EESTI STANDARD

EVS-EN 61078:2016

Reliability block diagrams

EESTI STANDARDIKESKUS
ESTONIAN CENTRE FOR STANDARDISATION

EESTI STANDARDI EESSÕNA / NATIONAL FOREWORD

See Eesti standard EVS-EN 61078:2016 sisaldab Euroopa standardi EN 61078:2016 ingliskeelset teksti.	This Estonian standard EVS-EN 61078:2016 consists of the English text of the European standard EN 61078:2016.
Standard on jõustunud sellekohase teate avaldamisega EVS Teatajas.	This standard has been endorsed with a notification published in the official bulletin of the Estonian Centre for Standardisation.
Euroopa standardimisorganisatsioonid on teinud Euroopa standardi rahvuslikele liikmetele kättesaadavaks 25.11.2016.	Date of Availability of the European standard is 25.11.2016.
Standard on kättesaadav Eesti Standardikeskusest.	The standard is available from the Estonian Centre for Standardisation.

Tagasisidet standardi sisu kohta on võimalik edastada, kasutades EVS-i veebilehel asuvat tagasiside vormi või saates e-kirja meiliaadressile standardiosakond@evs.ee.

ICS 03.120.01, 03.120.99

EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

EN 61078

November 2016

ICS 03.120.01; 03.120.99

Supersedes EN 61078:2006

English Version

Reliability block diagrams (IEC 61078:2016)

Diagrammes de fiabilité (IEC 61078:2016)

Zuverlässigkeitsblockdiagramme (IEC 61078:2016)

This European Standard was approved by CENELEC on 2016-09-16. 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 CEN-CENELEC Management Centre or to any CENELEC member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CENELEC member into its own language and notified to the CEN-CENELEC Management Centre has the same status as the official versions.

CENELEC members are the national electrotechnical committees of Austria, Belgium, Bulgaria, Croatia, Cyprus, the Czech Republic, Denmark, Estonia, Finland, Former Yugoslav Republic of Macedonia, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, the Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.

European Committee for Electrotechnical Standardization
Comité Européen de Normalisation Electrotechnique
Europäisches Komitee für Elektrotechnische Normung

CEN-CENELEC Management Centre: Avenue Marnix 17, B-1000 Brussels

Ref. No. EN 61078:2016 E

European foreword

The text of document 56/1685/FDIS, future edition 3 of IEC 61078, prepared by IEC/TC 56 "Dependability" was submitted to the IEC-CENELEC parallel vote and approved by CENELEC as EN 61078:2016.

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)	2017-06-16
• latest date by which the national standards conflicting with the document have to be withdrawn	(dow)	2019-09-16

This document supersedes EN 61078:2006.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CENELEC [and/or CEN] shall not be held responsible for identifying any or all such patent rights.

Endorsement notice

The text of the International Standard IEC 61078:2016 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 61025	NOTE	Harmonized as EN 61025.
IEC 61165	NOTE	Harmonized as EN 61165.
IEC 62551	NOTE	Harmonized as EN 62551.
IEC 60812	NOTE	Harmonized as EN 60812.
IEC 61508:2010 Series	NOTE	Harmonized as EN 61508:2010 Series.
IEC 61511:2016 Series	NOTE	Harmonized as EN 61511:2016 Series.
ISO/TR 12489	NOTE	Harmonized as CEN ISO/TR 12489.

Annex ZA
(normative)

Normative references to international publications with their corresponding European publications

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

NOTE 1 When 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 60050-192	-	International Electrotechnical Vocabulary - Part 192: Dependability	-	-
IEC 61703	-	Mathematical expressions for reliability, availability, maintainability and maintenance support terms	EN 61703	-

CONTENTS

INTRODUCTION

A reliability block diagram (RBD) is a pictorial representation of a system's successful functioning. It shows the logical connection of (functioning) components (represented by blocks) needed for successful operation of the system (hereafter referred to as “system success”). Therefore an RBD is equivalent to a logical equation of Boolean variables and the probabilistic calculations are primarily related to constant values of the block success/failure probabilities.

Many different analytical methods of dependability analysis are available, of which the RBD is one. Therefore, the purpose of each method and their individual or combined applicability in evaluating the availability, reliability, failure frequency and other dependability measures as may be applicable to a given system or component should be examined by the analyst prior to deciding to use the RBD. Consideration should also be given to the results obtainable from each method, data required to perform the analysis, complexity of analysis and other factors identified in this standard.

Provided that the blocks in the RBD behave independently from each other and that the order in which failures occur does not matter then the probabilistic calculations can be extended to time dependent probabilistic calculations involving non-repaired as well as repaired blocks (e.g. blocks representing non-repaired or repaired components). In this case three dependability measures related to the system successful functioning have to be considered: the reliability itself, $R_S(t)$, but also the availability, $A_S(t)$ and the failure frequency, $w_S(t)$. While, for systems involving repaired components, the calculations of $A_S(t)$ or $w_S(t)$ can be done quite straightforwardly, the calculation of $R_S(t)$ implies systemic dependencies (see definition 3.34) which cannot be taken into account within the mathematical framework of RBDs. Nevertheless, in particular cases, approximations of $R_S(t)$ are available.

The RBD technique is linked to fault tree analysis [1][1] and to Markov techniques [2]:

- The underlying mathematics is the same for RBDs and fault tree analysis (FTA): when an RBD is focused on system success, the FT is focused on system failure. It is always possible to transform an RBD into an FT and vice versa. From a mathematical point of view, RBD and FT models share dual logical expressions. Therefore, the mathematical developments and the limitations are similar in both cases.
- When the availability $A_i(t)$ of one block can be calculated by using an individual Markov process [2] independent of the other blocks, this availability, $A_i(t)$, can be used as input for the calculations related to an RBD including this block. This approach where an RBD provides the logic structure and Markov processes numerical values of the availabilities of the blocks is called "RBD driven Markov processes".

For systems where the order of failures is to be taken into account, or where the repaired blocks do not behave independently from each other or where the system reliability, $R_S(t)$, cannot be calculated by analytical methods, Monte Carlo simulation or other modelling techniques, such as dynamic RBDs, Markov [2] or Petri net techniques [3], may be more suitable.

---

1 Numbers in square brackets refer to the Bibliography.