

TECHNICAL SPECIFICATION

SPECIFICATION TECHNIQUE



Integration of internal arc-fault mitigation systems in power switchgear and controlgear assemblies (PSC assemblies) according to IEC 61439-2

Intégration de systèmes de limitation de défaut d'arc interne dans des ensembles d'appareillage de puissance (EAP) conformément à l'IEC 61439-2



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INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

COMMISSION
ELECTROTECHNIQUE
INTERNATIONALE

ICS 29.130.20

ISBN 978-2-8322-8249-6

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

**INTEGRATION OF INTERNAL ARC-FAULT MITIGATION SYSTEMS IN
POWER SWITCHGEAR AND CONTROLGEAR ASSEMBLIES
(PSC-ASSEMBLIES) ACCORDING TO IEC 61439-2**

FOREWORD

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Technical specifications are subject to review within three years of publication to decide whether they can be transformed into International Standards.

IEC TS 63107, which is a technical specification, has been prepared by subcommittee 121B: Low-voltage switchgear and controlgear assemblies, of IEC technical committee 121: Switchgear and controlgear and their assemblies for low-voltage.

The text of this technical specification is based on the following documents:

DTS	Report on voting
121B/89/DTS	121B/97/RVDTS

Full information on the voting for the approval of this technical specification can be found in the report on voting indicated in the above table.

This technical specification is to be read in conjunction with IEC 61439-1 and IEC 61439-2. The provisions of IEC 61439-1 and IEC 61439-2 are applicable to this document where they are specifically cited. When this document states "addition", "modification" or "replacement", the relevant text in IEC 61439-1 and IEC 61439-2 is to be adapted accordingly.

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 web site under "<http://webstore.iec.ch>" in the data related to the specific document. At this date, the document will be

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INTRODUCTION

Internal arc-fault mitigation systems (IAMS) denote systems that consist of an internal arc-fault control device (IACD) and an internal arc-fault reduction device (IARD).

An IACD and an IARD can be combined and designed in one device.

An IACD uses the effects of an arc, e.g. light, gas pressure, change of current and/or voltage to detect an arc inside the power switchgear and controlgear assembly (PSC-assembly) to generate a trigger signal for an associated IARD.

An IARD reduces the arc energy below the level which would be released if an IARD was not present and the fault would be interrupted by the conventional short-circuit protective device (SCPD).

The operation of IARDs can be achieved by various methods, individually or in combination including, but not limited to, the following examples:

- a) by interruption using an upstream SCPD triggered by an IACD;
- b) by parallel connection of a low-impedance current path by using an arc quenching device (AQD) for commutation of current to this parallel path. The operation of an upstream SCPD is also required to interrupt the short-circuit current caused by the AQD before it exceeds its current carrying capabilities;
- c) by introducing a defined impedance in series with the arc-fault circuit by using an internal arc-fault limiting device (IALD). An upstream SCPD may be required to extinguish the arc.

The most commonly used techniques are described under a) and b) above.

The purpose of this document is:

- to define the specific requirements for the correct integration of the IAMS into PSC-assemblies which shall be fulfilled by the original manufacturer of the assembly.
- to provide the necessary requirements in order to verify the correct operation of the IAMS.
- to provide the user with details of the different options that can be considered when requiring IAMS within a PSC-assembly.
- to provide guidance to the original manufacturer of PSC-assemblies on the constructional requirements needing particular attention when incorporating the IAMS.

For the safe and reliable operation of the IAMS, the proper operation of the IARD in conjunction with the accompanying IACD is crucial. It is assumed, that passing all tests detailed in this document will verify the correct functioning of the entire system (combination and integration of the respective devices).

This document defines tests to verify there will be no unintentional operation of the IAMS which could be caused by e.g. switching operation of built-in components.

It is important to consider the behaviour of the complete system when an internal arc occurs immediately after the assembly is energised.

Additionally, external influences in surrounding environment, e.g. sources of light, have to be considered.

The aim of the integration of the IAMS into PSC-assemblies is to reduce the released energy in case of an internal arc-fault by using the activation of an IARD in order to:

- reduce the damage to PSC-assemblies;

- improve the suitability of PSC-assemblies for further service after an internal arc-fault;
- improve the ability of PSC-assemblies to reduce the risk of injury to personnel;

The protection offered by an IAMS has some limitations. These are described in this document in the term "IAMS protected area" (verified within specific ranges of values for the rated operational voltage and the prospective short-circuit current) for the correct functioning of the IAMS.

IEC TR 61641 provides guidance for testing of PSC-assemblies with an integrated IAMS under conditions of arcing in air due to an internal fault and addresses personnel safety and damage to the PSC-assembly. Subclause 10.101.4 of this document (Verification of an IAMS in PSC-assemblies by test) is intended to be used in conjunction with IEC TR 61641.

INTEGRATION OF INTERNAL ARC-FAULT MITIGATION SYSTEMS IN POWER SWITCHGEAR AND CONTROLGEAR ASSEMBLIES (PSC-ASSEMBLIES) ACCORDING TO IEC 61439-2

1 Scope

This document states requirements for integration and testing of IAMS in low-voltage switchgear and controlgear assemblies – power switchgear and controlgear assemblies according to IEC 61439-1 and IEC 61439-2 (PSC-assemblies) to demonstrate their correct operation.

This document does not address personnel safety or damage to the PSC-assembly. These requirements are dealt with in IEC TR 61641 (see also 10.10.1).

NOTE This document can be used as a reference for other types of assemblies in the IEC 61439 series, but adaptation of the test procedures and acceptance criteria can apply taking into account the specifics of such other assemblies or products.

IAMS consist of IACDs and IARDs complying with their relevant product standard (e.g. optical based IACDs in accordance with IEC 60947-9-2, AQDs in accordance with IEC 60947-9-1 and SCPD's in accordance with IEC 60947-2). For the reliable function in a PSC-assembly, the verification of correct operation of the complete system under built-in conditions is addressed.

This document applies only to enclosed PSC-assemblies and deals with all required verifications needed for the integration in conjunction with IEC 61439-1 and IEC 61439-2.

The test procedure given in this document takes into consideration:

- the correct function of the IAMS within the PSC-assembly;
- the prevention of unintended operation of the IAMS within the PSC-assembly;
- the functioning behaviour of the system immediately after the assembly is energised.

Different tests under more severe conditions (e.g. doors in open position) can be performed with an agreement between the user and the original manufacturer of the PSC-assembly.

This document does not supersede any individual product standard. Individual devices are required to comply with their relevant standard.

This document does not apply to integration of arc fault detection devices (AFDD) according to IEC 62606.

The informative Annex II gives guidance on particular constructional requirements for incorporation of IAMS within a PSC-assembly.

The informative Annex HH gives guidance for the user of PSC-assemblies about the criteria to be considered when specifying a PSC-assembly with an integrated IAMS.

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.

IEC 60947-9-1:2019, *Low-voltage switchgear and controlgear - Part 9-1: Active arc-fault mitigation systems - Arc quenching devices*

IEC 60947-9-2:—, *Low-voltage switchgear and controlgear - Active arc-fault mitigation systems - Part 9-2: Optical-based internal arc-detection and mitigation devices*¹

IEC 61439-1:2020, *Low-voltage switchgear and controlgear assemblies - Part 1: General rules*

IEC 61439-2:—, *Low-voltage switchgear and controlgear assemblies - Part 2: Power switchgear and controlgear assemblies*²

IEC TR 61641:2014, *Enclosed low-voltage switchgear and controlgear assemblies - Guide for testing under conditions of arcing due to internal fault*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in IEC 61439-2, and the following, apply.

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

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

3.1

internal arc-fault mitigation system

IAMS

system consisting of an internal arc-fault control device (IACD) and an internal arc-fault reduction device (IARD) that operates in case of an internal arc-fault

Note 1 to entry: An IAMS can include a "combined type" single device which combines the functions of an IACD and an IARD as defined in IEC 60947-9-2.

Note 2 to entry: This note applies to the French language only.

3.2

internal arc-fault control device

IACD

device intended to detect an internal arc-fault, which provides a signal for operation of a separate mitigation device, or automatically mitigates the internal arc-fault

Note 1 to entry: IACD with mitigation capability combines in the same device internal arc-fault detection and breaking or making capabilities.

Note 2 to entry: This note applies to the French language only.

[SOURCE: IEC 60947-9-2:—, 3.3]

¹ Under preparation. Stage at the time of publication: IEC/CCDV 60947-9-2:2020.

² Under preparation. Stage at the time of publication: IEC/RFDIS 61439-2:2020.