
**Space systems — Space launch
complexes, integration sites and other
facilities — General testing guidelines**

*Systèmes spatiaux — Complexes de lancement spatial, sites
d'intégration et autres installations — Lignes directrices pour les
essais*

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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.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT), see www.iso.org/iso/foreword.html.

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

This second edition cancels and replaces the first edition (ISO/TR 17400:2003), which has been technically revised.

The main changes compared to the previous edition are as follows:

- in the document all recommendations (“should”) were replaced by other verbs (“is”, “are”), all permissions (“may”) were replaced by “can”;
- the term “main system” was updated;
- [3.1](#), [5.5](#), [6.3.3](#), [6.6.5](#), [6.6.8](#) were specified according to comments and proposals of the subcommittee experts.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Introduction

The purpose of this document is describing the uniform practices for organizing the tests and promoting verification of all parameters and characteristics of various launch complexes. It is necessary to define the functions and to coordinate the activities of all the test participants, namely, the developers of complexes and systems, the manufacturers of systems and equipment, the organizers of tests, the customer, and others.

This document describes test activities and lists who will be responsible for the testing at launch pad and integration sites for launch vehicle and spacecraft.

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Space systems — Space launch complexes, integration sites and other facilities — General testing guidelines

1 Scope

This document is applicable to new projects and programs and to redesigned and upgraded launch pad and integration sites. This document describes the testing phases, goals, and general aspects for launch space complexes and complexes for assembly and tests of a vehicle and spacecraft and the associated equipment that, after successful testing, will be ready for launch vehicle processing and launch. This document can be applied to the creation of international launch pad and integration sites. At creation of new launching space complexes and complexes for assembly and tests of a vehicle and spacecraft (or at their modernization) within the framework of one country, the rules established by that country can be applied.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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 9000, *Quality management systems — Fundamentals and vocabulary*

3 Terms and definitions

ISO/PRF TR 17400

For the purposes of this document, the terms and definitions given in ISO 9000 and the following apply.

ISO and IEC maintain terminology databases for use in standardization at the following addresses:

- ISO Online browsing platform: available at <https://www.iso.org/obp>
- IEC Electropedia: available at <https://www.electropedia.org/>

3.1

integration site

equipment and facility designed for launch vehicle storage, assembly and testing, and launch vehicle (space rocket) and spacecraft/payload(s) integration, post-integration testing, and launch preparation, maintenance, servicing and preparation for transportation to the *launch pad* (3.3)

3.2

international launch pad and integration sites

land, ground/airborne/marine facilities, equipment, utilities, and infrastructure, created with the cooperation of several countries or the entities that belong to more than one country, necessary for the launch operations of launch vehicle and payload and for in-flight operations during the launch phase

3.3

launch pad

equipment and facility designed to provide for the pre-launch and launch operations of spacecraft

3.4

end-to-end testing

launch pad (3.3) or *integration site* (3.1) development (3.1) phase including the testing and evaluation of its overall readiness to support a launch vehicle and a spacecraft

**3.5
support system**

integral part of the launch complex or *integration site* (3.1), which ensures the functioning of technological units (systems) and the conditions of normal life of the operating personnel

**3.6
main system**

constituent part of *launch pad* (3.3) or constituent part of *integration site* (3.1) primarily responsible for providing preparation and launch of a launch vehicle or spacecraft

**3.7
main system factory testing**

launch pad (3.3) or *integration site* (3.1) development phase that includes the testing of a completely assembled and checked out *main system* (3.6) to determine its operational readiness to be shipped to the operational launch pad or integration site for further testing or operation

**3.8
main system field testing**

launch pad (3.3) or *integration site* (3.1) development phase including the testing of an assembled, fully equipped, and checked out (or factory tested) *main system* (3.6), which is conducted at the operational launch pad or integration site to determine the system readiness for further testing or operation

**3.9
test supervision team
acceptance team**

group of experts formed by the customer (organization, company, etc.) with the goal of coordinating work during specific testing or acceptance phases

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4 General characteristics

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4.1 Testing of launch pad and integration sites and the main systems is conducted in accordance with the regulatory and design documentation specifications.

4.2 The test supervision team coordinates use of the launch pad and integration site and the system testing process and work management.

4.3 The launch pad and integration site developer provides technical management during the launch pad and integration site and system testing.

4.4 Appointments to test supervision and acceptance team are determined according to company or agency recommendations before the beginning of a related testing phase.

Customer representatives participate in team activities and sign respective documents in the event the representatives are employees of the company or agency.

4.5 As an option, customer representatives, participating in the testing, work in a joint control and acceptance group (JCAG). JCAG functions are determined in agreements developed by the customer.

4.6 The system testing and acceptance team has the authority to convene representatives of design and unit manufacturing organizations. These representatives are involved in:

- factory testing (the system manufacturing organization);
- field testing (the test organization);
- end-to-end testing (the team chairman).

4.7 Depending on the results of the analysis of malfunctions or failures found in the course of testing, the team has the authority to:

- continue testing without repeating the operations completed earlier;
- repeat the testing starting with a specific phase;
- repeat the testing from the beginning;
- stop testing before finding out the cause of the failure.

4.8 If failures occurred in the testing or the system was subjected to changes, the test supervision team has the authority to increase the scope of testing as necessary.

4.9 The test supervision team has the authority to suspend or terminate testing in the event of the following situations:

- occurrence of an emergency posing a hazard to personnel safety;
- failures;
- systems revealed to be out of conformance with the design specifications or documentation.

In these cases, the team reports to the body that appointed the team indicating the reasons for such a termination (suspension) and provides the necessary documentation.

4.10 Testing suspended in accordance with 4.9 can be restarted only upon permission from the body that appointed the team.

4.11 Personnel permitted to perform testing have the skills required to operate the main systems within the range of their operational duties and have passed tests on the knowledge of the equipment, its operating instructions, safety regulations, and test programs and procedures.

4.12 Personnel working in hazardous conditions or with harmful substances undergo a medical examination prior to commencement of duties and annually thereafter.

4.13 Prior to the start of the tests or work at the site, measures are taken to ensure the safety of the operating personnel and the environment.

4.14 The organization ensures safety requirements are observed and appropriate safety documents are maintained.

4.15 During system testing and acceptance, interested organizations can conduct experimental and research projects under special programs.

4.16 In the event experimental and research activities require the use of mock-ups of launch vehicles, spacecraft, or testing equipment, the special programs and reports are cleared with the space complex development organization.

4.17 Those main system items that fail during the tests are replaced upon the team decision.

4.18 When any test fails, the cause of the failure is established and eliminated.

4.19 Verify that the cause of the failure has been eliminated and continue testing:

- in case of a first-time (including independent elimination) failure - test team chairman, the tests continue from the moment of the termination;

- in case of recurrence of the same failure - test team chairman, the amount of retest is determined by the test team chairman depending on character of failure.
- in case of occurrence of the same failure in a third time - enterprise-developer of the main system together with the enterprise-manufacturer and representative customer, the tests are completely repeated. The differences among the developer of the main system, manufacturer, and representative customer are resolved by the developer of the launch pad (integration site) and customer.

4.20 Malfunctions and failures identified in the course of testing are eliminated by the organizations responsible for the cause of these malfunctions and failures.

4.21 During test preparation, performance, and finalization and during the acceptance of the launch pad and integration sites, main systems, and facilities, the organization in charge of the related work processes reports under the procedure established in accordance with its respective national aerospace industry practices.

4.22 The final decision on the results of the main system test and acceptance for operation is made by the launch pad and integration site developers.

4.23 During the testing of main systems, a test log is maintained. The following is entered into the log:

- list of completed operations;
- test progress report;
- defects, malfunctions, failures, deviations or functioning irregularities of the main system found during testing;
- methods for correcting the defects, malfunctions and failures;
- information on fine tuning or adjustments that were made;
- information about replaced components;
- main system nonconformities with the design documentation specifications;
- main system operating times on a daily or per-operation basis;
- decisions regarding test programs and/or procedure updates;
- suggestions for main system design and schemes improvement.

4.24 The main system and the changes required for the elimination of failures are implemented on the basis of the design documents authorizing the changes. If necessary, the design documentation is changed.

4.25 The procedure and timing for the submission of claims for faulty or incomplete main systems or for poor quality are established in accordance with the regulations accepted in the respective national space industry.

4.26 Companies finalize (approve and adopt) test programs and procedures within 30 calendar days of receipt (or agreed specified date between related organizations).

4.27 In performing the facility and assembly work, the test organization and the chief engineering system and facilities development organization, on a regular basis, ensure job quality control, building code compliance control, technical specification conformance control, and design document requirement conformance control. Experts from the operations or test organizations and the customer are involved in the control.

5 Testing and acceptance phases and goals for launch pad and integration site

5.1 Testing phases

The following main system and launch pad and integration site testing phases are adopted:

- main system factory testing;
- main system field testing;
- launch pad and integration site end-to-end testing (including space complex flight testing).

If necessary or on demand of the customer, other extra phases of tests are possible also.

5.2 Acceptance phases

The following main system and launch pad and integration site acceptance phases are adopted:

- main system acceptance after factory testing;
- main system and facility acceptance after field testing;
- launch pad and integration site acceptance after end-to-end testing.

5.3 Facility testing and acceptance

Facility testing and acceptance are accomplished in conformance with the established respective national aviation and space industry practice and the facility specifications.

5.4 Main system factory testing ISO/PRE TR 17400

Main system factory testing is conducted to verify the main system conformance to the design specifications and documentation, the operational readiness requirements, the main system acceptance by the customer's representatives, and system readiness for shipping to the assembly launch pad or integration site for further testing. The goals of the main system factory testing are:

- verification of main system completeness;
- verification of main system operational readiness and functioning interfaces and conformance to the design specifications and documentation;
- verification of the correct interaction and functioning of the item;
- verification of system compatibility and operation with the components of the launch vehicles, spacecraft, and main systems of the launch pad, as necessary;
- verification of the accuracy of the adopted design approaches;
- verification of the feasibility of the assembly process;
- verification of the serviceability of the protective devices and electrical interlocks in emergency modes;
- verification of the main system operational readiness and strength at the extreme parameter values indicated in the design specifications;
- verification of the adequacy and completeness of operations documentation;
- verification of the adequacy and applicability of the tools, devices, and instruments required for the main system operation;
- verification of the adequacy of the operational safety provisions;

- verification of maintenance and repair accessibility;
- verification of the quality of manufacturing, assembly, and checkout;
- dating the scope of the main system field testing;
- verification of transportability;
- evaluation of the main system's reliability;
- verification of the availability of component reliability documents (for experimental items only);
- verification of test metrological support.

5.5 Main system field testing

The main system field testing is conducted for the purpose of verifying main system operational readiness and determining system readiness for end-to-end testing (in the event the main systems are designated to undergo the end-to-end testing) or commissioning, if main systems aren't designed to undergo the end-to-end testing. The main system field testing goals are:

- verification of main system completeness;
- verification of main system assembly and checkout quality;
- verification of main system operational readiness and functioning interfaces and conformance to the design specifications and documentation;
- verification of the main system compatibility and operation with the launch pad and integration site's other main systems and facilities, as necessary;
- verification of the adequacy of the main system operation safety instructions indicated in the operations documentation;
- verification of maintenance and repair accessibility;
- verification of the human habitability conditions (lighting, ventilation, heating, harmful gas content, etc.);
- verification of the adequacy of the operations personnel;
- verification of the efficiency of modifications made based on the factory test results;
- verification of the sufficiency and serviceability of the tools, devices, and instruments required for main system operation;
- evaluation of the main system's reliability;
- verification of test metrological support;
- systems readiness assessment for end-to-end testing or commissioning, if systems aren't designed to undergo the end-to-end testing.

5.6 Launch pad and integration site end-to-end testing

The end-to-end testing is conducted for the purpose of verifying the launch pad and integration site operational readiness and determining the launch pad and integration site readiness for launch or other subsequent tests (if necessary). The end-to-end launch pad and integration site testing goals are:

- verification of the launch pad and integration site operational readiness and its conformance to the design specifications and documentation during standard operations involving launch vehicles