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**Requirements for connecting to the liquid loop, nitrogen supply  
and gas exhaust systems of a space station**

空间站空间应用气液回路接入要求

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### Foreword

This document complies with the provisions of GB/T 1.1-2020 "Standardization Work Guidelines Part

1. Structure and Drafting Rules of Standardization Documents". Drafting. Please note that some content in this document may involve patents. The issuing organization of this document assumes no responsibility for identifying patents. This document is under the jurisdiction of the National Manned Spaceflight Standardization Technical Committee (SAC/TC570). This document was drafted by the Center for Space Applications Engineering and Technology, Chinese Academy of Sciences. The main drafters of this document are. Xue Jing, Wang Ke, Sheng Qiang, Guo Dong, Guo Dongcai, Zhang Lu, and Wang Ze. Space station space application gas-liquid loop access requirements

1. Scope This document specifies the requirements and verification tests related to the gas-liquid loop connection for space applications on the space station. This document applies to all access payloads that utilize the gas-liquid loop resources of the space station's space applications.

### 4 Overview

Space application gas-liquid circuit is a general term for application fluid circuit, application nitrogen supply system, application vacuum system and application exhaust gas system. The access payload utilizes the resources and conditions provided by the space application gas-liquid loop, becoming part of the space application gas-liquid loop to carry out on-orbit operations or... experiment.

### 5 General Access Requirements

5.1 Requirements for controlling excess materials The load on the gas-liquid circuit for space applications should meet the requirements for controlling excess material.

a) Ensure that there are no visible foreign objects (metallic or non-metallic impurities, other particulate matter, etc.) in the gas-liquid working fluid flow section before proceeding.

Assembly and testing;

b) When the gaseous or liquid working fluid flows through an exposed area, appropriate protective covers or other protective measures should be used to protect the exposed area. Protective measures such as covers and shields should be properly stored and no unnecessary items should be introduced.

5.2 Cleanliness Requirements The sections through which the gaseous and liquid working fluids of the incoming load flow should meet the cleanliness requirements in Tables 1 and 2.

## 6 Requirements for connecting to the application fluid loop

6.1 General Requirements An applied fluid loop is a closed loop with unidirectional fluid flow, used for liquid cooling of connected loads. Loads connected to the applied fluid loop... The scientific and technological testing cabinets and the load-bearing space inside the cabin are managed in a unified manner.

a) The quick-connect fittings used for the connected loads should be compatible with the connection location.

b) The location of the load connected to the application fluid circuit should be clearly defined.

c) The flow path and direction of the heat dissipation working fluid throughout the entire mission cycle should be from the inlet to the outlet and cannot be changed.

d) For loads containing pipelines, their binding, fixing, storage and transportation shall meet the design and usage requirements of the corresponding pipeline specifications.

e) For loads connected to the application fluid loop, the requirements for anti-condensation, antibacterial, and anti-fouling should be comprehensively considered, taking into account the cabin environment conditions and the load's own thermal characteristics. Design requirements for mold.

f) The valve devices connected to the application fluid circuit shall be managed and regulated by the relevant overall unit, and each load shall not be controlled independently.

g) The load connected to the application fluid loop should be equipped with sensors, such as temperature, pressure, and flow rate sensors, adapted to the working fluid, as required by the load developer; The measurement range and accuracy of the instrument should match the measurement requirements, and relevant overall units should be provided with information regarding the heat dissipation working fluid sensor and load. Normal usage plans and troubleshooting strategies related to heat dissipation.

6.2 Working fluid requirements The requirements for the working medium for the application

fluid circuit are as follows:

- a) The working medium used in the access payload during development, testing, and uplink processes is consistent with the on-orbit working medium;
- b) The working fluid temperature range for the entire mission profile of the connected load should be 16°C~40°C;
- c) The working fluid filling pressure should be the same as the system working pressure during upward movement, and no tests related to the working fluid flow should be performed after filling.

6.3 Pressure resistance requirements The pressure resistance requirements for the fluid loop load in the application are as follows:

- a) The sections through which the heat dissipation medium flows should pass a pressure test at

## 7 Requirements for connecting to the nitrogen system

7.1 General Requirements A nitrogen supply system is used to provide the necessary nitrogen resources for the experiments to the connected payloads. Requirements for payloads connected to the nitrogen supply system. as follows:

- a) The quick-connect fitting used should be compatible with the connection location.
- b) The flow path and direction of the nitrogen working fluid should be from the inlet to the outlet and cannot be changed.
- c) Loads containing pipelines shall be bound, secured, stored and transported in accordance with the design and usage requirements of the corresponding pipeline specifications.
- d) For loads connected to the nitrogen system, the following considerations should be taken into account. cabin environmental conditions, pressure change rate, and load thermal characteristics to ensure compliance with anti-settling requirements. Designed to meet requirements for exposure, antibacterial and mildew prevention.
- e) When using valve devices connected to a nitrogen system, it is advisable to open the lower-level valve first, then open the upper-level valve; when closing, close the upper-level valve first. After closing the door, shut off the downstream valve.
- f) The load for the nitrogen gas system should be equipped with sensors, such as temperature, pressure, and flow rate sensors, adapted to the working fluid, as required by the load developer; The measurement range and accuracy of the instrument should match the measurement requirements, and the working principle of the connected load should be provided to the relevant overall unit. Obstacle handling strategies, etc.

7.2 Working fluid requirements The nitrogen used in the nitrogen system load of the application should comply with the provisions of GB/T 8979.

7.3 Pressure resistance requirements The load pressure resistance requirements for the nitrogen system being connected to the application are as follows:

- a) The nitrogen system connection should pass a pressure test at 1.5 times the working pressure;
- b) Components connected to the nitrogen system should be at normal pressure when going up.

7.4 Flow resistance requirements The flow resistance requirements for loads connected to the nitrogen system are as follows:

- a) Based on the working pressure of the nitrogen supply system and its own flow requirements, design a flow resistance that meets the experimental conditions. The flow resistance should not exceed [a certain value]. 0.9MPa;

## 8 Requirements for connecting to the application vacuum system

8.1 General Requirements The application vacuum system creates internal vacuum conditions for the connected payloads to conduct experiments in orbit. The requirements for the payloads connected to the application vacuum system are as follows:

- a) The quick-connect fitting used should be compatible with the connection location.
- b) The gas flow path and direction for each operating mode should be fixed and cannot be changed.
- c) Loads containing pipelines shall be bound, secured, stored and transported in accordance with the design and usage requirements of the corresponding pipeline specifications.
- d) Loads connected to the application vacuum system should comprehensively consider the chamber environment conditions, pressure reduction rate, vacuum holding time, and load thermal characteristics. Develop designs that meet the requirements for preventing condensation, antibacterial and anti-mildew properties.
- e) Shut-off valve devices connected to the application vacuum system should have the control capability of both the device itself and the upstream device.
- f) The load for the application vacuum system should be equipped with sensors, such as temperature, pressure, and flow rate sensors, adapted to the working fluid, as required by the load developer; The measurement range and accuracy of the instrument should match the measurement requirements, and the vacuum system operating conditions of the connected load should be provided to the relevant overall unit. Principles, troubleshooting