
**Space systems — Format for spacecraft
launch environment test report**

*Systèmes spatiaux — Format de rapport d'essais d'environnement de
lancement de véhicule spatial*

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

ISO 19933 was prepared by Technical Committee ISO/TC 20, *Aircraft and space vehicles*, Subcommittee SC 14, *Space systems and operations*.

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Introduction

This International Standard provides spacecraft (SC) manufacturers with a specific format to write launch environment test reports required to qualify the SC to the launch environment conditions. The format has been applied satisfactorily for many years to most of the commercial launch vehicle (LV) systems in agreement with SC manufacturers worldwide.

The format follows the overall guidelines of ISO 17566 with the objective of generating self-contained documents. Relevant sections of the standard test plan, specification, procedure, and report documents are combined to form the comprehensive and compact SC launch environment test reports requested by LV service providers.

The format for the following sections of the test reports is independent of the nature of the test: introduction, documentation, nomenclature, test objectives, test article configuration, test facility configuration, test description, test result evaluation, test deviations, and test conclusions. For this reason, a unique format is specified for all types of tests in Clauses 4, 5, 6, 7, 8, 9, 10, 12, 13, and 14.

The format for the presentation of test results is specific to the test in question. For this reason, Clause 11 is divided into multiple subclauses, corresponding to all types of tests that are required to qualify SC to the launch environment.

In principle, there is one test report per type of test; however, several test reports may be combined if deemed appropriate.

SC organizations may include additional test topics if required. Conversely, some sections of this test report format may not apply to the launch services in question, in which case it is advisable that they be ignored.

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Space systems — Format for spacecraft launch environment test report

1 Scope

This International Standard provides a specific format to report the test process and results of spacecraft (SC) qualification to the launch environment. The following types of tests are considered:

- static load;
- modal survey;
- sine vibration;
- acoustic noise;
- random vibration;
- shock; and
- electromagnetic compatibility (EMC).

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The definition of test specifications and test requirements are derived from launch vehicle (LV) user's manuals as defined in ISO 14303. Only those tests that are intended to demonstrate the compliance of a given SC design with its LV environment are taken into consideration.

2 Normative references

The following referenced 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.

ISO 14303, *Space systems — Launch-vehicle-to-spacecraft interfaces*

ISO 15863, *Space systems — Spacecraft-to-launch-vehicle interface control document*

3 Terms, definitions and abbreviated terms

3.1 Terms and definitions

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

3.1.1

SC adaptor

structure that mates the SC to the LV and includes the separation system for SC/LV separation

3.1.2

line load of a force

ratio of the resultant axial force applied to the SC centre of gravity (CG) to the perimeter of the SC adaptor interface

3.1.3

line load of a moment

ratio of the resultant moment applied to the SC CG to the surface area delimited by the perimeter of the SC adaptor interface

NOTE The line load definition is not applicable to point-to-point interfaces.

3.2 Abbreviated terms

CG centre of gravity

CLA coupled-loads analysis

dB decibel

EMC electromagnetic compatibility

g acceleration unit (9.81 m/s²)

Hz hertz

LV launch vehicle

m metre

N Newton

PSD power spectral density

rms root mean square

s second

SC spacecraft

V volt

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4 Introduction section of a test report

4.1 General

This section shall provide general information about the technical content of the test report in question. It shall include a brief description of the test or sequence of tests. The overall test objective shall be described, and the criteria for the test article qualification or acceptance shall be stated.

4.2 Overall test sequence

This section shall summarize the overall sequence of environmental tests conducted to demonstrate the qualification or acceptance status of the SC to the launch environment and shall explain how the test in question fits into this sequence.

The following types of tests shall be considered if applicable to the SC test programme:

- static load;
- modal survey;
- sine vibration;
- acoustic noise;
- random vibration;
- shock; and
- EMC.

5 Referenced documentation section of a test report

5.1 General

This section shall contain a list of documents to which reference is made in the test report in question. The documentation list may include

- normative references,
- applicable references, or
- informative references.

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5.2 Normative references

Normative references are published standards and specifications which provide requirements or constraints for conducting the test. The required format for the list of normative documents is shown below.

Document number	Document description	Revision level and release date

5.3 Applicable references

Applicable references are programme-related documents which provide requirements or constraints for conducting the test. The required format for the list of reference documents is shown below.

Document number	Document description	Revision level and release date

5.4 Informative references

Informative references are documents included for information only, which amplify or clarify the document content but do not contain requirements applicable to the test. The required format for the list of informative documents is shown below.

Document number	Document description	Revision level and release date

6 Nomenclature section of a test report

The Terms and definitions section shall define the specific terms used in the test report in question. In some cases, a project dictionary or glossary may be referenced.

The Symbols section shall give a list of the symbols used in the test report in question. Unless there is a need to list symbols in a specific order to reflect technical criteria, all symbols shall be listed in alphabetical order.

The Abbreviations section shall define the abbreviations used in the test report in question.

7 Test objective section of a test report

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7.1 General

This section shall detail the general and specific test objectives in the context of the SC design and launch environment test requirements of the LV service provider.

7.2 Test strategy matrix

The test strategy matrix shall define the testing strategies that will be used to demonstrate compliance with the LV service provider's requirements related to the SC design and tests as specified in the LV user's manual (ISO 14303) and in the LV-SC interface control document (ISO 15863). The required format for the strategy matrix is shown below.

Document	Paragraph reference	Requirement	Test strategy to demonstrate compliance

8 Test article configuration section of a test report

8.1 General

This section shall describe the general test article configuration, including the corresponding reference frame definition and mass properties, relevant figures or the references of relevant drawings. When necessary, it shall document how the configuration supports the overall test objectives.

8.2 Identification and general configuration matrix

All major pieces of hardware and equipment and all the critical launch environment structural elements (including, but not limited to, the primary structure, platforms, supporting struts, propellant tanks and associated support structures and fastenings, pressure vessels, solar panels and related mechanisms, battery packs, reflectors, antennas and critical payload package) shall be listed in the configuration matrix and identified as flight-standard, flight-representative, or simulated items. The required format for the configuration matrix is shown below.

Item	Flight-standard	Flight-representative	Simulated

8.3 Deviations from flight configuration

Deviations of the general test article configuration from the flight configuration that are critical for the qualification of the SC with respect to the launch environment shall be identified (see 8.2). The qualification logic with respect to the overall system qualification of those items that are not in the flight standard category shall be explained.

8.4 Functional configuration

The state of physical systems of the test article shall be described and compared to the expected SC launch configuration. Any change of functional configuration in the course of the test shall be mentioned. The functional configuration addresses the operational mode of the test article and the state of the major electrical systems, including, but not limited to, radio-electrical, pyrotechnic, attitude control and thermal subsystems.

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9 Test facility configuration section of a test report

9.1 General

This section shall describe the overall test facility configuration as run during the test. In addition, the test facility, its location and the test date(s) shall be indicated.

9.2 Test configuration

9.2.1 General configuration

The general test set-up shall be briefly outlined, including relevant figures or the references of relevant drawings. This outline shall include concise information about the test equipment, instrumentation, interfaces to the test article, environmental conditions, data acquisition system and any specific infrastructure required to perform the test.

9.2.2 Test adaptor

Special emphasis shall be given to the description of the interface between the test facility and the test article (test adaptor) if the behaviour of the test article during the test can be affected by the adaptor. In this case, the Test result section (see Clause 11) shall explain how the characteristics of the test adaptor affect the test results with respect to mechanics, acoustics and EMC.

9.2.3 As-run configuration

If the planned test configuration is modified as the test develops, the resulting changes, their causes and the potential effects on the test procedure or test results (see Clause 11) shall be explained.