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**Radioisotope thermoelectric generators for lunar and deep
space probes**

月球与深空探测用同位素温差电池

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Table of Contents

1 Scope ...	1
2 Normative references ...	1
3 Terms and Definitions ...	1
4 Technical requirements ...	1
4.1 Functional Requirements ...	1
4.2 Product composition ...	2
4.3 Electrical performance requirements ...	2
4.4 Quality Requirements ...	3
4.5 Appearance Requirements ...	3
4.6 Material Requirements ...	3
4.7 Mechanical Interface ...	3
4.8 Thermal Interface ...	3
4.9 Electrical Interface ...	3
4.10 Leakage rate requirements ...	3
4.11 Radiation dose equivalent rate requirements ...	3
4.12 Nuclear protection requirements ...	4
4.13 Lifespan Requirements ...	4
4.14 Reliability Requirements ...	4
4.15 Environmental adaptability requirements ...	4
4.16 Emergency adaptability requirements ...	4
5 Test methods ...	4
5.1 General Principles ...	4
5.2 Electrical properties ...	5
5.3 Quality ...	5
5.4 Appearance ...	5
5.5 Materials ...	5
5.6 Mechanical Interface ...	5
5.7 Thermal Interface ...	5
5.8 Electrical Interface ...	5
5.9 Leakage rate ...	5
5.10 Radiation dose equivalent rate ...	6
5.11 Nuclear Protection ...	6

5.12 Lifespan	6
5.13 Reliability	6
5.14 Environmental adaptability	6
5.15 Emergency Adaptability	6
6 Inspection Rules	7
6.1 Inspection categories	7
6.2 Test conditions	7
6.3 Inspection items, requirements and methods	7
6.4 Identification and delivery inspection requirements	8
6.5 Judgment Rules	8
7 Markings, labels and accompanying documents	8
8 Packaging, transportation and storage	9
9 Installation and Usage Requirements	9
9.1 Device Installation	9
9.2 Intended use and usage requirements	9

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 for standardization documents" Drafting is required. Please note that some of the contents of this document may involve patents. The issuing organization of this document does not assume the responsibility for identifying patents. This document was proposed and coordinated by the National Technical Committee for Standardization of Aerospace Technology and Its Applications (SAC/TC 425). This document was drafted by: Beijing Space Vehicle General Design Department, China Electronics Technology Group Corporation 18th Institute, China Atomic Energy Scientific Research Institute, China Aerospace Standardization Institute. The main drafters of this document are: Chen Jianxin, Zhang Yan, Chen Yang, Lei Yingjun, Hou Xufeng, Tang Xian, Chen Xiangdong, Ma Juyin, Li Haifei, Quan Haofang, Zhang Youwei, Lü Dongxiang, Qin Shaopeng, Liu Zijun, Shi Dongbo, Wang Xue, Li Xuan, Zhang Ningkan. Isotope temperature difference battery for lunar and deep space exploration

1 Scope

China's national standard for the radioisotope thermoelectric generators used on lunar and deep space probes. An RTG converts the heat of decaying plutonium-238 directly into electricity through thermocouples, with no moving parts, and it produces power for decades

regardless of sunlight. That last point is why it exists: beyond Jupiter the sunlight is too weak for solar arrays, and on the lunar surface the night lasts fourteen days at temperatures approaching minus 180 degrees C, which no battery bridges and which will destroy a lander that cannot keep itself warm. Chinese lunar missions have carried radioisotope heat sources for exactly that reason. The engineering constraints are unusual: the generator is a sealed source of ionising radiation handled by people during assembly and launch, it must survive a launch failure without dispersing its fuel, and its output declines predictably over the mission in a way the power budget must anticipate.

This document specifies the technical requirements, test methods, inspection rules, marking, labeling and Accompanying documents, packaging, transportation and storage, installation and usage requirements. This document applies to the design, production, testing and acceptance of isotope temperature difference batteries for lunar and deep space exploration.

2 Normative references

The contents of the following documents constitute the essential clauses of this document through normative references in this document. For referenced documents without a date, only the version corresponding to that date applies to this document; for referenced documents without a date, the latest version (including all amendments) applies. in this document.

GB/T 191 Pictorial markings for packaging, storage and transportation

GB/T 2423.22 Environmental testing Part

3 Terms and definitions

The terms and definitions defined in GB/T 4960.4 and GB/T 37750 and the following apply to this document.

3.1 radioisotope thermoelectric generator; RTG A device that uses the Seebeck effect of semiconductor materials to directly convert the decay heat of radioactive isotopes into electrical energy.

3.2 Isotope heat source radioisotope heat unit; RHU A component that uses the decay of a radioactive isotope to generate heat.

4 Technical requirements

4.1 Functional requirements The function of RTG is to convert part of the heat energy generated by isotope decay into electrical energy to provide power for spacecraft or onboard equipment. The spacecraft or its onboard equipment provides thermal energy to maintain the temperature of the equipment.