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Hydraulic machines - Guide for dealing with hydro-abrasive erosion in Kaplan, Francis, and Pelton turbines (IEC 62364:2013 (EQV))

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EN 62364

August 2013

ICS 23.100.10; 27.140

English version

Hydraulic machines - Guide for dealing with hydro-abrasive erosion in Kaplan, Francis, and Pelton turbines

(IEC 62364:2013)

Machines hydrauliques - Guide relatif au traitement de l'érosion hydro-abrasive des turbines Kaplan, Francis et Pelton (CEI 62364:2013)

Wasserturbinen - Leitfaden für den Umgang mit hydroabrasiver Erosion in Kaplan-, Francis- und Pelton-Turbinen (IEC 62364:2013)

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Foreword

The text of document 4/279/FDIS, future edition 1 of IEC 62364, prepared by IEC TC 4 "Hydraulic turbines" was submitted to the IEC-CENELEC parallel vote and approved by CENELEC as EN 62364:2013.

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)	2014-05-01
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IEC 60193:1999	NOTE	Harmonised as EN 60193:1999 (not modified).

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CONTENTS

FOREWORD 5
INTRODUCTION 7
1 Scope 8
2 Terms, definitions and symbols 8
2.1 Units 8
2.2 Terms, definitions and symbols 9
3 Abrasion rate 11
3.1 Theoretical model 11
3.2 Introduction to the PL variable 13
3.3 Survey results 15
3.4 Reference model 16
4 Design 17
4.1 General 17
4.2 Water conveyance system 17
4.3 Valve 18
4.3.1 General 18
4.3.2 Selection of abrasion resistant materials and coating 18
4.3.3 Stainless steel overlays 19
4.3.4 Protection (closing) of the gap between housing and trunnion 19
4.3.5 Stops located outside the valve 19
4.3.6 Proper capacity of inlet valve operator 19
4.3.7 Increase bypass size to allow higher guide vane leakage 19
4.3.8 Bypass system design 20
4.4 Turbine 20
4.4.1 General 20
4.4.2 Hydraulic design 20
4.4.3 Mechanical design 22
4.4.4 Operation 28
4.4.5 Spares and regular inspections 29
4.4.6 Particle sampling and monitoring 29
5 Abrasion resistant materials 30
5.1 Guidelines concerning relative abrasion resistance of materials including abrasion resistant coatings 30
5.1.1 General 30
5.1.2 Discussion and conclusions 31
5.2 Guidelines concerning maintainability of abrasion resistant coating materials 32
5.2.1 Definition of terms used in this sublcause 32
5.2.2 Time between overhaul for protective coatings 32
5.2.3 Maintenance of protective coatings 33
6 Guidelines on insertions into specifications 34
6.1 General 34
6.2 Properties of particles going through the turbine 35
6.3 Size distribution of particles 35
6.4 Mineral composition of particles for each of the above mentioned periods 36
Annex A (informative) PL calculation example 37
Annex B (informative) Measuring and recording abrasion damages 39

This is a free page sample. Access the full version online.

Annex C (informative) Water sampling procedure 52
Annex D (informative) Procedures for analysis of particle concentration, size, hardness and shape 53
Annex E (informative) Tests of abrasion resistant materials 56
Annex F (informative) Typical criteria to determine overhaul time due to abrasion erosion 67
Annex G (informative) Example to calculate the amount of erosion in the full model 68
Annex H (informative) Examples to calculate the TBO in the reference model 70
Bibliography 73

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 – Example of flow pattern in a Pelton injector at different load 14
Figure 3 – Example of protection of transition area 19
Figure 4 – Runner blade overhang in refurbishment project 21
Figure 5 – Example of “mouse-ear” cavitation on runner band 22
Figure 6 – Detailed design of guide vane trunnion seals 23
Figure 7 – Example of fixing of facing plates from the dry side 25
Figure 8 – Head cover balancing pipes with bends 26
Figure 9 – Step labyrinth with optimized shape for hard coating 28
Figure 10 – Development of spiral pressure over time 33
Figure D.1 – Typical examples of particle geometry 55
Figure E.1 – Schematic of test rig used for test 1 56
Figure E.2 – ASTM test apparatus 58
Figure E.3 – Test coupon 59
Figure E.4 – Slurry pot test facility 60
Figure E.5 – High velocity test rig 61
Figure E.6 – Samples are located on the rotating disk 62
Figure E.7 – Comparison of two samples after testing 62
Figure E.8 – Whole test system of rotating disk 62
Figure E.9 – Schematic of test rig used for test 8 64
Figure E.10 – Testing of samples on hydro abrasive stand 65
Figure E.11 – Cover of disc 65
Figure E.12 – Curve of unit abrasion rate with circumference velocity for 3 kinds of materials 66

Table 1 – Data analysis of the supplied questionnaire 16
Table 2 – Overview over the feasibility for repair C 33
Table 3 – Form for properties of particles going through the turbine 35
Table 4 – Form for size distribution of particles 36
Table 5 – Form for mineral composition of particles for each of the above mentioned periods 36
Table A.1 – Example of documenting sample tests 37
Table A.2 – Example of documenting sample results 38
Table B.1 – Inspection record, runner blade inlet form 44

This is a free page sample. Access the full version online.

Table B.2 – Inspection record, runner blade outlet form 45
Table B.3 – Inspection record, runner band form 46
Table B.4 – Inspection record, guide vanes form 47
Table B.5 – Inspection record, facing plates and covers form 48
Table B.6 – Inspection record, upper stationary seal form 49
Table B.7 – Inspection record, upper rotating seal form 49
Table B.8 – Inspection record, lower stationary seal form 50
Table B.9 – Inspection record, lower rotating seal form 51
Table E.1 – Relative wear resistance in laboratory test 1 57
Table E.2 – Relative wear resistance in laboratory test 2 57
Table E.3 – Relative wear resistance in laboratory test 3 58
Table E.4 – Relative wear resistance in test 4 59
Table E.5 – Results of test 60
Table E.6 – Results of test 61
Table E.7 – Results from test 63
Table E.8 – Relative wear resistance in laboratory test 8 64
Table E.9 – Results of relative wear resistance for some materials (U = 40m/s) 66
Table G.1 – Calculations 69
Table H.1 – Pelton turbine calculation example 70
Table H.2 – Francis turbine calculation example 71

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

HYDRAULIC MACHINES – GUIDE 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.

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

FDIS	Report on voting
4/279/FDIS	4/283/RVD

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

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

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The committee has decided that the contents of this publication will remain unchanged until the stability date indicated on the IEC web site under "http://webstore.iec.ch" in the data related to the specific publication. At this date, the publication will be

- reconfirmed,
- withdrawn,
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INTRODUCTION

Many owners of hydroelectric plants contend with the sometimes very aggressive deterioration of their machines due to particle abrasion. Such owners must find the means to communicate to potential suppliers of machines 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 particle abrasion.

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 particle abrasion service. This has led some owners to write into their specifications, conditions which cannot be met with known methods and materials.

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

1 Scope

This Guide serves to:

a) present data on particle abrasion rates on several combinations of water quality, operating conditions, component materials, and component properties collected from a variety of hydro sites;

b) develop guidelines for the methods of minimizing particle abrasion by modifications to hydraulic design for clean water. These guidelines do not include details such as hydraulic profile shapes which should be determined by the hydraulic design experts for a given site;

c) develop guidelines based on “experience data” concerning the relative resistance of materials faced with particle abrasion problems;

d) develop guidelines concerning the maintainability of abrasion resistant materials and hard facing coatings;

e) develop 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) develop guidelines concerning operation mode of the hydro turbines in water with particle materials to increase the operation life;

It is assumed in this Guide 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 Guide to address these issues.

It is assumed in this Guide that cavitation is not present in the turbine. Cavitation and abrasion may reinforce each other so that the resulting erosion is larger than the sum of cavitation erosion plus abrasion erosion. The quantitative relationship of the resulting abrasion is not known and it is beyond the scope of this guide to assess it, except to recommend 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 may impact turbine components and produce damage. This damage may in turn increase the flow turbulence thereby accelerating wear by both cavitation and abrasion. Abrasion resistant coatings can also be damaged locally by impact of large solids. It is beyond the scope of this Guide to address these issues.

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

2 Terms, definitions and symbols

2.1 Units

The International System of Units (S.I.) is adopted throughout this guide but other systems are allowed.

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