SLOVENSKI STANDARD
SIST EN 16603-20-20:2018

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Vesoljska tehnika - Električna zasnova in zahteve vmesnika za napajalna omrežja

Space engineering - Electrical design and interface requirements for power supply

Raumfahrttechnik - Anforderungen an Schnittstellen für elektrische Leistung

Ingénierie spatiale - Exigences de conception et d'interface électriques pour alimentation bord

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ICS:

49.140	Vesoljski sistemi in operacije	Space systems and operations

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English version

Space engineering - Electrical design and interface requirements for power supply

Ingénierie spatiale - Exigences de conception et d'interface électriques pour alimentation bord

Raumfahrttechnik - Anforderungen an Schnittstellen für elektrische Leistung

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This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CEN and CENELEC member into its own language and notified to the CEN-CENELEC Management Centre has the same status as the official versions.

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European Foreword

This document (EN 16603-20-20:2018) has been prepared by Technical Committee CEN-CENELEC/TC 5 "Space", the secretariat of which is held by DIN.

This standard (EN 16603-20-20:2018) originates from ECSS-E-ST-20-20C.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by February 2019, and conflicting national standards shall be withdrawn at the latest by February 2019.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CEN shall not be held responsible for identifying any or all such patent rights.

This document has been prepared under a standardization request given to CEN by the European Commission and the European Free Trade Association.

This document has been developed to cover specifically space systems and has therefore precedence over any EN covering the same scope but with a wider domain of applicability (e.g. : aerospace).

According to the CEN-CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, Former Yugoslav Republic of Macedonia, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.

Introduction

This standard identifies the requirements needed to specify, procure or develop a space power distribution based on Latching Current Limiters, both from source and load perspective.

For a reference architecture description, it is possible to refer to ECSS-E-HB-20-20.

ECSS-E-HB-20-20 includes a clarification of the principles of operation of a power distribution based on LCLs, identifies important issues related to LCLs and explains the requirements of the present standard.

Note that the present issue of the standard covers electrical design and interface requirements for power distribution based on Latching Current Limiters only. Future issues of the present standard will cover additional power interfaces.

1 Scope

The target applications covered by this standard are all missions traditionally provided with power distribution and protection by LCLs/RLCLs (science, earth observation, navigation) with exclusion of applications for which the power distribution and protection is provided by fuses (e.g. most of the GEO telecom satellites).

The present standard applies to power distribution by LCLs/RLCLs for power systems, and in general for satellites, required to be Single Point Failure Free.

The present standard document applies exclusively to the main bus power distribution by LCLs/RLCLs to external satellite loads.

A particular case of LCLs (Heater LCLs, or HLCLs) is also treated. The HLCLs are the protections elements of the power distribution to the thermal heaters in a spacecraft.

Internal power system protections of LCLs/RLCLs are not covered.

Paralleling of LCLs to increase power supply line reliability is not covered by the present standard, since this choice does not appreciably change the reliability of the overall function (i.e. LCL plus load).

In fact, a typical reliability figure of the LCL (limited to the loss of its switch-on capability) is 20 FIT or less.

If the load to be connected to the LCL line has a substantial higher failure rate than this, it is not necessary to duplicate the LCL to supply that load.

This standard may be tailored for the specific characteristic and constrains of a space project in conformance with ECSS-S-ST-00.

2
Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this ECSS Standard. For dated references, subsequent amendments to, or revision of any of these publications do not apply. However, parties to agreements based on this ECSS Standard are encouraged to investigate the possibility of applying the more recent editions of the normative documents indicated below. For undated references, the latest edition of the publication referred to applies.

EN reference	Reference in text	Title
EN 16601-00-01	ECSS-S-ST-00-01	ECSS system - Glossary of terms
EN 16603-20	ECSS-E-ST-20	Space engineering - Electrical and electronic

3 Terms, definitions and abbreviated terms

3.1 Terms from other standards

a. For the purpose of this Standard, the terms and definitions from ECSS-S-ST-00-01 apply, in particular for the following terms:

1. redundancy
2. active redundancy
3. hot redundancy
4. cold redundancy
5. fault
6. fault tolerance

3.2 Terms specific to the present standard

3.2.1 centralised

feature that serves a number of elementary functions in a system

3.2.2 current overshoot decay time

maximum time constant decay time from current overshoot peak to actual limitation current after an overcurrent event, under the assumption that the decay time is modelled by an exponential law

3.2.3 current overshoot recovery time

time needed for the to reduce from its maximum value to ±10 % of the excess current, at the application of an overload to the LCL/RLCL/HLCL

NOTE 1 See Figure 3-1 and Figure 3-2.

NOTE 2 Excess current is intended as overshoot peak minus actual limitation current value.

3.2.4 fault condition

internal failure of one of the following devices: LCL, RLCL or HLCL

NOTE This definition is aimed at clarifying that the fault condition is not the one relevant to the load.

3.2.5 fault current emission

maximum current emission of a given circuit at external interface under abnormal conditions

NOTE Abnormal in this context can cover fault condition or operator error.

3.2.6 fault current tolerance

minimum abnormal interface current that a circuit can sustain without being damaged

3.2.7 fault voltage emission

maximum voltage emission of a given circuit at external interface under abnormal conditions

NOTE Abnormal condition can cover fault condition or operator error.

3.2.8 fault voltage tolerance

minimum abnormal interface voltage that a circuit can sustain without being damaged

3.2.9 feature

part of a function to which a specific requirement refers

3.2.10 heater latching current limiter HLCL

LCL used as protection element in a power distribution to satellite thermal heaters

3.2.11 input filter charge time

time required for the LCL to charge the load input filter

NOTE See Figure 3-3.

3.2.12 input overshoot charge

charge requested at the LCL/RLCL/HLCL input at the application of an overload, for current in excess of the actual limitation current

NOTE See Figure 3-1 and Figure 3-2.

3.2.13 latching current limiter LCL

switchable and latching protection placed between a power source and the relevant load, causing a trip-off after having achieved at its output an overcurrent limitation for a definite trip-off time

3.2.14 LCL class

maximum allowable current that can flow through the LCL itself, under given standard conditions

NOTE LCL classes are defined in Table 3-1.

3.2.15 LCL switch dissipative failure

failure corresponding to an equivalent gate to drain short circuit on a MOSFET

NOTE The voltage across is approximately 4 V to 5 V maximum.

3.2.16 nominal condition

operative condition of the LCL/RLCL/HLCL, with no internal failure

3.2.17 repetitive overload

overcurrent event that repeats for a number of cycles or indefinitely

3.2.18 retriggerable latching current limiter RLCL

LCL that automatically attempts to switch ON when powered or after a retrigger interval when a trip-off event occurred

3.2.19 retriggerability

characteristic of an RLCL protection to be able to restart automatically after being triggered

3.2.20 retrigger interval

time duration in high impedance state of a RLCL after a permanent overcurrent event occurred and the relevant trip-off time elapsed

NOTE 1 See Figure 3-4.

NOTE 2 High impedance state is equivalent to OFF condition.

3.2.21 RLCL class

maximum allowable current that can flow through the RLCL itself, under given standard conditions

NOTE RLCL classes are defined in Table 3-2.

3.2.22 sub-feature

sub-part of a function to which a specific requirement refers

3.2.23 switch-on response time

time needed to enable actual ON command reception, under specified conditions

3.2.24 UVP switch-off response time

time to achieve UVP action in dynamical conditions, when under voltage excitation is achieved under standard conditions

NOTE The UVP action is the OFF of the relevant function.

3.2.25 time to current overshoot

maximum time from max limitation current to actual current overshoot peak after an overcurrent event

NOTE See Figure 3-1 and Figure 3-2.

3.2.26 trip-off

event occurring when a current protection latch flips and opens the protected distribution line after an overcurrent condition

NOTE To open a distribution line means to set the distribution line in high impedance status.

3.2.27 trip-off time

time in between LCL crossing actual current limitation value and the trip-off event, in permanent overcurrent condition.

NOTE See Figure 3-1 and Figure 3-2.

3.2.28 undervoltage protection
UVP

protection that is triggered when the voltage provided to a function falls below a predefined threshold

NOTE LCL and RLCL are examples of functions for which UVP is activated.

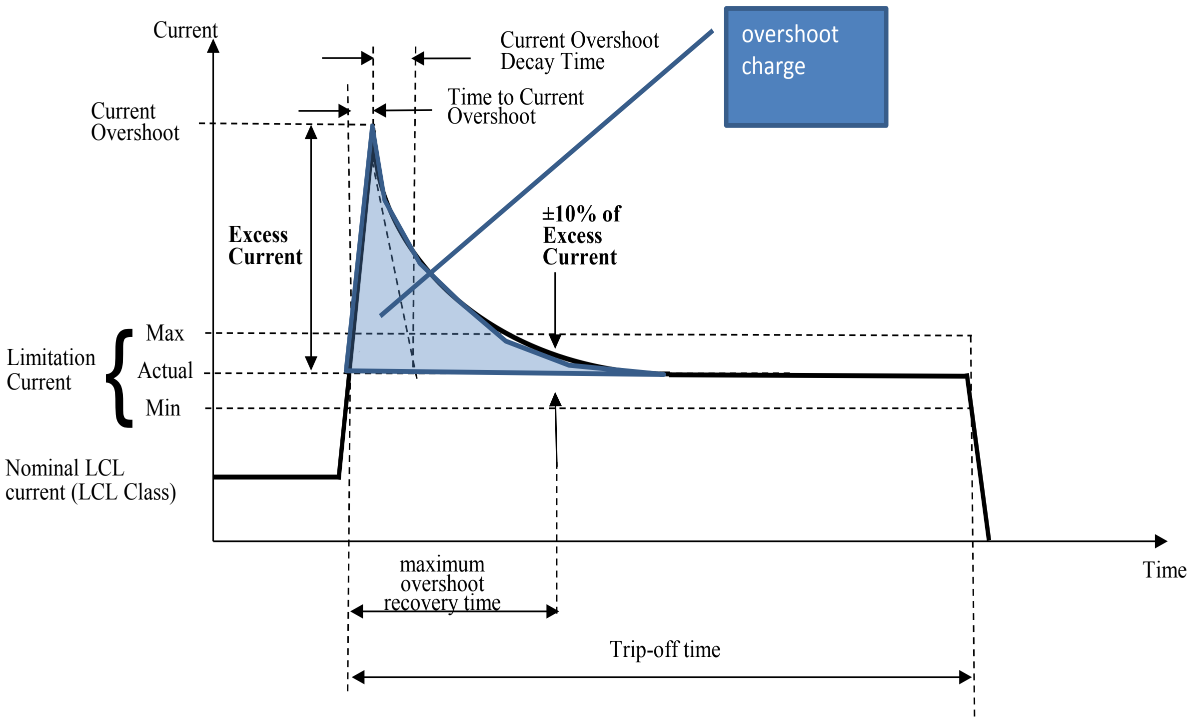

Figure 3-1: LCL overload timing diagram (case 1)

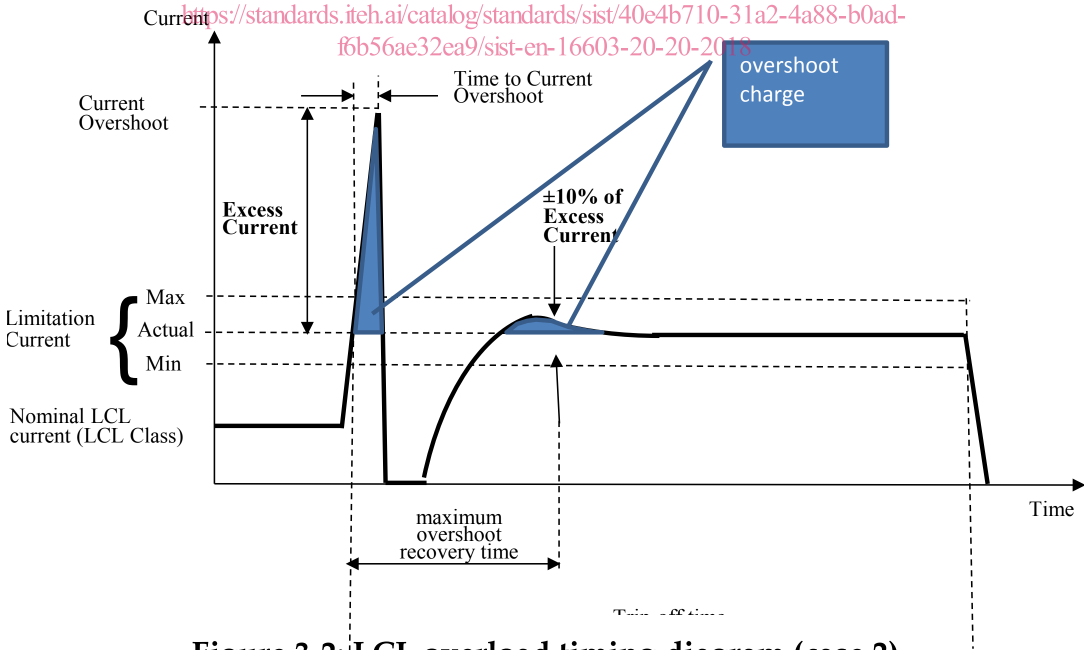

Figure 3-2: LCL overload timing diagram (case 2)

NOTE Figure 3-1 and Figure 3-2 show typical current diagrams expected when an LCL/RLCL/HLCL are subject to an overload. They can represent either the LCL/RLCL/HLCL input or output current.