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

GB/T 29085-2012

Technical requirements of contamination control for satellite

卫星防污染技术要求

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Foreword

GB/T 29085-2012 was issued on 31 December 2012 by the General Administration of Quality Supervision, Inspection and Quarantine and the Standardization Administration of the People's Republic of China, and has been in force since 1 June 2013.

The document is a recommended national standard: the /T in the designation marks it as recommended rather than compulsory.

1 Scope

China's national technical requirements for contamination control on satellites. Contamination is one of the few spacecraft problems that cannot be fixed after launch and that gets worse rather than better in orbit. Particles settling on an optical surface scatter light and reduce a sensor's sensitivity; a film of condensed organic material on a radiator changes its emissivity and the spacecraft runs hot for the rest of its life; and molecular contamination on a solar array reduces the power available permanently. The sources are the spacecraft itself as much as the cleanroom, because the plastics, adhesives, lubricants and coatings all outgas in vacuum and what leaves one surface deposits on a colder one. The standard specifies the contamination control work to be carried out through the whole development of a satellite and its technical requirements, covering the design, the detection and control through manufacture and test, the treatment on the ground and the treatment in orbit.

This standard specifies the items of contamination control work to be carried out throughout the development of a satellite, and their technical requirements.

This standard applies to the development of the complete satellite; subsystems and assemblies, including equipment and parts, may also use it for reference.

2 Normative references

The following documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

GB 50073-2001 Code for design of clean room

ASTM E595-1993 Standard test method for total mass loss and collected volatile condensable materials from outgassing in a vacuum environment

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

3.1 contaminant - any unwanted foreign matter that may cause harm and non-negligible effects on the operation, reliability and performance of a system, subsystem, equipment, part or material.

3.2 particulate; particulate matter; particle - particulate solid matter with observable length, width and thickness, of a size from 0.001 micrometre to 1000 micrometres, including fibres.

3.3 non-volatile residue, NVR - the soluble matter remaining after a volatile liquid has evaporated, or the non-volatile matter determined with a dedicated analytical instrument. It is usually measured as milligrams of contaminant per unit volume or per unit area.

3.4 volatile condensable material, VCM - the gaseous substance desorbed, separated or decomposed from a component, material or contamination source under high temperature, low pressure and vacuum conditions, which can condense on a low temperature surface.

3.5 collected volatile condensable material, CVCM - the ratio of the mass of volatile condensable material collected on a surface, under specified temperature and vacuum conditions and over a given temperature and time, to the initial mass of the material sample. It is usually expressed as a percentage.

3.6 total mass loss, TML - the ratio of the total mass lost within a given time, under specified temperature and vacuum conditions, by a sample of material containing volatile condensable material, to the initial mass of that sample. It is usually expressed as a percentage.

3.7 water vapour regained, WVR - the mass of water vapour absorbed by a material sample, obtained by calculating the change in mass of the sample when it is re-exposed under specified temperature and vacuum conditions for a given time after the TML and CVCM tests. It is usually expressed as a percentage.

3.8 recovered mass loss, RML - the total mass loss of the material sample itself after deducting the water vapour absorbed ($RML = TML - WVR$). It is usually expressed as a percentage.

3.9 cleanliness level - the level into which the maximum permitted quantity of contaminant is divided, on the basis of the detection criterion, according to the size, number and distribution of the contaminant per unit area or volume. Note: in accordance with GB 50073-2001, the cleanliness levels of airborne particles in a clean room and a clean zone are, from highest to lowest, class 1, class 2, class 3, class 4, class 5, class 6, class 7, class 8 and class 9.

3.10 obscuration factor - the ratio of the surface area on which particulate matter has settled or which it covers, to the total area.

3.11 contaminant sensitive part or surface - a part or surface whose performance or life is affected by contamination, including solar array panels, thermal control surfaces such as multilayer insulation and optical solar reflectors, optical or radiating surfaces with high cleanliness requirements, high precision moving surfaces of mechanisms, and sliding contact surfaces, contacts and connectors with high conductivity requirements.

3.12 contaminant sensitivity level - the classification of the degree of sensitivity to contamination, determined by the degree to which the contaminant sensitive parts or surfaces carried by the satellite product affect the accomplishment of its mission objectives; from low to high these are low, medium and high contamination sensitivity.

3.13 contamination control - all the anti-contamination measures, organisation and coordination activities undertaken to ensure the cleanliness of the product.

4.1 General principles

4.1.1 Satellite contamination prevention is a piece of systems engineering that runs through the whole process of design, manufacture, test, launch preparation and in-orbit operation of the satellite and its products. Its core content comprises: a) anti-contamination design; b) contamination detection and control throughout development; c) contamination treatment in the ground phase; d) contamination treatment in the in-orbit phase.

4.1.2 An integrated anti-contamination control plan shall be incorporated into the overall design scheme of the satellite. Contamination control work shall be taken up from the top-level design, from the concept demonstration, and from the system and from the source.

4.1.3 The key to satellite contamination control lies in strictly controlling the selection of materials carried on the satellite, in shielding and protecting contamination sensitive parts, in cleaning and bake-out degassing of materials and parts at the proper time, and in giving particular attention to the sealed equipment of the propulsion system, the thermal control

multilayer insulation assemblies and the optical equipment.

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