIS, AND PELTON TURBINES****FOREWORD**

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International Standard IEC 62364 has been prepared by IEC technical committee 4: Hydraulic turbines.

This second edition cancels and replaces the first edition published in 2013. This edition constitutes a technical revision.

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

- a) the formula for TBO in Pelton reference model has been modified;
- b) the formula for calculating sampling interval has been modified;
- c) the chapter in hydro-abrasive erosion resistant coatings has been substantially modified;
- d) the annex with test data for hydro-abrasive erosion resistant materials has been removed;
- e) a simplified hydro-abrasive erosion evaluation has been added.

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

| | |
|------------|------------------|
| FDIS | Report on voting |
| 4/351/FDIS | 4/366/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

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INTRODUCTION

The number of hydro power plants with hydro-abrasive erosion is increasing worldwide.

An overall approach is needed to minimize the impact of this phenomenon. Already at the start of the planning phase an evaluation should be done to quantify the hydro-abrasive erosion and the impact on the operation. For this, the influencing parameters and their impact on the hydro-abrasive erosion have to be known. The necessary information for the evaluation comprises among others the future design, the particle parameters of the water, which will pass the turbine, the reservoir sedimentation and the power plant owner's framework for the future operation like availability or maximum allowable efficiency loss, before an overhaul needs to be done.

Based on this evaluation of the hydro-abrasive erosion, an optimised solution can then be found, by analysing all measures in relation to investments, energy production and maintenance costs as decision parameters. Often a more hydro-abrasive erosion-resistant design, instead of choosing the turbine design with the highest efficiency, will lead to higher revenue. This analysis is best performed by the overall plant designer.

With regards to the machines, owners should find the means to communicate to potential suppliers for their sites, their desire to have the particular attention of the designers at the turbine design phase, directed to the minimization of the severity and effects of hydro-abrasive erosion.

Limited consensus and very little quantitative data exists on the steps which the designer could and should take to extend the useful life before major overhaul of the turbine components when they are operated under severe hydro-abrasive erosion service. This has led some owners to write into their specifications, conditions which cannot be met with known methods and materials.

HYDRAULIC MACHINES – GUIDELINES FOR DEALING WITH HYDRO-ABRASIVE EROSION IN KAPLAN, FRANCIS, AND PELTON TURBINES

1 Scope

This document gives guidelines for:

- a) presenting data on hydro-abrasive erosion rates on several combinations of water quality, operating conditions, component materials, and component properties collected from a variety of hydro sites;
- b) developing guidelines for the methods of minimizing hydro-abrasive erosion by modifications to hydraulic design for clean water. These guidelines do not include details such as hydraulic profile shapes which are determined by the hydraulic design experts for a given site;
- c) developing guidelines based on “experience data” concerning the relative resistance of materials faced with hydro-abrasive erosion problems;
- d) developing guidelines concerning the maintainability of materials with high resistance to hydro-abrasive erosion and hardcoatings;
- e) developing guidelines on a recommended approach, which owners could and should take to ensure that specifications communicate the need for particular attention to this aspect of hydraulic design at their sites without establishing criteria which cannot be satisfied because the means are beyond the control of the manufacturers;
- f) developing guidelines concerning operation mode of the hydro turbines in water with particle materials to increase the operation life.

It is assumed in this document that the water is not chemically aggressive. Since chemical aggressiveness is dependent upon so many possible chemical compositions, and the materials of the machine, it is beyond the scope of this document to address these issues.

It is assumed in this document that cavitation is not present in the turbine. Cavitation and hydro-abrasive erosion can reinforce each other so that the resulting erosion is larger than the sum of cavitation erosion plus hydro-abrasive erosion. The quantitative relationship of the resulting hydro-abrasive erosion is not known and it is beyond the scope of this document to assess it, except to suggest that special efforts be made in the turbine design phase to minimize cavitation.

Large solids (e.g. stones, wood, ice, metal objects, etc.) traveling with the water can impact turbine components and produce damage. This damage can in turn increase the flow turbulence thereby accelerating wear by both cavitation and hydro-abrasive erosion. Hydro-abrasive erosion resistant coatings can also be damaged locally by impact of large solids. It is beyond the scope of this document to address these issues.

This document focuses mainly on hydroelectric powerplant equipment. Certain portions can also be applicable to other hydraulic machines.

2 Terms, definitions and symbols

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: