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Aerospace — Solid-state remote power controllers — General performance requirements

Aéronautique et espace — Contacteurs-disjoncteurs statiques commandés à distance — Exigences générales de performance

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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 on the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the WTO principles in the Technical Barriers to Trade (TBT) see the following URL: Foreword - Supplementary information

The committee responsible for this document is ISO/TC 20, *Aircraft and space vehicles*, Subcommittee SC 1, *Aerospace electrical requirements*.

This second edition cancels and replaces the first edition (ISO 27027:2008), which has been technically revised.

Introduction

This International Standard is the general performance requirements of the solid state (remote) power controller (SSPC) for aerospace.

Trend of aircrafts electric power system will be toward high voltage system. To accompany that trend, arc fault in the aircraft's wiring will become one of the major problems for the electric power distribution system. This second edition takes into account the arc fault detection.

The purpose of this International Standard, the definitions of SSPC and the contents of the document are as follows:

a) The purpose of this International Standard

   1) To standardize the requirements for SSPC those are physically and environmentally diversified.

   2) To provide the applicable standard document for various SSPC.

b) The definitions of SSPC

   1) Consists of a solid-state switching device and its driver circuit.

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

   3) Detects the over current in the load which results in limiting this current or shutting down for this current and/or optionally detects the arc fault in the circuit which results in shutting down the fault.

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

c) The contents of this International Standard

   1) Definitions of the technical term.

   2) Electrical requirements.

   3) Test methods.

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

Aerospace — Solid-state remote power controllers — General performance requirements

1 Scope

This International Standard specifies the definitions, titles of general performance requirements, and test methods to determine the performance of solid state (remote) power controller (SSPC) for use in aerospace electrical power systems.

The SSPC consists of solid state-switching device(s) and associated solid-state circuitry for protection, action of control signals, and providing status information.

2 Normative references

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.

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

ISO 7137, *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.

3.1
arc fault
sustained luminous discharge of electricity across a gap in a circuit or between conductors

Note 1 to entry: Arc impedance can reduce low-voltage fault current magnitudes appreciably.

3.2
current limiting
function to limit the power output current to the required level within required time from overload or short circuit conditions which is shown in Figure 2

3.3
load voltage
voltage between the power output terminal of the SSPC and the power ground

3.4
load voltage rise and fall time (D.C. devices and non-zero crossing turn-off A.C. devices)
time interval between 10 % and 90 % of the steady state load voltage value which is shown in Figure 1 a) for D.C. devices

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

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

3.7
parallel arc fault
arc fault condition in which arcing occurs in a circuit from line-to-line or line-to-ground and not through any load(s)

Note 1 to entry: Only the arc impedance and the system current impedance limit the magnitude of the arc fault current.

3.8
peak let-through current
peak value of the current at maximum system voltage that the SSPC will conduct for a specified time interval without damage

3.9
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 SSPC is OFF, the power dissipation includes only dissipation due to leakage currents and internal power supplies.

3.10
reset
restoration of the tripped SSPC to a state from which it can be turned ON

3.11
reverse current
current into the load terminal of the SSPC from the load energy source

3.12
series arc fault
arc fault condition in which the current passes through the arc and each circuit load

Note 1 to entry: The load equipment limits the magnitude of the arc fault current.

3.13
short circuit
circuit with the impedance of less then 1 mΩ applied between the output terminal and ground

3.14
soft on/off
function for the power output current to increase linearly with turn-on signal and to decrease linearly with turn-off signal

3.15
supply voltage
voltage applied between the power input terminal of the SSPC and the power ground

3.16
trip
automatic reversion to the OFF state of the SSPC output caused by an overload condition or detection of arc fault

3.17
trip curve
curve which sets the minimum and maximum trip points of the SSPC and is plotted as current verses time

3.18
trip free
feature which will prevent subsequent re-closing unless preceded by a reset signal, when the SSPC has tripped due to an overcurrent condition or detection of arc fault

3.19
trip time
time interval between the application of an overcurrent condition or detection of arc fault and the 10 % value of rated output current

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

3.20
turn-off signal
control signal level at which the power controller is turned OFF

3.21
turn-on signal
control signal level at which the power controller is turned ON

3.22
turn-off time
A.C. devices with zero-crossing turn-off
time interval between initiation of turn-off signal and the time when the output switch is OFF at zero crossing

Note 1 to entry: Shown in Figure 1 b).

3.23
turn-off time
D.C. devices and non-zero crossing turn-off A.C. devices
time interval between initiation of turn-off signal and the time when the output reach 10 % of its steady-state ON value

Note 1 to entry: Shown in Figure 1 a).

3.24
turn-on time
A.C. devices with zero-crossing turn-on

time interval between initiation of turn-on signal and the time when the output switch is ON at zero crossing

Note 1 to entry: Shown in Figure 1 b).

3.25
turn-on time
D.C. devices and non-zero crossing turn-on A.C. devices
time interval between initiation of turn-on signal and the time when the output reach 90 % of its steady-state ON value

Note 1 to entry: Shown in Figure 1 a).

3.26
unwanted trip
tripping function in response to a condition that is not an arcing fault 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.

3.27
voltage drop
voltage across load and line terminals of the SSPC in the ON state at the specified load

3.28
zero voltage turn-on/zero current turn-off (A.C. devices only)
characteristic that requires the SSPC to turn ON and turn OFF only at the half-cycle zero-crossing point, regardless of when the control signal is applied or removed

4 Requirements

4.1 Detail requirements

The individual item requirements shall be specified in accordance with the detail requirements that are issued individually. It is recommended to use ISO 7137 for the specification of environmental conditions and test procedures for the SSPCs installed in the airborne equipment.

4.2 Electrical characteristics

When tested as specified in 5.1, the SSPC shall operate with supply voltage variations in accordance with ISO 1540 or the detail requirements, and the SSPC shall be capable of controlling all type of loads as required by the detail requirements.

4.3 Performance

4.3.1 Control signals

When tested as specified in 5.1.2, the control signals shall be as specified in the detail requirements.

4.3.2 Turn-on and turn-off time

When tested as specified in 5.1.3, the turn-on and turn-off time shall be as specified in the detail requirements.

4.3.3 Load voltage rise and fall time (soft on/off function)

When tested as specified in 5.1.4, the rise and fall time as the soft on/off function shall be as specified in the detail requirements.

4.3.4 Isolation

The control/power isolation test voltage shall be as specified in the detail requirements, when tested as specified in 5.1.5.

4.3.5 Control signal levels

When tested as specified in 5.1.6, the control signal levels shall be as specified (see 4.1). Where maximum control signals are specified (see 4.1) the signal shall be applied for 10 min without any damage to the SSPC.

4.3.6 Voltage drop

When tested as specified in 5.1.7, the voltage drop shall not exceed the values specified in the detail requirements for load current values from no load to 100 % rated.

4.3.7 Off-state leakage current

When tested as specified in 5.1.8, the leakage current shall not exceed the values specified in the detail requirements.

4.3.8 Off-state output voltage

When tested as specified in 5.1.9, the output voltage shall not exceed the values specified in the detail requirements.

4.3.9 Power dissipation

When tested as specified in 5.1.10, the power dissipation shall not exceed the values specified in the detail requirements.

4.3.10 Overload characteristics

4.3.10.1 Current limiting

When specified in the detail requirements and tested as specified in 5.1.11.1, the output current shall be within the trip curve specified. At the initiation of the overload condition, the peak let through current (see 4.1) shall not exceed the value specified.

4.3.10.2 Trip characteristics with the overload condition

When tested as specified in 5.1.11.2, the SSPC shall not reset until commanded, the trip time shall be within the trip curve specified in the detail requirements without any damage.

4.3.11 State indication

The SSPC shall provide the means of state indication specified in the detail requirements when tested as specified in 5.1.12. State indication shall include the detection of load current above or below a minimum current threshold and the presence or absence of drive to the output power switches as specified in the detail requirements. These state indication means, in conjunction with the control signal, shall be capable of providing feedback on normal controller operation or controller faults as specified in the detail requirements.

4.3.12 Trip-free characteristics

When tested as specified in 5.1.13, the SSPC shall reset, trip-out, and stay tripped out for the duration of the test.

4.3.13 Zero voltage turn-on and zero current turn-off (Figure 1 b)

When tested as specified in 5.1.14, the SSPC turn-on shall occur at zero voltage crossover within the voltage or time specified, and the SSPC turn-off shall occur at zero current crossover within the current or time specified. The SSPC shall turn-on and turn-off at the same voltage slope when specified.

4.3.14 Reverse current

When specified in the detail requirements and tested as specified in 5.1.15, the SSPC shall not be damaged and shall be performed as specified.

4.3.15 Exponential rate of voltage rise

When tested as specified in 5.1.16, the SSPC shall achieve the specified output voltage within the specified time.

4.3.16 Arc fault characteristics

4.3.16.1 Trip characteristics with parallel arc fault

When tested as specified in 5.1.17.1 and 5.1.17.2, the SSPC shall trip by parallel arc fault, the trip time shall be within the trip curve specified in the detail requirements without any damage.