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Aircraft — Smart contactor — General requirements

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ISO copyright office
CP 401 • Ch. de Blandonnet 8
CH-1214 Vernier, Geneva
Phone: +41 22 749 01 11
Fax: +41 22 749 09 47
Email: copyright@iso.org
Website: www.iso.org

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Foreword

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The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT) see www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 20, *Aircraft and space vehicles*, Subcommittee SC 1, *Aerospace electrical requirements*.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

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Introduction

This document provides general requirements of the smart contactor for aircraft.

Smart Contactor based power distribution systems are emerging among advanced aircraft applications, especially among More Electric Aircraft and All Electric Aircraft. Standardization is increasingly needed for Smart Contactors in aircraft power systems based on intelligent high current switching and protecting technology. Those systems have the potential for higher reliability and longer operating life, with higher capability for status sensing, over-current protection, lower maintenance costs, higher flexibility of designing power switching as well as protecting performance compared with conventional contactor switched systems.

The purpose of this document, the definitions of smart contactor and the contents of the document are as follows:

a) The purpose of this document:

   1) To standardize the requirements for smart contactors that are physically and environmentally diversified.

   2) To provide the applicable document for various smart contactors.

b) The definitions of smart contactor:

   1) Consists of an intelligent circuit and a power switch.

   2) Turns on/off the power output by receiving the control signal.

   3) Detects the over current in the load which results in shutting down for this current.

   4) Indicates the on/off status of the power output.

   5) Reports the status of smart contactor.

c) The contents of this document:

   1) Definitions of the technical terms.

   2) Electrical requirements.

   3) Test methods.

In order to satisfy the purpose of this document, requirements such as physical, environmental and individual items are specified in accordance with the detail requirements that are issued individually.

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Aircraft — Smart contactor — General requirements

1 Scope

This document specifies the definitions, titles of design and general requirements and test methods to determine the performance of smart contactors for use in aircraft electrical power systems. The smart contactor consists of a switching driving circuit and a power switch for protection, action on control signals, and providing status information.

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.

ISO 1540, *Aerospace — Characteristics of aircraft electrical systems*

ISO 2678:1985,*Environmental tests for aircraft equipment — Insulation resistance and high voltage tests for electrical equipment*

ISO 7137:1995,*Aircraft — Environmental conditions and test procedures for airborne equipment*

3 Terms and definitions

For the purposes of this document, the following terms and definitions 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 https://www.iso.org/obp

3.1
bounce time
for a contact which is closing (opening) its circuit, the time interval between the instant when the contact circuit first closes (opens) and the instant when the circuit is finally closed (opened)

3.2
contact bounce
intermittent opening of contacts after initial closure due to contact impact

3.3
control signals
signals including control or status which is specified for operation of the smart contactor, i.e. voltage supply, control signals including turn on/off, switch status, and/or communication signals, or other

3.4
load voltage
voltage between the power output terminal of the smart contactor and the power ground

3.5
off state
condition which, with the turn-off signal applied, the device prevents power from being passed to the load

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3.6
on state
condition which, with the turn-on signal applied, the device allows power to be passed to the load

3.7
peak let-through current
peak value of the current at maximum system voltage that the smart contactor will conduct for a specified time interval without damage

3.8
power dissipation
power dissipation which includes all power dissipated in the power switching circuit, power losses due to internal leakage currents, and power supplies

Note 1 to entry: When the smart contactor is OFF, the power dissipation includes only dissipation due to leakage currents and internal power supplies.

3.9
reset
restoration of the tripped smart contactor to a state from which it can be turned ON

3.10
rupture current
maximum current the power circuit is capable of interrupting at maximum system voltage without damage

3.11
short circuit
circuit with the impedance of less than 1 mΩ applied between the output terminal and ground

3.12
short-circuit current
maximum current that the power circuit will pass without damage for a specified maximum time under the most adverse combination of electrical and environmental conditions

3.13
smart contactor
device consisting of an intelligent circuit and a power switch

Note 1 to entry: The contactor provides a power switch for high current from its power supply to its load terminal when in the ON state and a high impedance in the OFF state. The intelligent circuit consists of a driving circuit to drive the contactor, a detecting circuit sensing the current in the load and intelligent core circuit with but not limited to programmable signal processing, programmable protection characteristics, commutating capability that can trip, report device status, provide command to driving circuit in accordance with the control signal and the on/off status.

Note 2 to entry: The state of the power switch normally conforms to that represented by the last command signal applied to the smart contactor.

— The smart contactor reverts to the OFF state on detection of an electrical overload or other specified condition. A resetting operation is required to terminate the trip state. Trip-free action prevents the ON state being held in the presence of an overload trip condition.

— The state of the power switch is represented by an indication signal supplied by the smart contactor.

3.14
supply voltage
voltage applied between the power input terminal of the smart contactor and the power ground

3.15
switch status
indication showing the actual state of the smart contactor (ON state or OFF state)

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3.16
trip
automatic reversion to the OFF state of the smart contactor output caused by an overload condition

3.17
trip curve
curve which sets the minimum and maximum trip points of the smart contactor and is plotted as current versus time

3.18
trip free
feature which will prevent subsequent re-closing unless preceded by a reset signal, when the smart contactor has tripped due to an over current condition

3.19
trip time
time interval between the application of an over current condition and the 10 % value of rated output current

Note 1 to entry: In general, the higher is the over current condition the shorter is the trip time.

3.20
turn-off signal
control signal level at which the smart contactor is turned OFF.

3.21
turn-off time
time interval between initiation of turn-off signal and the time when the output reach 10 % of its steady-state ON value

3.22
turn-on signal
control signal level at which the smart contactor is turned ON

3.23
turn-on time
time interval between initiation of turn-on signal and the time when the output reach 90 % of its steady-state ON value

3.24
unwanted trip
tripping function in response to a condition that is not an over-current protection but a condition that occurs as part of the normal or anticipated operation of circuit components

Note 1 to entry: Nuisance trip is synonymous with unwanted trip.

3.25
voltage drop
voltage across input and output terminals of the smart contactor in the ON state at the specified load

4 General requirements

4.1 Detail specification sheets

The device manufacturer shall prepare an individual specification sheet for each type of device produced. The individual specification sheet shall define the value for parameters.

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