IEC 62125

Edition 1.0 2019-09

INTERNATIONAL STANDARD

colour inside

Environmental considerations specific to insulated electrical power and control cables

iTeh STANDARD PREVIEW
(standards.iteh.ai)
IEC 62125:2019
https://standards.iteh.ai/catalog/standards/sist/df416cb0-a156-498b-abb7-12ea8f936ecc/iec-62125-2019

IEC 62125:2019-09(en)

THIS PUBLICATION IS COPYRIGHT PROTECTED
Copyright © 2019 IEC, Geneva, Switzerland

All rights reserved. Unless otherwise specified, no part of this publication may be reproduced or utilized in any form or by any means, electronic or mechanical, including photocopying and microfilm, without permission in writing from either IEC or IEC's member National Committee in the country of the requester. If you have any questions about IEC copyright or have an enquiry about obtaining additional rights to this publication, please contact the address below or your local IEC member National Committee for further information.

IEC Central Office
3, rue de Varembé
CH-1211 Geneva 20
Switzerland

Tel.: +41 22 919 02 11
info@iec.ch
www.iec.ch

About the IEC
The International Electrotechnical Commission (IEC) is the leading global organization that prepares and publishes International Standards for all electrical, electronic and related technologies.

About IEC publications
The technical content of IEC publications is kept under constant review by the IEC. Please make sure that you have the latest edition, a corrigendum or an amendment might have been published.

IEC publications search - webstore.iec.ch/advsearchform
The advanced search enables to find IEC publications by a variety of criteria (reference number, text, technical committee,…). It also gives information on projects, replaced and withdrawn publications.

IEC Just Published - webstore.iec.ch/justpublished
Stay up to date on all new IEC publications. Just Published details all new publications released. Available online and once a month by email.

IEC Customer Service Centre - webstore.iec.ch/csc
If you wish to give us your feedback on this publication or need further assistance, please contact the Customer Service Centre: sales@iec.ch.

Electropedia - www.electropedia.org
The world's leading online dictionary on electrotechnology, containing more than 22 000 terminological entries in English and French, with equivalent terms in 16 additional languages. Also known as the International Electrotechnical Vocabulary (IEV) online.

IEC Glossary - std.iec.ch/glossary
67 000 electrotechnical terminology entries in English and French extracted from the Terms and Definitions clause of IEC publications issued since 2002. Some entries have been collected from earlier publications of IEC TC 37, 77, 86 and CISPR.

iTeh STANDARD PREVIEW
(standards.iteh.ai)
IEC 62125:2019
https://standards.iteh.ai/catalog/standards/sist/df416cb0-a156-498b-abb7-12ea8f936ecc/iec-62125-2019

IEC 62125

Edition 1.0 2019-09

INTERNATIONAL STANDARD

colour inside

Environmental considerations specific to insulated electrical power and control cables

iTeh STANDARD PREVIEW
(standards.iteh.ai)
IEC 62125:2019
https://standards.iteh.ai/catalog/standards/sist/df416cb0-a156-498b-abb7-12ea8f936ecc/iec-62125-2019

INTERNATIONAL ELECTROTECHNICAL COMMISSION

ICS 29.060.20 ISBN 978-2-8322-7374-6

Warning! Make sure that you obtained this publication from an authorized distributor.

® Registered trademark of the International Electrotechnical Commission

CONTENTS

iTeh STANDARD PREVIEW
(standards.iteh.ai)
IEC 62125:2019
https://standards.iteh.ai/catalog/standards/sist/df416cb0-a156-498b-abb7-12ea8f936ecc/iec-62125-2019

iTeh STANDARD PREVIEW
(standards.iteh.ai)
IEC 62125:2019
https://standards.iteh.ai/catalog/standards/sist/df416cb0-a156-498b-abb7-12ea8f936ecc/iec-62125-2019

INTERNATIONAL ELECTROTECHNICAL COMMISSION

____

ENVIRONMENTAL CONSIDERATIONS SPECIFIC TO INSULATED ELECTRICAL POWER AND CONTROL CABLES

FOREWORD

1) The International Electrotechnical Commission (IEC) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of IEC is to promote international co-operation on all questions concerning standardization in the electrical and electronic fields. To this end and in addition to other activities, IEC publishes International Standards, Technical Specifications, Technical Reports, Publicly Available Specifications (PAS) and Guides (hereafter referred to as "IEC Publication(s)"). Their preparation is entrusted to technical committees; any IEC National Committee interested in the subject dealt with may participate in this preparatory work. International, governmental and non-governmental organizations liaising with the IEC also participate in this preparation. IEC collaborates closely with the International Organization for Standardization (ISO) in accordance with conditions determined by agreement between the two organizations.
2) The formal decisions or agreements of IEC on technical matters express, as nearly as possible, an international consensus of opinion on the relevant subjects since each technical committee has representation from all interested IEC National Committees.
3) IEC Publications have the form of recommendations for international use and are accepted by IEC National Committees in that sense. While all reasonable efforts are made to ensure that the technical content of IEC Publications is accurate, IEC cannot be held responsible for the way in which they are used or for any misinterpretation by any end user.
4) In order to promote international uniformity, IEC National Committees undertake to apply IEC Publications transparently to the maximum extent possible in their national and regional publications. Any divergence between any IEC Publication and the corresponding national or regional publication shall be clearly indicated in the latter.
5) IEC itself does not provide any attestation of conformity. Independent certification bodies provide conformity assessment services and, in some areas, access to IEC marks of conformity. IEC is not responsible for any services carried out by independent certification bodies.
6) All users should ensure that they have the latest edition of this publication.
7) No liability shall attach to IEC or its directors, employees, servants or agents including individual experts and members of its technical committees and IEC National Committees for any personal injury, property damage or other damage of any nature whatsoever, whether direct or indirect, or for costs (including legal fees) and expenses arising out of the publication, use of, or reliance upon, this IEC Publication or any other IEC Publications.
8) Attention is drawn to the Normative references cited in this publication. Use of the referenced publications is indispensable for the correct application of this publication.
9) Attention is drawn to the possibility that some of the elements of this IEC Publication may be the subject of patent rights. IEC shall not be held responsible for identifying any or all such patent rights.

iTeh STANDARD PREVIEW
(standards.iteh.ai)
IEC 62125:2019
https://standards.iteh.ai/catalog/standards/sist/df416cb0-a156-498b-abb7-12ea8f936ecc/iec-62125-2019

International Standard IEC 62125 has been prepared by IEC technical committee 20: Electric cables.

This first edition cancels and replaces IEC TR 62125, published in 2007. This edition constitutes a technical revision.

This edition includes the following significant technical changes with respect to IEC TR 62125:2007:

a) development of the document from TR to international standard;
b) inclusion of a methodology for LCA;
c) inclusion of a methodology for conductor size optimization.

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

FDIS	Report on voting
20/1876/FDIS	20/1881/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.

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,
- replaced by a revised edition, or
- amended.

A bilingual version of this publication may be issued at a later date.

iTeh STANDARD PREVIEW
(standards.iteh.ai)

IMPORTANT – The 'colour inside' logo on the cover page of this publication indicates that it contains colours which are considered to be useful for the correct understanding of its contents. Users should therefore print this document using a colour printer.

IEC 62125:2019
https://standards.iteh.ai/catalog/standards/sist/df416cb0-a156-498b-abb7-12ea8f936ecc/iec-62125-2019

INTRODUCTION

The cable sector has, for many years, considered the impact of electric cables on the environment with respect to their operating conditions. Transmission system operators, distribution system operators, manufacturers, installers/contractors, users and authorities have considerably increased their requirements to take into account the environmental impact of electric cables.

IEC TC 20 regularly reviews its approach to the incorporation of environmental aspects into standards for electric cables and their components. Environmental considerations should be included in both design and redesign work with respect to the raw materials used, energy consumption, emissions and generation of waste during production, end of life recycling or disposal, and in-service performance.

This document supersedes IEC TR 62125 published 2007, which intended to give assistance to writers of standards within IEC Technical Committee 20, to take into account the relevant environmental aspects that are specific to electric cables in normal use.

This document is addressed to writers of standards, manufacturers and users of power cables to provide guidance when evaluating:

– the qualitative environmental impact (checklist approach), or
– the quantitative environmental impact (LCA approach), and
– the environmental and energy cost-based conductor size optimization (ECSO).

iTeh STANDARD PREVIEW
(standards.iteh.ai)
IEC 62125:2019
https://standards.iteh.ai/catalog/standards/sist/df416cb0-a156-498b-abb7-12ea8f936ecc/iec-62125-2019

ENVIRONMENTAL CONSIDERATIONS SPECIFIC TO INSULATED ELECTRICAL POWER AND CONTROL CABLES

1 Scope

This document provides methodologies addressing environmental evaluation and communication related to cables in normal use.

It includes an environmental checklist for power cables, the method for life cycle assessment (LCA) and a methodology for conductor size optimization.

The results obtained by applying such methodologies can be used for external communication. Environmental communication can also include other topics, such as material declaration.

2 Normative references

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.

iTeh STANDARD PREVIEW
(standards.iteh.ai)

IEC 60287-3-2:2012, *Electric cables – Calculation of the current rating – Part 3-2: Sections on operating conditions – Economic optimization of power cable size*

IEC 62125:2019
https://standards.iteh.ai/catalog/standards/sist/…
12ea8f936ecc/iec-62125-2019

ISO 14040:2006, *Environmental management – Life cycle assessment – Principles and framework*

ISO 14044:2006, *Environmental management – Life cycle assessment – Requirements and guidelines*

3 Terms, definitions and symbols

3.1 Terms and definitions

3.1.1
life cycle assessment
LCA
compilation and evaluation of the inputs, outputs and the potential environmental impacts of a product system throughout its life cycle

[SOURCE: ISO 14040:2006, 3.2]

3.1.2
life cycle inventory
LCI
phase of life cycle assessment involving the compilation and quantification of inputs and outputs for a product throughout its life cycle

[SOURCE: ISO 14040:2006, 3.3]

3.1.3
life cycle impact assessment
LCIA
phase of life cycle assessment aimed at understanding and evaluating the magnitude and significance of the potential environmental impacts for a product system throughout the life cycle of the product

[SOURCE: ISO 14040:2006, 3.4]

3.1.4
life cycle thinking
LCT
consideration of all relevant environmental aspects during the entire lifecycle of products

[SOURCE: IEC 62430:2009, 3.11]

3.1.5
reference flow
measure of the outputs from processes in a given product system required to fulfil the function expressed by the functional unit

[SOURCE: ISO 14040:2006, 3.29]

3.1.6
functional unit
quantified performance of a product system for use as a reference unit

iTeh STANDARD PREVIEW
(standards.iteh.ai)
IEC 62125:2019
https://standards.iteh.ai/catalog/standards/sist/df416cb0-a156-498b-abb7-12ea8f936ecc/iec-62125-2019

[SOURCE: ISO 14040:2006, 3.20]

3.1.7
environment
surroundings in which a product or system exists, including air, water, land, natural resources, flora, fauna, humans and their interrelation

Note 1 to entry: "Environment" in this document means ecological environment. It does not refer to surrounding factors influencing the cable (such as humidity or temperature), nor to the business environment.

[SOURCE: IEC Guide 109:2012, 3.3, modified – Note 1 to entry has been added.]

3.1.8
life cycle
consecutive and interlinked stages of a product system, from raw material acquisition or generation from natural resources to final disposal

[SOURCE: ISO 14040:2006, 3.1]

3.1.9
environmental impact of a product
change to the environment, whether adverse or beneficial, wholly or partially resulting from the life cycle of a product

3.1.10
unit process
smallest element considered in the life cycle inventory analysis for which input and output data are quantified

[SOURCE: ISO 14040:2006, 3.34]

3.2 Symbols

α_{20}	temperature coefficient of conductor resistance at 20 °C (for copper: 0,003 93, for aluminium: 0,004 03)	1/K
θ	maximum rated conductor operating temperature	°C
θ_a	ambient average temperature	°C
θ_m	mean operating conductor temperature	°C
$\Delta\theta$	temperature rise of conductor $\Delta\theta = (\theta_m - 20$ °C)	°C
μ	loss load factor, see IEC 60853-1	–
C_{af}	cost for ancillary materials and installation materials (like conduits)	cu/km
C_C	cable cost including transportation	cu/km
C_I	initial cost of the cable being considered	cu/km
$C_{I(CO_2)}$	cost for CO_2 emission during mining, manufacturing, transportation, installation and final disposal for a certain conductor size	cu/km
C_{I1}	initial cost of the next smaller standard size of conductor	cu/km
$C_{I1(CO_2)}$	cost for CO_2 emission during mining, manufacturing, transportation, installation and final disposal for the next smaller size of conductor	cu/km
C_{I2}	initial cost of the next larger standard size of conductor	cu/km
$C_{I2(CO_2)}$	cost for CO_2 emission during mining, manufacturing, transportation, installation and final disposal for the next larger size of conductor	cu/km
C_J	present value of the cost of joule losses during N years	cu/km
$C_{J(CO_2)}$	present value of the costs for CO_2 emission during anticipated life time due to Joule losses	cu/km
C_L	cable installation (including laying, removal and disposal) cost	cu/km
C_T	life cycle cost	cu/km
C_{T1}	life cycle cost for the next smaller size of conductor	cu/km
C_{T2}	life cycle costs for the next larger size of conductor	cu/km
cu	arbitrary currency unit	
E_{CONV}	CO_2 emission of the cable of conventional size per year during use phase	CO_2-kg/year

iTeh STANDARD PREVIEW
(standards.iteh.ai)
IEC 62125:2019
https://standards.iteh.ai/catalog/standards/sist/df416cb0-a156-498b-abb7-12ea8f936ecc/iec-62125-2019

E_{OPTI}	CO_2 emission of the cable of optimum size per year during use phase	CO_2-kg/year
F	auxiliary quantity defined by Formula (8)	cu/W
f_1	load factor	
f_2	power factor (= cos φ, φ being the phase angle between voltage and current)	
I_{max}	maximum load current	A
I_{upper}	upper limit of I_{max}	A
I_{lower}	lower limit of I_{max}	A
I_Z	CO_2 emissions during mining, manufacturing, transportation, installation and final disposal	CO_2-kg/km
K	CO_2 emission for generation of unit power to be adjusted to the national situation	CO_2-kg/kWh
k_w	Coefficient based on wiring system, e.g. 3 phase-3 wire $k_w = \sqrt{3}$, for DC cables $k_w = 1$	
L	cable length	km
M	coefficient for converting CO_2 emissions to cost to be adjusted to the national situation	CO_2-cu/kg
N	service life, a synonym (anticipated life time)	year
N_p	number of loaded phase conductors	–
P	cost of one kilowatt-hour at relevant voltage level	cu/kWh
R	conductor resistance of conductor per length (considered to be a constant value at an average operating temperature)	Ω/km
R_1	conductor resistance per length of the next smaller standard conductor size	Ω/km
R_2	conductor resistance per length of the next larger standard conductor size	Ω/km
R_{20}	conductor resistance at 20 °C per length, (ohm/km)	Ω/km
R_{conv}	AC resistance per length of the cable with conventional size for AC system and DC resistance per length of the cable with conventional size for DC system	Ω/km
R_{opti}	AC resistance per length of the cable with optimum size for AC system and DC resistance per length of the cable with optimum size for DC system	Ω/km
S	cross-sectional area of a cable conductor	mm^2

iTeh STANDARD PREVIEW
(standards.iteh.ai)
IEC 62125:2019
https://standards.iteh.ai/catalog/standards/sist/df416cb0-a156-498b-abb7-12ea8f936ece/iec-62125-2019

S_1	cross-sectional area of the next smaller standard conductor size	mm^2
S_2	cross-sectional area of the next larger standard conductor size	mm^2
U	system voltage	V
W	amount of power consumption per year	kWh/year
W_{conv}	distribution losses with the cable of conventional size	kWh/year
W_{opti}	distribution losses of the cable with optimum size	kWh/year
Y	annual operating days	days

4 General principles

The environmental impact of an electric cable shall be considered throughout all life cycle phases: from design till end of life. This is called the concept of life cycle thinking.

There are various tools for the environmental evaluation of the products, for example:

– a checklist approach, which is a qualitative consideration of the environmental aspects related to the life cycle steps of the product, i.e. use of the checklist in accordance with Clause 5 and Annex A, that is based on IEC Guide 109 and specifically focused on power cables;

iTeh STANDARD PREVIEW
(standards.iteh.ai)
IEC 62125:2019

– life cycle assessment (LCA), which is a scientific tool providing a quantitative evaluation of the environmental impact occuring during the whole life cycle of the product, i.e. use of the life cycle assessment in accordance with Clause 6 for assessment of the environmental impacts of a product.

The use of LCA methodology is recommended, as it provides quantified and detailed information on product environmental impact. Nevertheless, considering the knowledge and resources required to perform LCA studies, the checklist might be acceptable, for instance if certain aspects are considered without determining the complete environmental impact. This choice has to be made depending on objectives and knowledge and resources available.

Apart from life cycle thinking, other approaches can be used, such as:

– ECSO, a tool (described in Clause 7) to evaluate and optimize the conductor size by combining environmental and energy costs. ECSO is the optimization of the conductor size so that the sum of the total costs and the conversion costs of CO_2 emissions throughout the life phases (defined in 6.2.4) of the cable is minimized.

Environmental improvement shall be balanced against other factors, such as product function, performance, health and safety, cost, marketability and quality, legal and regulatory requirements and other standards.

5 Environmental checklist approach

5.1 What is the checklist approach?

The checklist approach is a simple method without quantification of the complete environmental impact. It is a working aid to evaluate the cable design and the cable choice for a certain application so as to find environmentally related aspects that may require consideration. The lists in 5.2 and Annex A address key factors that have an impact on the environment.