

## Weibull analysis

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## EESTI STANDARDI EESSÕNA

## NATIONAL FOREWORD

Käesolev Eesti standard EVS-EN 61649:2008 sisaldab Euroopa standardi EN 61649:2008 ingliskeelset teksti.

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This Estonian standard EVS-EN 61649:2008 consists of the English text of the European standard EN 61649:2008.

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English version

**Weibull analysis**  
(IEC 61649:2008)

Analyse de Weibull  
(CEI 61649:2008)

Weibull-Analyse  
(IEC 61649:2008)

This European Standard was approved by CENELEC on 2008-10-01. 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.

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**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 text of document 56/1269/FDIS, future edition 2 of IEC 61649, prepared by IEC TC 56, Dependability, was submitted to the IEC-CENELEC parallel vote and was approved by CENELEC as EN 61649 on 2008-10-01.

The following dates were fixed:

- latest date by which the EN has to be implemented  
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- latest date by which the national standards conflicting  
with the EN have to be withdrawn (dow) 2011-10-01

Annex ZA has been added by CENELEC.

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## Endorsement notice

The text of the International Standard IEC 61649:2008 was approved by CENELEC as a European Standard without any modification.

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

IEC 60300-1	NOTE Harmonized as EN 60300-1:2003 (not modified).
IEC 60300-2	NOTE Harmonized as EN 60300-2:2004 (not modified).
IEC 60300-3-1	NOTE Harmonized as EN 60300-3-1:2004 (not modified).
IEC 60300-3-2	NOTE Harmonized as EN 60300-3-2:2005 (not modified).
IEC 60300-3-4	NOTE Harmonized as EN 60300-3-4:2008 (not modified).
IEC 61703	NOTE Harmonized as EN 61703:2002 (not modified).

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## Annex ZA (normative)

### Normative references to international publications with their corresponding European publications

The following referenced documents are indispensable for the application 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 When an international publication has been modified by common modifications, indicated by (mod), the relevant EN/HD applies.

<u>Publication</u>	<u>Year</u>	<u>Title</u>	<u>EN/HD</u>	<u>Year</u>
IEC 60050-191	1990	International Electrotechnical Vocabulary (IEV) - Chapter 191: Dependability and quality of service	-	-
IEC 60300-3-5	2001	Dependability management - Part 3-5: Application guide - Reliability test conditions and statistical test principles	-	-
IEC 61810-2	- <sup>1)</sup>	Electromechanical elementary relays - Part 2: Reliability	EN 61810-2	2005 <sup>2)</sup>
ISO 2854	1976	Statistical interpretation of data - Techniques of estimation and tests relating to means and variances	-	-
ISO 3534-1	2006	Statistics - Vocabulary and symbols - Part 1: General statistical terms and terms used in probability	-	-

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<sup>1)</sup> Undated reference.

<sup>2)</sup> Valid edition at date of issue.

## CONTENTS

FOREWORD.....	5
INTRODUCTION.....	7
1 Scope.....	8
2 Normative references .....	8
3 Terms, definitions, abbreviations and symbols.....	8
3.1 Terms and definitions .....	8
3.2 Abbreviations .....	10
3.3 Symbols .....	10
4 Application of the techniques.....	11
5 The Weibull distribution.....	11
5.1 The two-parameter Weibull distribution.....	11
5.2 The three-parameter Weibull distribution .....	13
6 Data considerations.....	13
6.1 Data types.....	13
6.2 Time to first failure .....	13
6.3 Material characteristics and the Weibull distribution .....	13
6.4 Sample size .....	13
6.5 Censored and suspended data .....	14
7 Graphical methods and goodness-of-fit .....	14
7.1 Overview .....	14
7.2 How to make the probability plot.....	14
7.2.1 Ranking.....	15
7.2.2 The Weibull probability plot .....	15
7.2.3 Dealing with suspensions or censored data .....	15
7.2.4 Probability plotting.....	17
7.2.5 Checking the fit .....	17
7.3 Hazard plotting.....	18
8 Interpreting the Weibull probability plot.....	19
8.1 The bathtub curve .....	19
8.1.1 General .....	19
8.1.2 $\beta < 1$ – Implies early failures.....	19
8.1.3 $\beta = 1$ – Implies constant instantaneous failure rate.....	20
8.1.4 $\beta > 1$ – Implies wear-out.....	20
8.2 Unknown Weibull modes may be "masked".....	20
8.3 Small samples .....	21
8.4 Outliers .....	22
8.5 Interpretation of non-linear plots.....	22
8.5.1 Distributions other than the Weibull .....	25
8.5.2 Data inconsistencies and multimode failures .....	25
9 Computational methods and goodness-of-fit .....	25
9.1 Introduction .....	25
9.2 Assumptions and conditions .....	26
9.3 Limitations and accuracy .....	26
9.4 Input and output data .....	26

9.5	Goodness-of-fit test.....	27
9.6	MLE – point estimates of the distribution parameters $\beta$ and $\eta$ .....	27
9.7	Point estimate of the mean time to failure.....	28
9.8	Point estimate of the fractile (10 %) of the time to failure.....	28
9.9	Point estimate of the reliability at time $t$ ( $t \leq T$ ).....	28
9.10	Software programs .....	28
10	Confidence intervals .....	28
10.1	Interval estimation of $\beta$ .....	28
10.2	Interval estimation of $\eta$ .....	29
10.3	MRR Beta-binomial bounds .....	30
10.4	Fisher's Matrix bounds .....	30
10.5	Lower confidence limit for $B_{10}$ .....	31
10.6	Lower confidence limit for R .....	31
11	Comparison of median rank regression (MRR) and maximum likelihood (MLE) estimation methods .....	31
11.1	Graphical display.....	31
11.2	B life estimates sometimes known as B or L percentiles .....	31
11.3	Small samples .....	32
11.4	Shape parameter $\beta$ .....	32
11.5	Confidence intervals.....	32
11.6	Single failure .....	32
11.7	Mathematical rigor.....	32
11.8	Presentation of results .....	32
12	WeiBayes approach.....	33
12.1	Description .....	33
12.2	Method.....	33
12.3	WeiBayes without failures .....	33
12.4	WeiBayes with failures .....	33
12.5	WeiBayes case study .....	34
13	Sudden death method .....	35
14	Other distributions .....	37
	Annex A (informative) Examples and case studies .....	38
	Annex B (informative) Example of computations .....	40
	Annex C (informative) Median rank tables.....	42
	Annex D (normative) Statistical Tables .....	47
	Annex E (informative) Spreadsheet example.....	48
	Annex F (informative) Example of Weibull probability paper.....	55
	Annex G (informative) Mixtures of several failure modes.....	56
	Annex H (informative) Three-parameter Weibull example.....	59
	Annex I (informative) Constructing Weibull paper.....	61
	Annex J (informative) Technical background and references.....	64
	Bibliography.....	67
	Figure 1 – The PDF shapes of the Weibull family for $\eta = 1,0$ .....	12
	Figure 2 – Total test time (in minutes).....	16
	Figure 3 – Typical bathtub curve for an item .....	19

Figure 4 – Weibull failure modes may be “masked” .....	21
Figure 5 – Sample size: 10 .....	21
Figure 6 – Sample size: 100 .....	22
Figure 7 – An example showing lack of fit with a two-parameter Weibull distribution .....	23
Figure 8 – The same data plotted with a three-parameter Weibull distribution shows a good fit with 3 months offset (location – 2,99 months) .....	24
Figure 9 – Example of estimating $t_0$ by eye .....	25
Figure 10 – New compressor design WeiBayes versus old design .....	35
Figure A.1 – Main oil pump low times .....	38
Figure A.2 – Augmenter pump bearing failure .....	39
Figure A.3 – Steep $\beta$ values hide problems .....	39
Figure B.1 – Plot of computations .....	41
Figure E.1 – Weibull plot for graphical analysis .....	49
Figure E.2 – Weibull plot of censored data .....	51
Figure E.3 – Cumulative hazard plot for data of Table E.4 .....	52
Figure E.4 – Cumulative hazard plots for Table E.6 .....	54
Figure H.1 – Steel-fracture toughness – Curved data .....	59
Figure H.2 – $t_0$ improves the fit of Figure H.1 data .....	60
Table 1 – Guidance for using this International Standard .....	11
Table 2 – Ranked flare failure rivet data .....	15
Table 3 – Adjusted ranks for suspended or censored data .....	16
Table 4 – Subgroup size to estimate time to X % failures using the sudden death method .....	36
Table 5 – Chain data: cycles to failure .....	36
Table B.1 – Times to failure .....	40
Table B.2 – Summary of results .....	41
Table D.1 – Values of the gamma function .....	47
Table D.2 – Fractiles of the normal distribution .....	47
Table E.1 – Practical analysis example .....	48
Table E.2 – Spreadsheet set-up for analysis of censored data .....	50
Table E.3 – Example of Weibull analysis for suspended data .....	50
Table E.4 – Example of Spreadsheet application for censored data .....	51
Table E.5 – Example spreadsheet .....	52
Table E.6 – A relay data provided by ISO/TC94 and Hazard analysis for failure mode 1 .....	53
Table I.1 – Construction of ordinate ( $Y$ ) .....	62
Table I.2 – Construction of abscissa ( $t$ ) .....	62
Table I.3 – Content of data entered into a spreadsheet .....	62



## INTRODUCTION

The Weibull distribution is used to model data regardless of whether the failure rate is increasing, decreasing or constant. The Weibull distribution is flexible and adaptable to a wide range of data. The time to failure, cycles to failure, mileage to failure, mechanical stress or similar continuous parameters need to be recorded for all items. A life distribution can be modelled even if not all the items have failed.

Guidance is given on how to perform an analysis using a spreadsheet program. Guidance is also given on how to analyse different failure modes separately and identify a possible weak population. Using the three-parameter Weibull distribution can give information on time to first failure or minimum endurance in the sample.

# WEIBULL ANALYSIS

## 1 Scope

This International Standard provides methods for analysing data from a Weibull distribution using continuous parameters such as time to failure, cycles to failure, mechanical stress, etc.

This standard is applicable whenever data on strength parameters, e.g. times to failure, cycles, stress, etc. are available for a random sample of items operating under test conditions or in-service, for the purpose of estimating measures of reliability performance of the population from which these items were drawn.

This standard is applicable when the data being analysed are independently, identically distributed. This should either be tested or assumed to be true (see IEC 60300-3-5).

In this standard, numerical methods and graphical methods are described to plot data, to make a goodness-of-fit test, to estimate the parameters of the two- or three-parameter Weibull distribution and to plot confidence limits. Guidance is given on how to interpret the plot in terms of risk as a function of time, failure modes and possible weak population and time to first failure or minimum endurance.

## 2 Normative references

The following referenced documents are indispensable for the application 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.

IEC 60050-191:1990, *International Electrotechnical Vocabulary – Part 191: Dependability and quality of service*

IEC 60300-3-5:2001, *Dependability management – Part 3-5: Application guide – Reliability test conditions and statistical test principles*

IEC 61810-2, *Electromechanical elementary relays – Part 2: Reliability*

ISO 2854:1976, *Statistical interpretation of data – Techniques of estimations and tests relating to means and variances*

ISO 3534-1:2006, *Statistics – Vocabulary and symbols – Part 1: General statistical terms and terms in probability*

## 3 Terms, definitions, abbreviations and symbols

For the purposes of this document, the definitions, abbreviations and symbols given in IEC 60050-191 and ISO 3534-1 apply, together with the following.

### 3.1 Terms and definitions

#### 3.1.1

#### **censoring**

terminating a test after either a given duration or a given number of failures

NOTE A test terminated when there are still unfailed items may be called a “censored test”, and test time data from such tests may be referred to as “censored data”.