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Hydraulic turbines, storage pumps and pump-turbines - Model acceptance tests

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National foreword

This British Standard is the UK implementation of EN IEC 60193:2019. It is identical to IEC 60193:2019. It supersedes BS EN 60193:1999, which is withdrawn.

The UK participation in its preparation was entrusted to Technical Committee MCE/15, Hydraulic turbines.

A list of organizations represented on this committee can be obtained on request to its secretary.

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Hydraulic turbines, storage pumps and pump-turbines - Model acceptance tests (IEC 60193:2019)

Turbines hydrauliques, pompes d'accumulation et pompes-turbines - Essais de réception sur modèle (IEC 60193:2019)

Hydraulische Turbinen, Speicherpumpen und Pumpturbinen - Modellabnahmeprüfungen (IEC 60193:2019)

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European foreword

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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) 2020-02-29
- latest date by which the national standards conflicting with the document have to be withdrawn (dow) 2022-05-30

This document supersedes EN 60193:1999.

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

IEC 60041:1991	NOTE	Harmonized as EN 60041:1994
IEC 60609-1:2004	NOTE	Harmonized as EN 60609-1:2005 (not modified)
IEC 60609-2:1997	NOTE	Harmonized as EN 60609-2:1999 (not modified)
IEC 60994:1991	NOTE	Harmonized as EN 60994:1992 (not modified)
ISO 4006:1991	NOTE	Harmonized as EN 24006:1993 (not modified)
ISO 4373:2008	NOTE	Harmonized as EN ISO 4373:2008 (not modified)
ISO 5167-1:2003	NOTE	Harmonized as EN ISO 5167-1:2003 (not modified)
ISO 20456:2017	NOTE	Harmonized as EN ISO 20456 (not modified)[1]

[1] Under preparation. Stage at the time of publication: prEN ISO 20456.

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(normative)

Normative references to international publications with their corresponding European publications

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

NOTE 1 Where an International Publication has been modified by common modifications, indicated by (mod), the relevant EN/HD applies.

NOTE 2 Up-to-date information on the latest versions of the European Standards listed in this annex is available here: www.cenelec.eu.

Publication	Year	Title	EN/HD	Year
IEC 62097	2009	Hydraulic machines, radial and axial - Performance conversion method from model to prototype	EN 62097	2009
ISO 2186	2007	Fluid flow in closed conduits - Connections for pressure signal transmissions between primary and secondary elements	-	-
ISO 2533	1975	Standard Atmosphere	-	-
ISO 4185	-	Measurement of liquid flow in closed conduits - Weighing method	EN 24185	1993
-	-		+ AC	1993
ISO 4287	1997	Geometrical Product Specifications (GPS) - Surface texture: Profile method - Terms, definitions and surface texture parameters	EN ISO 4287	1998
ISO 8316	-	Measurement of liquid flow in closed conduits - Method by collection of the liquid in a volumetric tank	EN ISO 8316	1995

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CONTENTS

FOREWORD 13
1 Scope 15
2 Normative references 17
3 Terms, definitions, symbols and units 18
3.1 General 18
3.2 General terminology 18
3.3 Units 20
3.4 Definition of terms, symbols and units 20
3.4.1 List of terms and definitions by topic 20
3.4.2 Subscripts and symbols 21
3.4.3 Geometric terms 23
3.4.4 Physical quantities and properties 25
3.4.5 Discharge, velocity and speed terms 26
3.4.6 Pressure terms 27
3.4.7 Specific energy terms 27
3.4.8 Height and head terms 30
3.4.9 Power and torque terms 32
3.4.10 Efficiency terms 34
3.4.11 General terms relating to fluctuating quantities 35
3.4.12 Fluid dynamics and scaling terms[a)] 37
3.4.13 Dimensionless terms 38
3.4.14 Terms relating to additional performance data 39
4 Nature and extent of guarantees related to hydraulic performance 40
4.1 General 40
4.1.1 Design data and coordination 40
4.1.2 Definition of the hydraulic performance guarantees 40
4.1.3 Guarantees of correlated quantities 41
4.1.4 Form of guarantees 41
4.2 Main hydraulic performance guarantees verifiable by model test 41
4.2.1 Guaranteed quantities for any machine 41
4.2.2 Specific application 42
4.3 Guarantees not verifiable by model test 43
4.3.1 Guarantees on cavitation erosion 43
4.3.2 Guarantees on maximum momentary overspeed and maximum momentary pressure rise 44
4.3.3 Guarantees covering noise and vibration 44
4.4 Additional performance data 44
5 Execution of tests 45
5.1 Requirements of test installation and model 45
5.1.1 Choice of laboratory 45
5.1.2 Test installation 45
5.1.3 Model requirements 46
5.2 Dimensional check of model and prototype 49
5.2.1 General 49
5.2.2 Explanation of terms used for model and prototype 49
5.2.3 Purpose of dimensional checks 49
5.2.4 General rules 50

This is a preview of "BS EN IEC 60193:2019". Click here to purchase the full version from the ANSI store.

5.2.5 Procedure 51
5.2.6 Application for different types of machines 52
5.2.7 Methods 52
5.2.8 Accuracy of measurements 61
5.2.9 Dimensions of model and prototype to be checked 62
5.2.10 Permissible maximum deviations in geometrical similarity between prototype and model for turbines, pumps and pump-turbines 66
5.2.11 Surface waviness and roughness 71
5.3 Hydraulic similitude 74
5.3.1 Theoretical basic requirements and similitude numbers 74
5.3.2 Conditions for hydraulic similitude as used in this document 74
5.3.3 Similitude requirements for various types of model tests 75
5.3.4 Reynolds similitude 76
5.3.5 Froude similitude 77
5.3.6 Other similitude conditions 80
5.4 Test conditions 81
5.4.1 Determination of test conditions 81
5.4.2 Minimum values for model size and test conditions to be fulfilled 82
5.4.3 Stability and fluctuations during measurements 83
5.4.4 Adjustment of the operating point 83
5.5 Test procedures 83
5.5.1 Organization of tests 83
5.5.2 Inspections and calibrations 86
5.5.3 Execution of tests 88
5.5.4 Faults and repetition of tests 93
5.5.5 Final test report 94
5.6 Introduction to the methods of measurement 95
5.6.1 General 95
5.6.2 Measurements related to the main hydraulic performance guarantees 95
5.6.3 Measurements related to additional data 97
5.6.4 Acquisition and processing of data 97
5.7 Physical properties 97
5.7.1 General 97
5.7.2 Acceleration due to gravity 97
5.7.3 Physical properties of water 98
5.7.4 Physical conditions of atmosphere 104
5.7.5 Density of mercury 104
6 Main hydraulic performances: methods of measurement and results 105
6.1 Data acquisition and data processing 105
6.1.1 Overview 105
6.1.2 General requirements 105
6.1.3 Data acquisition 105
6.1.4 Component requirements 107
6.1.5 Check of the data acquisition system 110
6.2 Discharge measurement 112
6.2.1 General 112
6.2.2 Choice of the method of measurement 112
6.2.3 Accuracy of measurement 113
6.2.4 Primary methods 114

This is a preview of "BS EN IEC 60193:2019". Click here to purchase the full version from the ANSI store.

6.2.5 Secondary methods 115
6.3 Pressure measurement 118
6.3.1 General 118
6.3.2 Choice of pressure-measuring section 119
6.3.3 Pressure taps and connecting lines 119
6.3.4 Apparatus for pressure measurement 121
6.3.5 Calibration of pressure measurement apparatus 128
6.3.6 Vacuum measurements 129
6.3.7 Uncertainty in pressure measurements 129
6.4 Free water level measurement (see also ISO 4373) 129
6.4.1 General 129
6.4.2 Choice of water level measuring sections 130
6.4.3 Number of measuring points in a measuring section 130
6.4.4 Measuring methods 130
6.4.5 Uncertainty in free water level measurement 131
6.5 Determination of *E* and *NPSE* 132
6.5.1 General 132
6.5.2 Determination of the specific hydraulic energy *E* 133
6.5.3 Simplified formulae for *E* 135
6.5.4 Determination of the net positive suction-specific energy *NPSE* 142
6.6 Shaft torque measurement 144
6.6.1 General 144
6.6.2 Methods of torque measurement 144
6.6.3 Methods of absorbing/generating power 145
6.6.4 Layout of arrangement 145
6.6.5 Checking of system 150
6.6.6 Calibration 150
6.6.7 Uncertainty in torque measurement (at a confidence level of 95 %) 151
6.7 Rotational speed measurement 152
6.7.1 General 152
6.7.2 Methods of speed measurement 152
6.7.3 Checking 152
6.7.4 Uncertainty of measurement 152
6.8 Computation and presentation of test results 153
6.8.1 General 153
6.8.2 Power, discharge and efficiency in the guarantee range 158
6.8.3 Computation of steady-state runaway speed and discharge 171
6.9 Error analysis 176
6.9.1 Definitions 176
6.9.2 Determination of uncertainties in model tests 178
6.10 Comparison with guarantees 182
6.10.1 General 182
6.10.2 Interpolation curve and total uncertainty bandwidth 183
6.10.3 Power, discharge and/or specific hydraulic energy and efficiency in the guarantee range 184
6.10.4 Runaway speed and discharge 188
6.10.5 Cavitation guarantees 189
7 Additional performance data – Methods of measurement and results 191
7.1 Introduction to additional data measurement 191

This is a preview of "BS EN IEC 60193:2019". Click here to purchase the full version from the ANSI store.

7.1.1 General 191
7.1.2 Test conditions and test procedures 192
7.1.3 Uncertainty in measurements 192
7.1.4 Model to prototype conversion 192
7.2 Fluctuating quantities 193
7.2.1 Data acquisition and processing for measurement of fluctuating quantities 193
7.2.2 Pressure fluctuations 197
7.2.3 Shaft torque fluctuations 213
7.3 Axial and radial thrust 214
7.3.1 General 214
7.3.2 Hydraulic axial thrust 215
7.3.3 Radial thrust 223
7.4 Hydraulic loads on control components 226
7.4.1 General 226
7.4.2 Guide vane torque 227
7.4.3 Runner blade torque 233
7.4.4 Pelton needle force and deflector torque 237
7.5 Testing in an extended operating range 241
7.5.1 General 241
7.5.2 Four quadrants 241
7.5.3 Operating modes (see Figure 116) 243
7.5.4 Scope of tests 244
7.5.5 Methods of testing in the extended operating range 246
7.6 Differential pressure measurement in view of prototype index test 248
7.6.1 General 248
7.6.2 Purpose of test 249
7.6.3 Execution of test 249
7.6.4 Analysis of test results 249
7.6.5 Transposition to prototype conditions 250
7.6.6 Uncertainty 250
Annex A (informative) Dimensionless terms 251
Annex B (normative) Physical properties, data 253
Annex C (informative) Summarized test and calculation procedure 261
C.1 General 261
C.2 Agreements to be reached prior to testing 261
C.3 Model, test facility and instrumentation 262
C.3.1 Model manufacture and dimensional checks 262
C.3.2 Test facility instrumentation and data acquisition system 262
C.4 Tests and calculation of the model values 262
C.4.1 Test types 262
C.4.2 Measurement of the main quantities during the test 263
C.4.3 Uncertainty of the measured quantities 263
C.4.4 Calculation of the quantities related to the main hydraulic performance 263
C.4.5 Calculation of the dimensionless factors or coefficients and of the Thoma number 263
C.4.6 Determination of δ_{ref} for the transposition of efficiency 264
C.4.7 Calculation of efficiency and power coefficients referred to Re_{M*} 264

This is a preview of "BS EN IEC 60193:2019". Click here to purchase the full version from the ANSI store.

C.4.8 Correction of the model-measured values taking into account the influence of cavitation 264
C.5 Calculation of prototype quantities 264
C.6 Plotting of model or prototype results 264
C.7 Comparison with the guarantees 265
C.8 Final protocol 265
C.9 Final test report 265
Annex D (normative) The scale effect on hydraulic efficiency for reaction machines 266
D.1 Basic statements and assumptions 266
D.2 Efficiency transposition formulae 266
D.2.1 Derivation of the general formula for efficiency transposition 266
D.2.2 Amount of relative scalable losses in the range of guaranteed efficiencies 267
D.2.3 Determination of the effect of scaling on the efficiency of the model 269
D.2.4 Determination of the formula for the transposition of efficiency from model to prototype 271
Annex E (informative) Comparison of the hydraulic efficiency transposition methods of IEC 60193 and IEC 62097 for reaction machines 273
E.1 IEC 60193 transposition method 273
E.1.1 Applications 273
E.1.2 Limitations 273
E.2 IEC 62097 transposition method 274
E.2.1 Applications 274
E.2.2 Limitations 274
Annex F (normative) Computation of the prototype runaway characteristics taking into account friction and windage losses of the unit 275
Annex G (informative) Example of determination of the best smooth curve: method of separate segments 276
G.1 General 276
G.2 Principle of the method 276
G.3 Choice of the minimum width of the intervals 278
G.4 Determination of the intervals 278
Annex H (informative) Examples of analysis of sources of error and uncertainty evaluation 279
H.1 General 279
H.2 Example of analysis of sources of error and of uncertainty evaluation in the measurement of a physical quantity 279
H.2.1 General 279
H.2.2 Errors arising during calibration 280
H.2.3 Errors arising during the tests 281
H.3 Example of calculation of uncertainty due to systematic errors in the determination of the specific hydraulic energy, mechanical runner/impeller power and hydraulic efficiency 281
H.3.1 General 281
H.3.2 Discharge 282
H.3.3 Pressure 282
H.3.4 Specific hydraulic energy 282
H.3.5 Power 283
H.3.6 Hydraulic efficiency 283
H.4 Example of calculation of uncertainty due to systematic errors in the determination of the net positive suction specific energy 284

This is a preview of "BS EN IEC 60193:2019". Click here to purchase the full version from the ANSI store.

H.4.1 General 284
H.4.2 Discharge 284
H.4.3 Pressure 284
H.4.4 Net positive suction specific energy 284
Annex I (normative) The scale effect on hydraulic efficiency for Pelton turbines 286
I.1 General 286
I.2 Similarity considerations 286
I.3 Transposition formula 288
Annex J (normative) Analysis of random errors for a test at constant operating conditions 289
J.1 General 289
J.2 Standard deviation 289
J.3 Confidence levels 290
J.4 Student's *t* distribution 290
J.5 Maximum permissible value of uncertainty due to random errors 291
J.6 Example of calculation 292
Annex K (normative) Calculation of plant Thoma number σ_{pl} 293
K.1 Definition of σ_{pl}, *NPSE* and *NPSH* 293
K.2 Data needed to calculate σ_{plc} 294
Annex L (informative) Flux diagram of specific hydraulic energy, flow and power 296
Annex M (informative) Synchronous and asynchronous components of pressure signals 299
Annex N (informative) Natural frequency of the hydraulic system 301
Annex O (informative) Calculation of axial force components 302
O.1 General 302
O.2 Calculating the force acting on the runner crown (F_2) 302
O.2.1 General 302
O.2.2 Pressure specific energy losses due to seal clearance 302
O.2.3 Pressure specific energy losses through the centrifugal zones between the stationary and rotating parts 304
O.2.4 Pressure specific energy losses in a pressure relief/equilibrium pipe 305
O.2.5 Additional specific energy losses 306
O.3 Calculating the force acting on the runner band (F_3) 307
Bibliography 308

Figure 1– Schematic representation of a hydraulic machine 22
Figure 2 – Guide vane opening and angle 22
Figure 3 – Reference diameter and bucket width 24
Figure 4 – Determination of σ_0 and σ_1 for typical cavitation curves 29
Figure 5 – Reference level of machine 31
Figure 6 – Flux diagram for power and discharge 33
Figure 7 – Illustration of some definitions related to oscillating quantities 36
Figure 8 – Procedure for dimensional checks, comparison of results "steel to steel" and application of tolerances for model and prototype 51
Figure 9 – Example of spiral case and distributor dimensions to be checked 54
Figure 10 – Example of draft tube dimensions to be checked 54

This is a preview of "BS EN IEC 60193:2019". Click here to purchase the full version from the ANSI store.

Figure 11 – Example of the dimensions to be checked on a bulb unit 55
Figure 12 – Example of the dimensions to be checked on the runner/impeller of a radial flow machine 56
Figure 13 – Runner/impeller of radial flow machine: examples of locations for blade profile measuring sections for templates or measuring points for CMM 57
Figure 14 – Runner/impeller of radial flow machine: check of outlet width and blade profiles by means of templates as illustrated on a Francis runner 57
Figure 15 – Runner/impeller of radial flow machine: check of inlet and outlet widths between blades (example of a pump-turbine runner) 58
Figure 16 – Runner/impeller of axial flow machine: example of locations for blade profile measuring sections for templates or measuring points for CMM 58
Figure 17 – Runner/impeller of axial flow machine: definition of blade adjustment and of blade profile tolerances 58
Figure 18 – Pelton turbine: example of dimensions to be checked on the distributor and the housing of vertical and horizontal shaft machines 59
Figure 19 – Pelton turbine: example of dimensions to be checked on the buckets and nozzles 60
Figure 20 – Definition of waviness and surface roughness 72
Figure 21 – Low specific hydraulic energy turbine example of recommended maximum surface roughness values on the runner blades (pressure side and suction side) 73
Figure 22 – Relation between the setting level z_r of a Francis turbine and the cavitation reference level z_c 78
Figure 23 – Dependence of σ values on level z for model and prototype 78
Figure 24 – Acceleration due to gravity g ($m \cdot s^{-2}$) 98
Figure 25 – Density of distilled water ρ_{wd} ($kg \cdot m^{-3}$) 101
Figure 26 – Time multiplexing data acquisition system 106
Figure 27 – Bus operated data acquisition system 107
Figure 28 – Time delay 108
Figure 29 – Typical low-pass filter attenuation characteristics 109
Figure 30 – Different measurement chains and their recommended checkpoints 111
Figure 31 – Examples of pressure taps 120
Figure 32 – Types of pressure manifolds: a) with separate connecting lines to manifold and b) with ring manifold 121
Figure 33 – Examples of experimental setup of liquid column manometers 123
Figure 34 – Dead weight manometer with compensation by pressure or force transducer (example of experimental set-up) 126
Figure 35 – Pressure weighbeam (example of experimental set-up) 127
Figure 36 – Stilling well 130
Figure 37 – Point and hook gauges 131
Figure 38 – Example showing main elevations, heights and reference levels of the test rig and model machine 134
Figure 39 – Determination of specific hydraulic energy through differential pressure measuring instrument 137
Figure 40 – Determination of specific hydraulic energy of the machine through separate measurement of gauge pressures 138
Figure 41 – Determination of specific hydraulic energy of the machine through separate measurement of pressures by water column manometers 139

This is a preview of "BS EN IEC 60193:2019". Click here to purchase the full version from the ANSI store.

Figure 42 – Pelton turbines with vertical axis: determination of specific hydraulic energy of the machine 140
Figure 43 – Pelton turbines with horizontal axis: determination of specific hydraulic energy of the machine 141
Figure 44 – Low-head machines: determination of specific hydraulic energy of the machine using free water levels 142
Figure 45 – Determination of net positive suction energy *NPSE* and net positive suction head *NPSH* 143
Figure 46 – Balance arrangement 146
Figure 47 – Balance arrangement with gear 147
Figure 48 – Balance arrangement with two separate frames 147
Figure 49 – Arrangement with machine bearings and seals not in balance 147
Figure 50 – Arrangement with lower bearing and seal not in balance 148
Figure 51 – Arrangement with intermediate bearing and seal not in balance 148
Figure 52 – Arrangement using a torquemeter 148
Figure 53 – Arrangement using a torquemeter with machine bearings and seals in balance 149
Figure 54 – Arrangement using a torquemeter with machine bearings and seals not in balance 149
Figure 55 – Choosing the appropriate transposition method 153
Figure 56 – Single-regulated (Francis) model turbine: performance hill diagram (discharge factor versus speed factor) 155
Figure 57 – Single-regulated (Francis) model turbine: performance hill diagram (energy coefficient versus discharge coefficient) 155
Figure 58 – Double-regulated (Kaplan) model turbine: performance hill diagram 156
Figure 59 – Single-regulated (radial) model pump: performance diagram 156
Figure 60 – Double-regulated model pump: performance diagram 157
Figure 61 – Pelton model turbine: performance hill diagram (example for a six-nozzle machine) 157
Figure 62 – Single-regulated (radial) model pump-turbine: general four-quadrant diagram 158
Figure 63 – Reaction machines: procedure for calculating test results in view of comparison with guarantees 159
Figure 64 – Single-regulated turbine: three-dimensional surface of hydraulic efficiency and curves of performance at E_{nD} constant 161
Figure 65 – Single-regulated pump: performance curves 162
Figure 66 – Double-regulated turbine: performance curves at E_{nD} constant 163
Figure 67 – Double-regulated pump: performance curves at E_{nD} constant 164
Figure 68 – Non-regulated turbine: performance curves 165
Figure 69 – Non-regulated pump: performance curves 166
Figure 70 – Efficiency curve correction in order to take into account cavitation influence (e.g. tubular machines at overload operation) 167
Figure 71 – Francis model turbine: cavitation curves 167
Figure 72 – Model pump: cavitation curves 167
Figure 73 – Francis model turbine cavitation curves: examples of limits for application of transposition formula 169
Figure 74 – Runaway curves for a single-regulated turbine (Francis) 172

This is a preview of "BS EN IEC 60193:2019". Click here to purchase the full version from the ANSI store.

Figure 75 – Runaway curves for a single-regulated turbine (six-nozzle Pelton) 172
Figure 76 – Runaway speed determined by extrapolation: example for a single-regulated turbine (Francis) 172
Figure 77 – Influence of Thoma number on runaway speed and discharge of a single-regulated turbine (Francis) 173
Figure 78 – Influence of the Thoma number on runaway speed and discharge of a double-regulated turbine (Kaplan) 174
Figure 79 – Influence of the Thoma number on the off-cam runaway curves of a double-regulated turbine (Kaplan) 174
Figure 80 – Example of calibration curve 178
Figure 81 – Single-regulated machine 184
Figure 82 – Double-regulated machine 184
Figure 83 – Single-regulated turbine: comparison between guarantees and measurements 185
Figure 84 – Non-regulated turbine: comparison between guarantees and measurements 186
Figure 85 – Non-regulated pump: comparison between guarantees and measurements 187
Figure 86 – Francis turbine runaway speed and discharge curves: comparison between guarantees and measurements 189
Figure 87 – Model turbine cavitation curve and comparison with the guarantee on the influence of the cavitation on the efficiency 190
Figure 88 – Typical data acquisition system 194
Figure 89 – Frequency response of analogue anti-aliasing filter 195
Figure 90 – Suggested locations of transducers 200
Figure 91 – Pump diagram with exploration paths 202
Figure 92 – Turbine hill-chart with exploration paths 203
Figure 93 – Normal pump mode operation of an n_{QE} = 0,102 pump-turbine model 205
Figure 94 – Zero discharge operation (10 % guide vane opening) of an n_{QE} = 0,102 pump-turbine model 205
Figure 95 – Part load operation of an n_{QE} = 0,321 Francis turbine model: Q_{nD}/Q_{nDopt} = 0,719 206
Figure 96 – Higher part load operation of an n_{QE} = 0,226 Francis turbine model: Q_{nD}/Q_{nDopt} = 0,764 207
Figure 97 – Full load operation of an n_{QE} = 0,173 Francis turbine model: Q_{nD}/Q_{nDopt} = 1,218 208
Figure 98 – Example of waterfall diagram of pressure fluctuations in the draft tube of a Francis turbine, transducer p_1 209
Figure 99 – Example of summarized diagram of pressure fluctuations in the draft tube of a Francis turbine, transducer p_2 210
Figure 100 – Interaction of the external system with sources of pressure fluctuations from the hydraulic machine 211
Figure 101 – Definition of coordinate system 214
Figure 102 – Individual elements of axial force acting on a radial machine 216
Figure 103 – Typical testing arrangement for axial thrust measurement 218
Figure 104 – Typical calibration arrangement for axial thrust measurement 219

This is a preview of "BS EN IEC 60193:2019". Click here to purchase the full version from the ANSI store.

Figure 105 – Axial force factor versus discharge factor at different constant specific hydraulic energies in pump mode 221
Figure 106 – Axial force factor versus speed factor measured at different guide vane openings in the four quadrants of a pump-turbine 221
Figure 107 – Typical arrangements for radial thrust measurement (horizontal or vertical shaft) 224
Figure 108 – Design examples for torque measuring guide vanes 228
Figure 109 – Guide vane torque factor versus guide vane angle measured at different constant specific hydraulic energies in turbine mode 230
Figure 110 – Guide vane torque factor versus guide vane angle measured at different constant specific hydraulic energies in pump mode 231
Figure 111 – Guide vane torque factor versus speed factor measured at different constant guide vane angles in the four quadrants of a pump-turbine 231
Figure 112 – Example for runner blade torque measuring arrangement using telemetry 234
Figure 113 – Performance and hydraulic runner blade torque characteristics of an axial turbine measured at one constant runner blade angle β and various constant guide vane angles α 236
Figure 114 – Pelton needle force factor as a function of relative needle stroke 240
Figure 115 – Example of four quadrants operation of a radial-type pump-turbine 242
Figure 116 – Chart illustrating the various operating modes 244
Figure 117 – S-shape characteristics in turbine brake mode 247
Figure 118 – Characteristic of a pump with positive slope range in a limited discharge range 247
Figure 119 – Example of graphical representation of index test data 250
Figure D.1 – Efficiency change in hydraulically similar operating conditions A and B having different *Re* values 267
Figure D.2 – Variation of relative scalable losses 268
Figure D.3 – Transposition curve for model efficiency using best efficiency point 270
Figure D.4 – Efficiency increase from constant Re_{M*} to constant Re_P 271
Figure D.5 – Efficiency increase from different Re_M to constant Re_P 272
Figure F.1 – Single-regulated turbine: determination of the maximum runaway speed of the prototype taking into account the friction and windage losses of the unit 275
Figure G.1 – Principle of the method of separate segments 277
Figure G.2 – Example of determination of intervals 277
Figure I.1 – Influence of Froude number 287
Figure I.2 – Influence of Weber number 288
Figure I.3 – Influence of Reynolds number 288
Figure K.1 – Definition for determination of net positive suction energy, *NPSE*, and net positive suction head, *NPSH*, of a prototype machine ($E_{LS} \neq 0$) 293
Figure L.1 – Turbine 296
Figure L.2 – Pump 297
Figure M.1 – a) Representation of asynchronous pressure pulsation and location of pressure transducers, and b) synchronous and c) asynchronous parts of the pressure signal 300
Figure O.1 – Crown seal clearance 304
Figure O.2 – Crown radius 305
Figure O.3 – Pressure relief pipe 306

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Figure O.4 – Runner band seal 307

Table 1 – Permissible maximum deviations 68
Table 2 – Maximum recommended prototype surface roughness *Ra* 73
Table 3 – Similitude numbers 74
Table 4 – Similitude requirements for various types of model tests 76
Table 5 – Minimum values for model size and test parameters 82
Table 6 – Coefficients of the Herbst and Roegener formula 100
Table 7 – Minimum test specific hydraulic energy 102
Table 8 – Nomenclature for Figure 46 to Figure 54 146
Table 9 – Variables defining the operating point of a machine 154
Table 10 – Summary of errors that determine total measurement uncertainty 179
Table 11 – Definition of individual force elements of axial thrust 217
Table 12 – Non-hydraulic forces influencing radial thrust measurement 225
Table 13 – Definition of quadrants and operating modes 242
Table B.1 – Acceleration due to gravity g ($m \cdot s^{-2}$) 253
Table B.2 – Density of distilled water ρ_{wd} ($kg \cdot m^{-3}$) *(1 of 2)* 254
Table B.3 – Kinematic viscosity of distilled water ν ($m^2 \cdot s^{-1}$) 256
Table B.4 – Vapour pressure of distilled water p_{va} (Pa) 257
Table B.5 – Density of dry air ρ_a ($kg \cdot m^{-3}$) 258
Table B.6 – Ambient pressure p_{amb} (Pa) 259
Table B.7 – Density of mercury ρ_{Hg} ($kg \cdot m^{-3}$) 260
Table D.1 – V_{ref} values 269
Table I.1 – Numerical data for surface tension σ^* 287
Table J.1 – Confidence levels 290
Table J.2 – Values of Student's t 291
Table J.3 – Computation of the estimated standard deviation and the uncertainty for eight observations 292
Table K.1 – Summary of calculated σ_{plc} values and other relevant data 295

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HYDRAULIC TURBINES, STORAGE PUMPS AND PUMP-TURBINES – MODEL ACCEPTANCE TESTS

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International Standard IEC 60193 has been prepared by IEC technical committee 4: Hydraulic turbines.

This third edition cancels and replaces the second edition published in 1999. This edition constitutes a technical revision.

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

a) update to methods/measuring tools currently used for checking dimensions on both model and prototype;
b) update to requirements of accuracy in the dimensional check procedure as a result of new technology;

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c) merging of tables/sections with redundant information in dimension check in 5.2;
d) update to methods of measuring discharge;
e) update to pressure fluctuation methods and terminology;
f) specification of measuring times for accurate pressure fluctuation analyses in the model;
g) redefine definition for the transposition of pressure fluctuations to prototype;
h) update to surface waviness requirements in prototype;
i) redefining methods/references in clause on cavitation nuclei content (5.7.3.2.2);
j) update to 7.3 and review of methods on radial thrust measurements;
k) update to 7.4 (Hydraulic loads on control components);
l) update and develop methodology in 7.5 for testing in the extended operating range;
m) update to 7.6 concerning index testing;
n) update to methods for measuring roughness;
o) updates to references;
p) updates to figures;
q) revision of sigma definition;
r) reference to new method of transposition in accordance with IEC 62097.

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

FDIS	Report on voting
4/371/FDIS	4/373/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.

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HYDRAULIC TURBINES, STORAGE PUMPS AND PUMP-TURBINES – MODEL ACCEPTANCE TESTS

1 Scope

This document applies to laboratory models of any type of impulse or reaction hydraulic turbine, storage pump or pump-turbine.

This document applies to models of prototype machines either with unit power greater than 5 MW or with reference diameter greater than 3 m. Full application of the procedures herein prescribed is not generally justified for machines with smaller power and size. Nevertheless, this document may be used for such machines by agreement between the purchaser and the supplier.

In this document, the term "turbine" includes a pump-turbine operating as a turbine and the term "pump" includes a pump-turbine operating as a pump.

This document excludes all matters of purely commercial interest, except those inextricably bound up with the conduct of the tests.

This document is concerned with neither the structural details of the machines nor the mechanical properties of their components, so long as these do not affect model performance or the relationship between model and prototype performances.

This document covers the arrangements for model acceptance tests to be performed on hydraulic turbines, storage pumps and pump-turbines to determine if the main hydraulic performance contract guarantees (see 4.2) have been satisfied.

It contains the rules governing test conduct and prescribes measures to be taken if any phase of the tests is disputed.

The main objectives of this document are:

– to define the terms and quantities used;
– to specify methods of testing and of measuring the quantities involved, in order to ascertain the hydraulic performance of the model;
– to specify the methods of computation of results and of comparison with guarantees;
– to determine if the contract guarantees that fall within the scope of this document have been fulfilled;
– to define the extent, content and structure of the final report.

The guarantees can be given in one of the following ways:

– guarantees for prototype hydraulic performance, computed from model test results considering scale effects;
– guarantees for model hydraulic performance.