
**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.

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.

In exceptional circumstances, when a technical committee has collected data of a different kind from that which is normally published as an International Standard ("state of the art", for example), it may decide by a simple majority vote of its participating members to publish a Technical Report. A Technical Report is entirely informative in nature and does not have to be reviewed until the data it provides are considered to be no longer valid or useful.

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.

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Introduction

This Technical Report establishes the general characteristics related to testing at launch pad and integration sites for launch vehicle and spacecraft.

The purpose of this Technical Report is to establish 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 Technical Report establishes recommended 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 Technical Report is applicable to new projects and programs and to redesigned and upgraded launch pad and integration sites. This Technical Report establishes 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 Technical Report may be applicable 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 may be applied.

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 9000:2000, *Quality management systems — Fundamentals and vocabulary*
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3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 9000:2000 and the following apply.

3.1

integration site

equipment and facility designed for launch vehicle storage, assembly, testing, preparation, maintenance, servicing and preparation for transportation to the launch pad

3.2

international launch site

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

launch pad site end-to-end testing

integration site end-to-end testing

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

3.5

**launch pad site support system
integration site support system**

component launch pad or integration site, which enables the main system to operate

3.6

main system

launch pad or integration site or components primarily responsible for providing preparation and launch of a launch vehicle or spacecraft

3.7

main system factory testing

launch pad or integration site development phase that includes the testing of a completely assembled and checked out main system 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 or integration site development phase including the testing of an assembled, fully equipped, and checked out (or factory tested) main system; the testing is conducted at the operational launch pad or integration site to determine the system readiness for further testing or operation

3.9

**test supervision
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 should be conducted in accordance with the regulatory and design documentation specifications.

4.2 The test supervision team should coordinate 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 should be the technical manager during the launch pad and integration site and system testing.

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

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

4.5 Customer representatives participating in the testing may work in a Joint Control and Acceptance Group (JCAG). JCAG functions should be determined in agreements developed by the customer.

4.6 The system testing and acceptance team should have the authority to convene representatives of design and unit manufacturing organizations. These representatives should be 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 should have 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.

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

4.9 The test supervision team should have 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 should report to the body that appointed the team indicating the reasons for such a termination (suspension) and provide the necessary documentation.

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

4.11 Personnel permitted to perform testing should have the skills required to operate the main systems within the range of their operational duties and should 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 should undergo a medical examination prior to commencement of duties and annually thereafter.

4.13 Launch pad and integration site safety precautions should be taken before the beginning of testing or experimental and research tasks.

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

4.15 During system testing and acceptance, interested organizations may 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 should be cleared with the space complex development organization.

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

4.18 When any test fails, the cause of the failure should be 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 should be 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 should process 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 should be made by the launch pad and integration site developers.

4.23 During the testing of main systems, a test log should be maintained. The following should be 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 may have been made;
- information about replaced components;
- main system nonconformity's 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 Implementation of the main system and the changes required for the elimination of failures should be implemented on the basis of the design documents authorizing the changes. If necessary, change the design documentation.

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

4.26 Companies should 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 should, 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 should be involved in the control.

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

5.1 Testing phases

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

- main system factory testing;
- main system field testing;
- launch pad and integration site end-to-end 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 should be 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 should be accomplished in conformance with the established respective national aviation and space industry practice and the facility specifications.

[ISO/TR 17400:2003](https://www.iso.org/standard/717400.html)

5.4 Main system factory testing

Main system factory testing should be 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 should be 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 other subsequent tests (if necessary). The main system field testing goals are:

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- 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.