

TECHNICAL REPORT

Maintenance of low voltage switchgear and controlgear and their assemblies

(<https://standards.iteh.ai>)

Document Preview

[IEC TR 63482:2024](https://standards.iteh.ai/catalog/standards/iec/4f22cb69-b7e0-450b-b06f-c6ab759e4ba8/iec-tr-63482-2024)

<https://standards.iteh.ai/catalog/standards/iec/4f22cb69-b7e0-450b-b06f-c6ab759e4ba8/iec-tr-63482-2024>



THIS PUBLICATION IS COPYRIGHT PROTECTED
Copyright © 2024 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 Secretariat
3, rue de Varembe
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 It also gives information on projects, replaced and withdrawn publications.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.

IEC Products & Services Portal - products.iec.ch

Discover our powerful search engine and read freely all the publications previews, graphical symbols and the glossary. With a subscription you will always have access to up to date content tailored to your needs.

Electropedia - www.electropedia.org

The world's leading online dictionary on electrotechnology, containing more than 22 500 terminological entries in English and French, with equivalent terms in 25 additional languages. Also known as the International Electrotechnical Vocabulary (IEV) online.

International Standards
Document Preview
standards.iteh.ai

[IEC TR 63482:2024](https://standards.iteh.ai/catalog/standards/iec/4f22cb69-b7e0-450b-b06f-c6ab759e4ba8/iec-tr-63482-2024)

<https://standards.iteh.ai/catalog/standards/iec/4f22cb69-b7e0-450b-b06f-c6ab759e4ba8/iec-tr-63482-2024>

TECHNICAL REPORT

Maintenance of low voltage switchgear and controlgear and their assemblies

(<https://standards.iteh.ai>)
Document Preview

[IEC TR 63482:2024](https://standards.iteh.ai/catalog/standards/iec/4f22cb69-b7e0-450b-b06f-c6ab759e4ba8/iec-tr-63482-2024)

<https://standards.iteh.ai/catalog/standards/iec/4f22cb69-b7e0-450b-b06f-c6ab759e4ba8/iec-tr-63482-2024>

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

ICS 29.130.20

ISBN 978-2-8322-9457-4

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

CONTENTS

| | |
|---|----|
| FOREWORD..... | 4 |
| INTRODUCTION..... | 6 |
| 1 Scope..... | 7 |
| 2 Normative references | 7 |
| 3 Terms and definitions | 7 |
| 4 Recommended safety measures | 9 |
| 4.1 Local regulations | 9 |
| 4.2 Appropriate skill level for maintenance..... | 9 |
| 4.3 Good practice and procedures for establishing a safe working environment..... | 9 |
| 4.3.1 Working procedures..... | 9 |
| 4.3.2 Emergency exits | 10 |
| 4.3.3 Fire extinguishing equipment | 10 |
| 4.3.4 First aid | 10 |
| 4.3.5 Lighting | 10 |
| 4.3.6 Access | 10 |
| 4.3.7 Isolation before and during maintenance work | 11 |
| 4.3.8 Working on live equipment..... | 11 |
| 4.3.9 Insulating equipment | 12 |
| 4.3.10 Earthing equipment | 12 |
| 4.3.11 Stored electrical energy | 12 |
| 4.3.12 Associated section of the installation | 12 |
| 4.3.13 Portable electric tools and inspection lamps | 12 |
| 4.3.14 Testing instrument | 12 |
| 4.3.15 Avoidance of contamination..... | 13 |
| 4.3.16 Temporary safety signs or labels | 13 |
| 5 Maintenance contributes to circular economy | 13 |
| 5.1 General..... | 13 |
| 5.2 Maintenance to extend lifetime..... | 13 |
| 5.2.1 General | 13 |
| 5.2.2 Maintenance to reduce carbon footprint..... | 13 |
| 5.2.3 Maintenance to maximise material efficiency | 13 |
| 5.3 Reused, refurbished and remanufactured products | 14 |
| 6 Electrical preventive maintenance | 14 |
| 6.1 General..... | 14 |
| 6.2 Values and benefits of electrical preventive maintenance..... | 14 |
| 7 Maintenance category of assemblies | 14 |
| 7.1 General..... | 14 |
| 7.2 Preventive maintenance categories..... | 15 |
| 7.2.1 Scheduled maintenance..... | 15 |
| 7.2.2 Condition-based maintenance..... | 15 |
| 7.2.3 Predictive maintenance | 15 |
| 8 Implementation and management of maintenance | 15 |
| 8.1 General..... | 15 |
| 8.2 Skill levels | 16 |
| 8.2.1 General | 16 |
| 8.2.2 Skill level 1 | 16 |

| | | |
|-----------------------|--|----|
| 8.2.3 | Skill level 2 | 16 |
| 8.2.4 | Skill level 3 | 17 |
| 8.3 | Maintenance instructions | 17 |
| 8.4 | Periodic verification | 18 |
| 8.5 | Replacement parts | 18 |
| 8.6 | Re-energisation | 18 |
| 8.7 | Documentation and records | 18 |
| 9 | Maintenance categories and associated functionalities | 18 |
| 9.1 | General | 18 |
| 9.2 | Maintenance category over lifetime of an assembly | 19 |
| 9.3 | Functions necessary to achieve a specific maintenance category | 19 |
| 9.4 | Details to be available for each category of maintenance | 19 |
| 9.5 | Shift from one category to another | 20 |
| Annex A (informative) | Maintenance plan according to maintenance level | 21 |
| Annex B (informative) | List of notes concerning certain countries | 23 |
| Annex C (informative) | Frequency of periodic verification | 24 |
| C.1 | Environmental conditions and device operating condition | 24 |
| C.1.1 | General | 24 |
| C.1.2 | Favourable environmental conditions and device operating conditions | 24 |
| C.1.3 | Normal environmental conditions and device operating conditions | 25 |
| C.1.4 | Severe environmental conditions and device operating conditions | 25 |
| C.2 | Criticality of user application | 25 |
| C.3 | Recommended frequency for maintenance program | 26 |
| Bibliography | | 27 |
| Table 1 | – Maintenance operation level | 17 |
| Table 2 | – Functions associated with each category of maintenance | 19 |
| Table 3 | – Details to be available for each category of maintenance | 20 |
| Table A.1 | – Maintenance plan | 21 |
| Table C.1 | – Favourable environmental conditions | 24 |
| Table C.2 | – Normal environmental conditions | 25 |
| Table C.3 | – Severe environmental conditions | 25 |
| Table C.4 | – Recommended frequency according to operating conditions and criticality of the user application | 26 |

INTERNATIONAL ELECTROTECHNICAL COMMISSION

MAINTENANCE OF LOW-VOLTAGE SWITCHGEAR AND CONTROLGEAR AND THEIR ASSEMBLIES

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) IEC draws attention to the possibility that the implementation of this document may involve the use of (a) patent(s). IEC takes no position concerning the evidence, validity or applicability of any claimed patent rights in respect thereof. As of the date of publication of this document, IEC had not received notice of (a) patent(s), which may be required to implement this document. However, implementers are cautioned that this may not represent the latest information, which may be obtained from the patent database available at <https://patents.iec.ch>. IEC shall not be held responsible for identifying any or all such patent rights.

IEC TR 63482 has been prepared by IEC technical committee 121: Switchgear and controlgear and their assemblies for low voltage. It is a Technical Report.

The text of this Technical Report is based on the following documents:

| | |
|-------------|------------------|
| Draft | Report on voting |
| 121/160/DTR | 121/165A/RVDTR |

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

The language used for the development of this Technical Report is English.

This document was drafted in accordance with ISO/IEC Directives, Part 2, and developed in accordance with ISO/IEC Directives, Part 1 and ISO/IEC Directives, IEC Supplement, available at www.iec.ch/members_experts/refdocs. The main document types developed by IEC are described in greater detail at www.iec.ch/publications.

The committee has decided that the contents of this document will remain unchanged until the stability date indicated on the IEC website under webstore.iec.ch in the data related to the specific document. At this date, the document will be

- reconfirmed,
- withdrawn, or
- revised.

iTeh Standards
(<https://standards.itih.ai>)
Document Preview

[IEC TR 63482:2024](#)

<https://standards.itih.ai/catalog/standards/iec/4f22cb69-b7e0-450b-b06f-c6ab759e4ba8/iec-tr-63482-2024>

INTRODUCTION

In the low-voltage domain, the evolution of the IEC 61439 series of standards (low-voltage switchgear and controlgear assemblies) incorporating devices according to IEC 60947 series (low-voltage switchgear and controlgear) have contributed significantly to improve safety, the performance and reliability of assemblies and power availability of low-voltage energy.

The IEC 61439 series is essentially dedicated to design and verification of assemblies up to the delivery to the customer. Most applications use assemblies to run 20 years or more. Over such long periods, without suitable maintenance, the performance of an assembly can be affected and unacceptably deteriorate with serious consequences for the safety of people and the application.

To minimize the risk of malfunction due to ageing of the low-voltage assemblies some type of maintenance is implemented depending on local rules, customer maintenance policy or assembly manufacturer instruction relating to the assembly or the built-in components within the assembly. Traditionally, maintenance is scheduled and has been predefined using a fixed schedule. To avoid malfunctions, the schedules are usually conservative.

As new technologies emerge, providing new functionalities and possibilities, for example measurement of equipment temperatures, loads including harmonic content, currents interrupted, climatic conditions, alternative and more effective maintenance approaches are possible. A preventive maintenance approach using such technologies can be more cost effective and less disruptive than the traditional schedule-based maintenance arrangements.

This document sets out the basic maintenance considerations for low-voltage switchgear, controlgear and their assemblies, which is supplemented by the assembly manufacturer's instructions. It recognises that the traditional basic approach of maintenance can be improved and enhanced. This document shows that it is possible to provide one suitable maintenance approach depending on the current customer's application, but it is also possible to move to a more advanced maintenance approach, if an assembly is suitably upgraded.

NOTE It is beneficial to refer to individual product standards and/or manufacturer instruction for further information on devices incorporated in an assembly.

MAINTENANCE OF LOW-VOLTAGE SWITCHGEAR AND CONTROLGEAR AND THEIR ASSEMBLIES

1 Scope

This document provides guidance for the specification and selection of the appropriate approach and for the planning and the execution of the maintenance of low-voltage switchgear and controlgear and their assemblies having a rated voltage up to and including 1 000 V AC or 1 500 V DC, and designed for a nominal frequency of the incoming supply or supplies not exceeding 1 000 Hz.

This document provides guidance on the safety precautions for personnel designed to carry out maintenance services, with the aim to minimize the safety risks, optimize service continuity (power availability) and contribute to the environment of a low-voltage switchgear and controlgear assemblies. It recognises there are different approaches to maintenance, e.g. scheduled maintenance, condition-based maintenance and predictive maintenance. This document does not consider specifically corrective maintenance but many of the recommendations included would apply when carrying out corrective maintenance. It provides additional recommendations to comply with validation requirements in IEC 60364-6.

This document explains how the use of preventive maintenance improves the efficiency and lifetime of built-in components and consequently the assemblies themselves. All parties (specifiers, owners, designers, manufacturers, maintenance personnel) involved with low-voltage switchgear and controlgear assemblies can benefit from this document.

This document applies to both stationary and movable switchgear and controlgear assemblies with or without an enclosure. It is also applicable to switchgear and controlgear assemblies intended for use under special service conditions, possibly with additional recommendations, for example in ships and rail vehicles. It also applies to low-voltage assembly upgrades which can have additional considerations to ensure modifications are fully verified to the appropriate assembly standard.

This document does not apply to low-voltage switchgear and controlgear assemblies used in potentially explosive atmospheres.

Finally, this document is not a substitute for national regulations regarding the safety of electrical equipment and for the manufacturer's maintenance instructions. These are required to complement the overall principles defined in this document.

2 Normative references

There are no normative references in this document.

3 Terms and definitions

For the purposes of this document, the terms and definitions given in the IEC 61439 series, the IEC 60947 series and the following apply.

ISO and IEC maintain terminology databases for use in standardization at the following addresses:

- IEC Electropedia: available at <https://www.electropedia.org/>
- ISO Online browsing platform: available at <https://www.iso.org/obp>

**3.1
maintenance**

combination of all technical and management actions intended to retain an item in, or restore it to, a state in which it can perform as required

Note 1 to entry: Management is assumed to include supervision activities.

[SOURCE: IEC 60050-192:2015, 192-06-01]

**3.2
corrective maintenance**

maintenance carried out after fault detection to effect restoration

[SOURCE: IEC 60050-192:2015, 192-06-06]

**3.3
preventive maintenance**

maintenance carried out to mitigate degradation and reduce the probability of failure (of an item)

[SOURCE: IEC 60050-192:2015, 192-06-05]

**3.3.1
scheduled maintenance**

preventive maintenance carried out in accordance with a specified time schedule

Note 1 to entry: Scheduled maintenance may identify the need for some corrective maintenance action.

[SOURCE: IEC 60050-192:2015, 192-06-12, modified: the term preventive has been added]

**3.3.2
condition-based maintenance**

preventive maintenance based on the assessment of physical condition

Note 1 to entry: The condition assessment may be by operator observation, conducted according to a schedule, or by condition monitoring of system parameters.

[SOURCE: IEC 60050-192:2015, 192-06-07]

**3.3.3
predictive maintenance**

advanced form of preventive maintenance using data analysis tools and techniques to predict anomalies in operation and anticipate malfunction to extrapolate the residual time before the failure

**3.4
digital twin**

virtual representation in a digital format of a product or a system

Note 1 to entry: In this document, digital twin can be used for design, simulation, optimization or maintenance purposes using real time data throughout lifetime of product or system.

3.5

mean time to restoration

MTTR

DEPRECATED: mean time to repair

DEPRECATED: mean time to recovery
expectation of the time to restoration

[SOURCE: IEC 60050-192:2015, 192-07-23]

4 Recommended safety measures

4.1 Local regulations

Local regulations can differ from country to country. When local regulations and legal obligations are in place, they take precedence over this document and the manufacturer's maintenance instructions.

See Annex B for list of notes concerning certain countries.

4.2 Appropriate skill level for maintenance

Unless required otherwise by national or local regulations, maintenance tasks are carried out by people with the appropriate level of competency: instructed persons, skilled persons or skilled persons mandated by the assembly manufacturer. See Table 1.

4.3 Good practice and procedures for establishing a safe working environment

4.3.1 Working procedures

The risk assessment prior to commencing work is the recognized method of identifying safety risks. For maintenance activities on equipment, there is usually a written system of rules and procedures and all personnel involved with maintenance activities are aware of their existence. The level of detail and complexity of the rules and procedures is dependent on the organisation, personnel, working environment and equipment to be used. The risk assessment process is used to ensure that hazards specific to maintenance activities have been adequately addressed in the development of the associated rules and procedures. For example, different working practices and competencies are required for work on DC systems than are required for AC systems. Safety rules set out the principles and practices expected clearly and in a format that can be understood by those expected to use them. The rules and procedures reflect the requirements of an overall electrical safety policy. In most circumstances a policy for working on electrical equipment requires equipment to be deenergised and isolated prior to work commencing.

Safety rules addressing specific issues such as circuits associated with:

- interlocking and padlocking supplies;
- auto-reclosing devices;
- alternative supplies including generators, battery supplies, photovoltaic (PV), wind power;
- mechanically stored energy;
- capacitively stored energy; and/or
- control supplies (AC and DC).

All personnel are made aware to take notice of warning signs and follow instructions provided by the assembly manufacturer.

Product standards are recommended to include minimum requirements for the maintenance instructions to be provided by the manufacturer.