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Space engineering - Two-phase heat transport equipment

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Raumfahrttechnik - Ausrüstung für Zwei-Phasen-Wärmetransport

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European foreword

This document (EN 16603-31-02:2015) has been prepared by Technical Committee CEN/CLC/TC 5 “Space”, the secretariat of which is held by DIN.

This standard (EN 16603-31-02:2015) originates from ECSS-E-ST-31-02C.

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of an identical text or by endorsement, at the latest by March 2016, and conflicting national standards shall be withdrawn at the latest by March 2016.

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

This document has been prepared under a mandate 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, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.

Introduction

This Standard is based on ESA PSS-49, Issue 2 "Heat pipe qualification requirements", written 1983, when the need for heat pipes in several ESA projects had been identified. At that time a number of European development activities were initiated to provide qualified heat pipes for these programmes, which culminated in a first heat pipe application on a European spacecraft in 1981 (MARECS, BR-200, ESA Achievements - More Than Thirty Years of Pioneering Space Activity, ESA November 30, 2001), followed by a first major application on a European communication satellite in 1987 (TV-SAT 1, German Communication Satellites).

ESA PSS-49 was published at a time, when knowledge of heat pipe technology started to evolve from work of a few laboratories in Europe (IKE, University Stuttgart, EURATOM Research Centre, Ispra). Several wick designs, material combinations and heat carrier fluids were investigated and many process related issues remained to be solved. From today's view point the qualification requirements of ESA PSS-49 appear therefore very detailed, exhaustive and in some cases disproportionate in an effort to cover any not yet fully understood phenomena. As examples the specified number of qualification units (14), the number of required thermal cycles (800) and the extensive mechanical testing (50 g constant acceleration, high level sine and random vibration) can be cited.

The present Standard takes advantage of valid requirements of ESA PSS-49, but reflects at the same time today's advanced knowledge of two-phase cooling technology, which can be found with European manufacturers. This includes experience to select proven material combinations, reliable wick and container designs, to apply well-established manufacturing and testing processes, and develop reliable analysis tools to predict in-orbit performance of flight hardware. The experience is also based on numerous successful two-phase cooling system application in European spacecraft over the last 20 years.

Besides stream-lining the ESA PSS-49, to arrive at today's accepted set of heat pipe qualification requirements, the following features have also been taken into account:

- Inclusion of qualification requirements for two-phase loops (CPL, LHP),
- Reference to applicable requirements in other ECSS documents,
- Formatting to recent ECSS template in order to produce a document, which can be used in business agreements between customer and supplier.

1
Scope

This standard defines requirements for two-phase heat transportation equipment (TPHTE), for use in spacecraft thermal control.

This standard is applicable to new hardware qualification activities.

Requirements for mechanical pump driven loops (MPDL) are not included in the present version of this Standard.

This standard includes definitions, requirements and DRDs from ECSS-E-ST-10-02, ECSS-E-ST-10-03, and ECSS-E-ST-10-06 applicable to TPHTE qualification. Therefore, these three standards are not applicable to the qualification of TPHTE.

This standard also includes definitions and part of the requirements of ECSS-E-ST-32-02 applicable to TPHTE qualification. ECSS-E-ST-32-02 is therefore applicable to the qualification of TPHTE.

This standard does not include requirements for acceptance of TPHTE.

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 16603-31	ECSS-E-ST-31	Space engineering - Thermal control general requirements
EN 16603-32	ECSS-E-ST-32	Space engineering - Structural general requirements
EN 16603-32-01	ECSS-E-ST-32-01	Space engineering- Fracture control
EN 16603-32-02	ECSS-E-ST-32-02	Space engineering - Structural design and verification of pressurized hardware
EN 16602-70	ECSS-Q-ST-70	Space product assurance - Materials, mechanical parts and processes
	EN 9100:2009	Aerospace series - Quality management systems - Requirements for Aviation, Space and Defense Organizations