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Guidelines for the design margin of aerospace products

航天产品裕度设计指南

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Foreword

This document is in accordance with the provisions of GB/T 1.1-2020 "Guidelines for Standardization Work Part

1. Structure and Drafting Rules of Standardization Documents" Drafting. Please note that some of the contents of this document may involve patents. The issuing agency of this document is not responsible for identifying patents. This document was proposed and managed by the National Aerospace Technology and Application Standardization Technical Committee (SAC/TC425). Drafting organizations of this document. Shanghai Institute of Aerospace System Engineering, China Aerospace Standardization Institute. The main drafters of this document. Han Dongmei, Wang Yiyuan, Liu Zhengyong, Feng Shuhong, Hu Dike, Chen Xiaoqiang, Lu Zhen, Li Peng, Zhang Hua, Shi Fei, Xu Dongyan. Guidelines for Margin Design of Aerospace Products

1 Scope

China's national guidelines for design margin in aerospace products. It gives the general rules for margin design and covers the environmental and other margins. Margin is the gap between what a component is designed to withstand and what it is expected to see, and aerospace has a more disciplined relationship with it than most engineering because both errors are expensive. Too little margin and the item fails in a place where nothing can be repaired; too much and it is heavier than it needs to be, which on a launch vehicle costs directly and on a spacecraft costs capability. The guidelines address the several distinct kinds - structural margin over the predicted loads, thermal margin over the predicted temperatures, electrical margin, and the timeline and resource margins of the mission itself - and the rule that governs all of them: margins are held at a defined level by a named authority and released deliberately, not consumed quietly as a programme runs into difficulty.

This document provides general rules for aerospace product margin design, environmental margin design, structural mechanism margin design, electronic circuit margin design, thermal Recommendations on protection margin design and software margin design, and

related information are given. This document is applicable to the margin design of launch vehicles and spacecraft products. Other aerospace products can be used as reference.

2 Normative references

The contents of the following documents constitute the indispensable clauses of this document through normative references in the text. Among them, dated quotations Only the version corresponding to that date is applicable to this document; for undated reference documents, the latest version (including all amendments) is applicable to This document.

GB/T 32296 Spacecraft commonly used coordinate system

GB/T 32452 Spacecraft Space Environment Terminology

GB/T 32455 Terminology for launch vehicles

3 Terms and definitions

The following terms and definitions defined in GB/T 32296, GB/T 32452 and GB/T 32455 apply to this document.

3.1 Margin Characterize the degree of margin between the design value and the demand value.

3.2 Radiation design margin radiationdesignmargin; RDM The ratio of the radiation resistance of the product to the predicted radiation dose in the working environment.

4 General

4.1 Basic principles The reliability margin design of aerospace products is used to compensate various uncertainties in product production and use, and to improve product reliability. conduct The basic principles of margin design generally include.

- a) Comprehensive design, manufacturing, testing, use, maintenance and other constraints of the entire life cycle of aerospace products, taking into account the advanced nature;
- b) Considering the different characteristics of aerospace products, adopting the corresponding generalized margin design, generally considering the environment (including heat protection, mechanical resistance, radiation resistance, Electromagnetic interference, etc.) margin, strength margin, drive margin, life margin, electronic circuit margin, software design margin, etc.;
- c) Attach importance to stress-strength interference analysis, adopting methods such as improving average strength, reducing average stress, avoiding stress concentration, and reducing strength dispersion, etc. Method to find the best match between stress and strength;

- d) Consider the limit design situation, including the worst case and combination of various parameters;
- e) Effectively evaluate and verify the margins of aerospace products. For those that have not been fully tested and verified and have poor consistency, it is recommended to use relatively Large margin.

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