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**NATIONAL STANDARD OF THE
PEOPLE'S REPUBLIC OF CHINA**

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**Environmental control requirements for spacecraft assembly,
integration and test**

航天器AIT环境控制要求

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6.1 Temperature

6.1.1 Temperature Requirements The temperature requirements are as follows:

- a) The operating temperature of the spacecraft's AIT (Autonomous Intervention) system should be $20^{\circ}\text{C} \pm 5^{\circ}\text{C}$. Any other special requirements shall be implemented in accordance with relevant regulations.
- b) When transporting spacecraft outside the factory, temperature-controlled packaging containers should be used, and the temperature inside the packaging containers should preferably be controlled at 5°C , 35°C , or follow the specific design documents, and real-time monitoring is recommended.

6.1.2 Temperature control requirements Temperature control requirements are as follows:

- a) Equipment that is significantly affected by ambient temperature should not be used in the AIT process; if it is used, temperature control measures should be implemented for the equipment.
- b) When excessively high local ambient temperatures during spacecraft testing affect its instruments and equipment, cooling measures should be taken, such as using non-thermal methods. Pollution-reducing methods such as air cooling;

- c) Temperature control measures should be implemented and monitoring and alarm functions should be activated for temperature-sensitive spacecraft components or parts;
- d) For temperature changes caused by operations in confined spaces (such as manned reentry capsules), ventilation or heat dissipation control measures should be implemented;
- e) Environmental control capabilities should meet the heat dissipation requirements of specific tests, such as spacecraft system-level thermal tests.

6.2 Humidity

6.2.1 Humidity Requirements Humidity requirements are as follows:

- a) The relative humidity of the spacecraft's AIT working environment should be 30%–60%. For other special requirements, the relevant documents shall apply.
- b) The relative humidity inside the packaging container should not exceed 60%, or as specified in the design documents.

6.2.2 Humidity Control Requirements Humidity control requirements are as follows:

- a) The AIT process should not have a significant impact on ambient humidity (e.g., spraying is not permitted during floor cleaning, and humidification should not be carried out). (To address the impact on spacecraft)
- b) For humidity-sensitive spacecraft components or parts (such as solar panel propulsion mechanisms), local dehumidification devices should be used to control humidity;
- c) For humidity-sensitive operations, such as soldering electronic components, dehumidification or humidification devices should be used to control the local humidity environment;
- d) The humidity inside the packaging container should be controlled by means of air conditioning, desiccant, and nitrogen gas to ensure the safety of the spacecraft surface. It will not condense.

6.3 Cleanliness and Contamination

6.3.1 Cleanliness Requirements The cleanliness level of the AIT working environment of the spacecraft should be ISO Class

8. Other special requirements shall be implemented in accordance with the relevant documents.

6.3.2 Cleanroom Control Requirements The cleanroom control requirements are as follows:

- a) Cleaning of the cleanroom shall be carried out in accordance with section 4.6 and Appendix F of GB/T 25915.5-2010;

b) A positive pressure difference should be maintained between the cleanroom and the outside environment; the pressure difference between cleanrooms (areas) of different grades should not be less than

5 Pa. The pressure difference between the clean area and the non-clean area should not be less than

5 Pa, and the pressure difference between the clean area and the outside should not be less than

c) Activities that generate pollutants, such as machining, should not be carried out in clean areas (rooms). If machining is absolutely necessary under special circumstances, [further procedures should be followed]. Take safe and effective control measures to remove excess material;

d) For cleanrooms with microbial control requirements, in addition to routine cleaning as described in a), sterilization should also be performed.

6.3.3 Requirements for personnel pollution control The requirements for personnel-related pollution control are as follows:

a) Cleanroom garment contamination control shall be carried out in accordance with section

4.2 and Appendix B of GB/T 25915.5-2010;

b) Contamination control for personnel entering the clean area shall be carried out in accordance with section

6.4 Vibration and Noise

6.4.1 Vibration and Noise Requirements The vibration and noise requirements are as follows:

a) The background noise level in general AIT work areas should not exceed 70 dBA. Personnel in control rooms and other similar areas need to concentrate or communicate effectively. The background noise level in such locations should not exceed 60 dBA.

b) The steady-state noise sound pressure level of short-term noise generated by special tests (such as vibration tests, noise tests, etc.) should not exceed 85 dBA.

c) Weak signal testing (such as micro-vibration, noise assessment inside manned spacecraft, etc.), the background noise signal-to-noise ratio should be higher than 10dB. Calculate according to formula (1).

6.4.2 Vibration and Noise Control Requirements Vibration and noise control requirements are as follows:

a) For work items sensitive to vibration and noise (such as micro-vibration testing, precision

testing, quality characteristic testing, etc.), a comprehensive evaluation of vibration and noise should be conducted. The impact of noise;

b) When ground equipment generates significant vibration as a vibration source, appropriate measures should be taken, such as selecting low-vibration equipment and using vibration-damping materials. The assessment methods for vibration and its impact on structures shall be carried out in accordance with GB/T 14124;

c) For equipment exceeding noise standards, necessary measures should be taken, such as optimizing equipment space layout, constructing enclosures, installing silencers, and using shielding (soundproof barriers). Measures to effectively prevent the spread of noise shall be implemented in accordance with GB/T 17249.2.

d) High-noise environments generated by special tests (such as noise tests, vibration tests, etc.) should be monitored and evaluated regularly;

e) In workplaces with high vibration or noise levels, it is advisable to take protective measures such as wearing earmuffs or earplugs;

f) Micro-vibration tests should take measures to reduce ambient background noise (e.g., conduct tests at night to reduce the impact of traffic on the test environment). (Impact, shutting down the air conditioning system, using vibration isolation devices, controlling personnel movement, reducing noise, etc.)

g) Strong noise sources in AIT working areas, such as reverberation chambers, should be subject to targeted noise reduction designs (e.g., sound insulation and airtightness of reverberation chamber doors, sound attenuation). (e.g., sound insulation design of roads)

h) Strong vibration sources in the AIT working area, such as vibration tables, should be subject to targeted vibration isolation design. After vibration isolation, the vibration environment indicators should not exceed [the specified limits]. 0.05g;

i) Equipment such as those used for thermal testing that are equipped with high-pressure exhaust pipes should be equipped with appropriate noise reduction measures.

6.5 Electrostatic Protection

6.5.1 Electrostatic Discharge Protection Requirements Before spacecraft AIT (Automatic Interchange), the electrostatic discharge (ESD) sensitivity of spacecraft components should be identified. For ESD sensitivity indicators... For products that meet the standard of not less than 100V for the Human Body Model (HBM) and not less than 200V for the Charged Device Model (CDM), the electrostatic discharge (ESD) protection requirements shall be as follows: The provisions of Chapter 5 of GB/T 32304-2015 and GB/T 41673-2022 shall apply; otherwise, stricter control measures shall be taken.