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Space systems — General management requirements for space test centres

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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 on 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 the following URL: 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*.

0 Introduction

0.1 General

This document provides the minimum requirements to demonstrate the competence of the test centres working for space projects.

This document also incorporates requirements from ISO/IEC 17025 that are considered applicable for space test centres.

In a specific context, the requirements defined in this document may be tailored to match the requirements of this context.

0.2 Nomenclature/formal verbs

To understand the verbal forms and expressions of provisions in this document, please consult Clause 7 of the ISO/IEC Directives Part 2.

Space systems — General management requirements for space test centres

1 Scope

This document specifies requirements for when a space test centre needs to demonstrate its competence to consistently provide space testing that meets customer requirements.

It specifies requirements for space test centres, applicable to the test process, test personnel (both, of the customer and the space test centre), test facilities, test environment and any operations related to the test item under responsibility of the space test centre as requested by the customer.

This document also defines the requirements for space testing and the development of test facilities.

This document was originally prepared with a focus on environmental testing (i.e. thermal vacuum, vibrations, acoustic, Electromagnetic Compatibility (EMC), Radio Frequency (RF), physical properties measurements, etc.).

This document applies to space test centres as self-standing organizations, or those belonging to a parent organization. This document has been prepared for organizations providing test services for space and launch segment elements and subsystems.

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 10794, *Space systems — Programme management — Material, mechanical parts and processes*

ISO 10795, *Space systems — Programme management and quality — Vocabulary*

ISO 14300-2, *Space systems — Programme management — Part 2: Product assurance*

ISO 14620-1, *Space systems — Safety requirements — Part 1: System safety*

ISO 15388, *Space systems — Contamination and cleanliness control*

ISO 15864, *Space systems — General test methods for space craft, subsystems and units*

ISO/IEC 17025, *General requirements for the competence of testing and calibration laboratories*

ISO 17566, *Space systems — General test documentation*

ISO 17666, *Space systems — Risk management*

ISO 23460, *Space projects — Programme management — Dependability assurance requirements*

ISO 23461, *Space systems — Programme management — Non-conformance control system*

ISO 27025, *Space systems — Programme management — Quality assurance requirements*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 10795 and the following apply.

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

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at http://www.electropedia.org/

3.1
critical operation
operation that can result in injury to persons, significant material damage or other unacceptable consequences if not properly performed

3.2
modification
change in the configuration of an existing test facility

Note 1 to entry: In the context of a test facility.

3.3
quality representative
representative from the space test centre management with designated responsibility for quality management

Note 1 to entry: In the context of test centres.

3.4
safety policy
overall intentions and directions of the space test centre with regard to safety as formally expressed by executive management

3.5
safety representative
representative from the space test centre management with designated responsibility for safety

Note 1 to entry: In the context of test centres.

3.6
space test
environmental test that is applied to space items using space centres facilities

3.7
space test centre
complete entity including the organization which provides, maintains, develops and operates test facilities for space project and applications including accompanied services

3.8
test campaign
series of test processes starting with the arrival of the test specimen in the space test centre and ending with its departure from the space test centre

Note 1 to entry: In the context of test centres.

3.9
test facility
technical plant to provide specific simulated conditions for testing equipment for space projects and applications, including test connections and instrumentation attached as necessary to perform the test

Note 1 to entry: Test facility includes test equipment and associated infrastructure, including supplies.

3.10
test personnel
staff developing, maintaining or operating a test process

3.11
test process
set of activities necessary to perform a test, or a series of tests, to comply with the requirements specified in the business agreement

Note 1 to entry: This includes, but is not limited to, test design, planning, preparation, acceptance, performance, reporting, reviewing and recording.

3.12
test specimen
spacecraft, subsystem, item or device under test

Note 1 to entry: This term is a synonym of test article and test item.

4 Abbreviated terms

The following abbreviated terms are defined and used in this document:

DRD document requirements definition

ESD electrostatic discharge

FRR facility readiness review

GSE ground support equipment

NCR non-conformance report

PTR post-test review

QA quality assurance

TRR test readiness review

5 Space test centre management principles

5.1 Objective

The objective is to ensure that all technical and programmatic risks associated with the testing of space products performed under the responsibility of the space test centre are adequately managed through the implementation of an effective management program.

5.2 General principles

The space test centre is responsible for demonstrating that a management programme covering the definition, design, development, implementation and continuous improvement, of competences, processes and facilities, is established, implemented and maintained throughout the test service provision to a customer.

The basic principles of the space test centre management programme are the early identification of aspects potentially detrimental for the quality of the test service, the safety of persons and products, and the cost-effective prevention of any adverse consequence of such aspects.

The management programme shall demonstrate the integration of activities from the following disciplines:

ISO 10794 *Space systems — Programme management — Material, mechanical parts and processes*

ISO 14300-2 *Space systems — Product assurance — Policy and principles*

ISO 14620-1 *Space systems — Safety requirements — Part -1: System safety*

ISO 17666 *Space systems — Risk management*

ISO 23460 *Space projects — Programme management — Dependability assurance requirements*

ISO 23461 *Space systems — Programme management — Non-conformance control system*

ISO 27025 *Space systems — Programme management — Quality Assurance requirements*

6 Management requirements

6.1 General requirements

a) The space test centre shall establish, document, implement and maintain a management system and continually improve its effectiveness.

b) The space test centre shall specify criteria and methods to demonstrate that both the operation and control of management process are effective.

c) The space test centre shall demonstrate the availability of resources and information to support the operation and monitoring of management processes.

d) The space test centre shall monitor, measure, and analyse management processes.

e) The space test centre shall implement actions to achieve planned results and continual improvement of management processes.

f) The management process of the space test centre, or its parent organization, shall be implemented and maintained to allow external and internal revisions or audits by customer or external authorities, ensuring due customers confidentiality.

g) If the space test centre is part of an organization performing activities other than testing, the responsibilities of key personnel in the organization that have an involvement on the testing activities of the space test centre shall be specified to identify potential conflicts of interest.

h) The space test centre shall ensure that non-space related activities have no detrimental effect over the activities carried out in the space test centre.

NOTE For example, non-space related activities include infrastructure works or testing performed for other industrial sector.

6.2 Documentation, records and data control

6.2.1 General

a) The space test centre shall establish and maintain a documented information and records control system.

b) The space test centre shall establish and maintain a system for the identification, storage, protection, retrieval, retention and disposition of test data.

6.2.2 Facility description

a) The space test centre shall establish and maintain a documented description of each test facilities and associated infrastructure, including as a minimum:

   1) functional performance;

   2) general arrangement drawing;

   3) interface definition.

b) The facility description shall be provided to the customer upon request.

6.3 Management responsibility

6.3.1 Organization

The space test centre shall define its organization and management structure, its place in the parent organization, and the relationships among management, technical operations, support services and the quality and safety management system.

6.3.2 Planning

The space test centre shall plan the following tasks:

a) the preparation of project and quality plans for critical processes;

b) the identification of controls, processes, equipment, fixtures, resources and skills;

c) the update of quality control, inspection and verification techniques, including the development of new instrumentation or complex facilities;

d) the development of their capability for any test requirements that exceed the current known state of the art;

e) the identification of standards for maintenance and calibration of items used by the space test centre;

f) the establishment and follow-up of rules to control conformity to requirements between design and acceptance of space test centre items;

g) the assessment of risks related to customer-supplied products and the applicable processes.

6.3.3 Responsibility and authority

a) Top management shall ensure that management and technical responsibilities and authorities are defined and communicated within the organization.

b) Management and technical responsibilities and authorities shall be delegated in case of personnel absence, and defined and communicated within the organization.

c) Top management shall ensure that space test centre personnel are free from undue pressures, conflict of interest or influences that can affect the quality of their work.

6.3.4 Quality and safety representatives

a) Top management shall appoint a quality representative with defined authority to:

   1) ensure that the quality management system is established, implemented and maintained;

   2) report its performance to the space test centre management and any needs for improvement; and

3) ensure quality assurance awareness throughout the space test centre.

b) Top management shall appoint a safety representative with defined authority to:

1) ensure that safety processes for the space test centre are established, implemented and maintained;

2) report to top management on the performance of safety in the space test centre and any need for improvement; and

3) ensure safety assurance awareness throughout the space test centre.

c) In case personnel safety, test specimens or test facilities are at risk, the safety representative, or designated trained staff, shall have defined authority to stop the activity.

7 Resource management

7.1 General

a) The space test centre shall train all personnel to make them competent and qualified to perform their assigned tasks.

b) The space test centre shall ensure that all personnel are trained to comply with the applicable safety requirements.

c) The space test centre shall ensure that personnel undergoing on-the-job training are subject to supervision by a person competent to perform such task.

d) Where contracted and additional technical and key personnel are used, the space test centre shall demonstrate that such personnel are competent and that they work in conformance with the management system.

e) All space test centre personnel conducting or supporting potentially hazardous operations shall receive specific safety training, including the preventive measures to be taken.

7.2 Competence, awareness and training

a) The space test centre shall specify and maintain job descriptions for managerial and technical personnel involved in the operations.

b) The space test centre shall identify the required competence and authorization to perform test processes and test facility related activities.

c) The space test centre shall identify the available competence and the training needs to reach the required competence and authorization.

d) The space test centre shall establish and implement criteria for managing the competences and the authorization to perform activities.

e) The identification of the competence and training objectives for the space test centre personnel shall be carried out on a periodic basis.

f) The identification of training needs shall include training for personnel being reassigned to jobs other than those for which they were originally trained.

g) The space test centre shall evaluate the effectiveness of the training performed.

h) Space test centre and customer personnel performing selected handling operations, lifting and hoisting operations shall be trained and authorized after competence verification. The space test centre shall maintain a list of authorized operators.

i) The space test centre shall maintain records of the relevant authorization(s) to perform the work, competence, training and professional qualifications, skills and experience of all technical personnel, including contracted personnel.

j) Records specified shall be available and shall include the date on which authorization or competence is confirmed.

7.3 Infrastructure and work environment

7.3.1 General

a) The space test centre shall ensure that all processes are carried out under controlled conditions using suitable test facilities, test and measuring equipment (hardware and software), servicing equipment and environmental conditions meeting all process requirements.

b) The space test centre shall ensure that the specified environmental and cleanliness conditions are achieved and maintained throughout the test process in order to preserve the test specimen and the test equipment.

c) Activities listed in the requirements 7.3.1 a) and 7.3.1 b) shall be planned and documented, prior to their beginning, and recorded during their execution.

d) The space test centre shall define and implement a housekeeping programme applicable to all test areas, including transport bays, airlocks, test floor environment, control rooms and associated infrastructure.

7.3.2 Environment control

a) The space test centre shall establish, document and implement an environmental control programme, as a minimum for temperature, relative humidity and differential pressure, to ensure conformance with the applicable levels.

b) In addition to environmental parameters, the space test centre shall assess the impacts of other parameters specified by the customer that affect the test specimen's environmental conditions or the test results.

NOTE The environmental control can consider other parameters such as inorganic contaminants, pressure, light level, electromagnetic radiation, magnetic cleanliness, ESD protection, vibration, ionizing radiation, and acoustic environment.

c) The cleanliness level of supplies shall be controlled when required by a test process. These supplies include gases and liquids involved in the test process and which can have an effect on the contamination level.

d) The results of all environmental control parameters are quality records and shall be controlled.

7.3.3 Cleanliness and contamination control

a) The space test centre shall establish, document and implement a cleanliness and contamination control programme, in conformance with ISO 15388, if necessary.

b) The space test centre cleanliness and contamination control programme shall document how to achieve, measure and maintain the applicable cleanliness levels throughout the space test centre.

c) The space test centre cleanliness and contamination control programme shall include:

1) the indication of a minimum set of cleanliness levels for the facility when no specific requirements are set by the customers;

2) the specific cleanliness levels to be verified;

3) the methods and frequencies of checking the cleanliness levels;

4) the procedures for the applicable competence and training of personnel;

5) the cleaning procedures; and

6) the working procedures for achieving and maintaining the applicable cleanliness levels.

d) In case a generic cleanliness and contamination control programme exists at parent organization level, any deviation and addition with respect to the generic programme, shall be documented in a space test centre dedicated document.

e) The cleanliness levels shall be specified for molecular contamination in terms of surface contamination.

f) The cleanliness levels shall be specified for particulate contamination in terms of both, surface and airborne contamination.

g) In absence of specific frequency requirements, the space test centre shall determine and justify the frequency at which surface cleanliness levels are measured.

h) The results of all cleanliness and contamination control parameters are quality records and shall be controlled.

i) When deposited contamination levels need to be considered, the minimum levels shall be specified and maintained. The levels can be agreed between the customer and test centre, according to specific work to be performed.

j) The particulate cleanliness level shall be expressed in terms of airborne contamination as defined by ISO 15388. The molecular cleanliness level shall be expressed in terms of surface cleanliness.

k) The measurements of the airborne particles and airborne molecular contaminants should not constitute a demonstration of the specimen cleanliness level, except when agreed by the customer.

NOTE See ISO 15388:2012, Clause 7 for guidance.

7.3.4 Site security and access control

a) The space test centre shall identify restricted areas, and implement a system for their security and access control.

NOTE Examples of restricted areas are cleanrooms, areas for storage of sensitive documentation, and areas where test specimens or hazardous items are stored, handled or tested.

b) The space test centre shall maintain a list of authorized persons who have access to restricted areas.

c) Before the test campaign starts, the space test centre shall identify with the customer the need for special provisions for the security and access control of the test specimen.

d) The access control to the test facilities and cleanrooms shall be implemented by one or more of the following methods:

— guard(s) posted at the entrance(s);

— a magnetic card lock system;

— an electrical door lock system;

— a camera monitoring system;

— a mechanical (normal) key system; and

— a biometrical system.

8 Test facilities

8.1 Design and development of test facilities

a) The space test centre shall establish and maintain documented information to:

   1) control and verify the design and development of existing and new test facilities;

   2) control and verify the modification of test facilities in conformance with requirements from 8.2;

   3) control and verify the software used in the test process in conformance with requirements from 8.2;

   4) verify the operation of the test facilities;

   5) demonstrate that the test facilities meet the specified performance requirements.

b) The space test centre shall identify and plan all phases of the test facilities development and related to processes.

   NOTE Phases of test facility development include design, planning, reviews, installation, commissioning and acceptance.

c) The space test centre shall demonstrate that processes specified in the requirement 8.1 b) are carried out under controlled conditions, including conformance to applicable standards specified in business agreements, quality and safety plans or documented procedures.

d) The space test centre shall demonstrate that personnel are trained and competent on the maintenance and operation of the new or modified test facility.

e) The space test centre shall specify the requirements for any verification and validation of test facilities or parts of them.

f) Records shall be maintained for verified and validated test facilities.

g) The space test centre shall demonstrate that computer software used for the operation of test facilities or for the acquisition of test results suits the intended application.

   NOTE This includes acceptance and revalidation after software updates.

8.2 Configuration control of test facilities

a) The space test centre shall establish, implement and maintain a documented information for:

   1) configuration identification;

   2) configuration change control; and

   3) configuration status accounting of its test facilities.

b) The space test centre shall specify a configuration item list for each test facility and associated equipment. The configuration item list shall include as a minimum:

   1) all software used;

   2) all critical items; and

   3) all facility items that are under maintenance control and whose replacement by a different part number changes the facility configuration.

c) The configured items of the facilities shall be described by the applicable documents and drawings.

d) The space test centre shall establish, implement and maintain a technical file for each test facility describing the as-built configuration status of the facility.

e) The space test centre shall establish and maintain a declared materials list for each thermal vacuum test facility.

NOTE The facility declared materials list applies only to materials exposed to vacuum.

f) Records shall be maintained for all items of test and measurement equipment, including at least:

1) the identification of the item or equipment, and its software;

2) the manufacturer's name and type identification, and serial number or other unique identifier;

3) the date on which the item was received and the date it was placed in service; and

4) the current location of the item.

8.3 Calibration and maintenance control

8.3.1 Calibration of test facilities

a) The space test centre shall implement a calibration programme in conformance with the requirements of the ISO/IEC 17025.

b) The space test centre shall demonstrate that all measurement equipment affecting test results are calibrated and traceable to the International System of Units.

c) The space test centre shall demonstrate the traceability of calibration by documenting the unbroken chain of activities performed to link the measurement results to the standards used to perform the calibration.

NOTE Traceability to a standard can be demonstrated by a dedicated calibration or a comparison to a calibrated reference standard or described and agreed methods.

d) The space test centre shall establish a calibration plan per facility to cover all measurement and acquisition equipment used in the test process. The calibration plan shall include:

1) a unique identification of the equipment to be calibrated;

2) the calibration activities with their periodicity;

3) the applicable specification; and

4) the identified resources.

e) The space test centre shall establish and maintain a calibration schedule to demonstrate that the calibration tasks are allocated, coordinated and synchronized in time and location.

f) If the calibration activity is outsourced, the space test centre shall specify the requirements to his supplier.

NOTE A supplier complying with the requirements of ISO/IEC 17025 or ISO 10012 can be selected.

g) The space test centre shall perform the acceptance of the calibration data coming from supplier work.

h) The space test centre shall establish a system to identify and label the calibration status of measurement and acquisition equipment.

i) Measurement and acquisition equipment that is not subject to calibration or not in calibrated state shall be identified and labelled as such.

j) Records of the performance of the calibration activities shall be available.

k) The calibration records shall contain as a minimum the measurement results, the measurement uncertainty or a statement of conformance with an identified specification.

8.3.2 Maintenance control of test facilities

a) The space test centre shall establish a maintenance plan for infrastructure, test facilities, test equipment environmental monitoring, and related software used in the test process.

b) The maintenance plan shall include for each facility item:

1) a unique identification;

2) the maintenance activities with their periodicity;

3) the applicable procedures; and

4) the identified resources.

c) If the maintenance activity is outsourced to a supplier, the space test centre shall specify the requirements to the supplier.

d) The space test centre shall perform the acceptance of the maintenance data coming from outsourced work.

e) The space test centre shall establish and maintain a maintenance schedule to demonstrate that the maintenance tasks are allocated, coordinated and synchronized in time and location.

f) Records of the performance of the maintenance activities shall be available and shall contain as a minimum:

1) the description of the work performed;

2) any relevant measurements; and

3) the date and the responsible space test centre personnel or supplier performing the maintenance activity.

g) The space test centre shall establish a procedure for periodical verification of test facility performance, which shall contain as a minimum the verification method, the pass or fail criteria and the periodicity.

NOTE Examples of facility verification include shaker footprint, sun simulator mapping and dummy tests in general.

8.4 Risk assessment of test facilities

a) For each facility, new or existing, a risk assessment covering all operational and non-operational aspects as well as health and safety risks shall be conducted and documented.

b) The risk assessment shall cover the following:

1) a summary and description of each hazardous activity;

2) an assessment of the risks associated with the hazard, its likelihood and severity;

3) an identification of all risk reduction measures and the verification of their effectiveness after implementation;

4) a clear indication of the remaining and acceptable risks to operate the facility; and

5) the methodology used for the risk assessment.

c) The risk assessment shall include the following:

1) the identification of safety critical items, equipment or systems;

2) the review of maintenance and inspection instructions, with respect to the safety critical items of the test facilities;

3) the review of procedures for operation of safety critical items, equipment or systems;

4) the review of facility emergency procedures; and

5) the review of facility recovery procedures.

NOTE See ISO 14620-1 for guidance on safety risk assessments.

8.5 Critical items control

a) A critical items control analysis shall be performed including all equipment and subassemblies of the test facility.

NOTE Example of a critical item control analysis is a failure modes, effects and criticality analysis (FMECA). For the methodology to perform a dependability analysis, see ISO 23460 and IEC 60812 for FMEA methodology.

b) Critical items shall be identified as a result of the analyses specified in 8.5 a) and the requirements of 8.4.

c) For critical items specified in 8.5 b), a mitigation action plan to reduce the criticality shall be identified and implemented before its further use.

d) The analyses specified in 8.5 a) and the requirements of 8.4 shall be performed for each new facility, reviewed after each facility upgrade or modification, and updated when effecting a change in the operation, functional performance or interfaces of the facility.

NOTE Items to be monitored can be:

— items with significant accumulated operational time compared to their expected (residual) life;

— items with a known history of problems;

— items performing functions which are critical to the test conduct; and

— items for which spare availability is scarce or missing.

e) The space test centre shall perform a failure trend analysis according to a defined method and periodicity.

NOTE Trend analyses can include data coming from:

— the assessment of tests performed in a given period regarding test duration and test conditions;

— a review of the maintenance activities performed; and

— a review of the root cause of non-conformances.

9 Test process realization

9.1 Planning of the test process

The space test centre shall establish and maintain documented information to verify the test planning, preparation, execution and related hardware and infrastructure so that the specified requirements of the customer are met.

NOTE Hardware, for example, includes jigs and tools.

9.2 Evaluation of customer requirements

a) The space test centre shall define the documented information for the review of requirements of routine, repetitive and new or complex tasks.

b) The space test centre shall maintain records of all requirements review,

c) Customer requirement review shall cover work that is outsourced by the space test centre.

9.3 Design and development of the test process

a) The space test centre shall identify and plan all phases of the testing process development and related servicing processes. The activities shall be performed with competent staff in engineering, quality and safety assurance.

NOTE Phases of testing include design, planning, preparation, acceptance, execution, report and reviews.

b) The space test centre shall ensure that processes specified in 9.3 a) are carried out under controlled conditions, including the following:

1) documented information specifying test design, test planning, test preparation, test execution and management, test data acquisition and storage, format and contents of test reports, test reviews and inspections, tracking of the test specimen throughout each test campaign;

2) conformance to applicable standards specified in the business agreements, quality and safety plans or documented information;

3) monitoring and control of test process parameters and test facility characteristics;

4) approval of test processes, procedures, facilities and equipment;

5) inspection and maintenance of test facilities, infrastructure, and software to demonstrate continuing test process capability;

6) applicable competence, training and certification (where applicable) of test personnel and lower-tier suppliers in conformance with the requirements of 7.2.

c) The planning shall demonstrate the compatibility of the design of the test processes with the infrastructure, the test facilities, the test execution, and the applicable test procedures.

d) The space test centre shall specify the requirements for any verification and validation of test processes or parts of them, including associated facilities, equipment and personnel.

e) Records of processes verification and validation shall be maintained.

f) The space test centre shall identify the development of the status of a test set-up and related documentation for the different phases of the test process, and maintain records of this status.

g) The space test centre shall assess the risks of the test process, performed with methodologies agreed by the quality and safety representative.

NOTE The risk assessment includes both technical and programmatic risks.

9.4 Test process and service provision

9.4.1 Facility test report

a) The space test centre shall ensure that all tests are documented in test reports.

b) The facility test report shall include as a minimum:

1) the name and address of the space test centre and the location where the test was carried out;

2) the names of key space test centre personnel involved in the test;

3) the name and address of the customer;

4) a description and identification of the test set up and test specimen;

5) the date of receipt of the test specimen and the date(s) of execution of the test;

6) the identification of the test specification or description of the method or procedure;

7) a description of the sampling procedure, where relevant;

8) measurements, examinations, derived results and measurement units, supported by tables, graphs, sketches and photographs as appropriate;

9) a statement on measurement uncertainty, where relevant;

10) the agreed confidentiality level.

9.4.2 Validation of the test process and service provision

a) The space test centre shall identify the need for dry-runs, rehearsals, simulations as well as the level of simulation, based on:

1) the complexity and specificity of the test process;

2) the evaluation of the risks for the test specimen and the facility in case of test interruption or failure;

3) the adequacy of qualifications of personnel employed on the test;

4) comprehensiveness and effectiveness of the end-to-end verification performed on the test set-up and facility subsystems.

b) Prior to the actual test run, the space test centre shall document the applicable inspections or tests and the records to be established.

9.4.3 Test specimen

a) The identification of the test specimen and associated test items shall be retained throughout all stages of work to ensure continued configuration control.

b) The space test centre shall ensure that all specified interfaces between the test facility and test specimen are available.

c) In case of a transfer of responsibility for the test specimen from the customer to the space test centre, this transfer shall be contractually specified.

d) The incoming inspection, the handling, the transport and the integration of the test set-up shall be performed in agreement with the customer.

e) Any activity carried out by the space test centre on the test specimen shall be authorized by the customer.

f) During the period that the space test centre has responsibility for the test specimen, the management of the test specimen related documents shall be specified and agreed by the customer.

g) For critical applications, regular interventions on the test specimen shall be performed by using step-by-step procedures.

9.4.4 Handling, storage, transportation and preservation

a) The space test centre shall implement handling, storage, transportation and preservation of the test specimen and associated test equipment in conformance with the required environmental conditions and taking into consideration all safety and security aspects, and in agreement with the customer.

b) The storage area for the test specimen and equipment shall be a designated area, separated from the working area.

c) Access control to the storage area shall be established to provide as a minimum the same security level as in working areas.

d) Prior to critical operations affecting the test specimen, the handling sequences shall be approved by the customer.

e) All lifting and hoisting equipment, including slings and accessories, shall be certified and covered by a valid certificate.

f) The certificates and their validity periods for all lifting and hoisting equipment shall be available to the customer.

g) Designated personnel shall brief customer personnel involved in lifting and hoisting operations inside the space test centre.

h) To perform ESD sensitive items tests the space centre shall provide an ESD protected area and implement ESD control process as requested by the customer.

9.5 Monitoring and measurement

9.5.1 Monitoring and measurement of test activities

a) The space test centre shall establish and maintain documented information for the assessment of readiness of the test facility and the test set-up to verify that the applicable requirements are met.

b) An FRR shall be performed by the space test centre before each test to verify the readiness of the test facility, with participation of the test personnel with designated responsibility in engineering, quality and safety.

c) Records of the FRR shall be kept by the space test centre.

d) The FRR shall address, as a minimum, the following topics:

   1) the test documentation in accordance with ISO 17566, including test methods in accordance with ISO 15864 and procedures and acceptance criteria;

   2) the test facility status, including:

      i) facility configuration for the test;

      ii) test facility data handling;

      iii) test facility measurement equipment;

iv) equipment calibration;

v) environmental conditions;

vi) cleanliness status;

vii) maintenance status;

viii) safety status;

ix) non-conformances, waiver and deviations that can affect the test;

3) the personnel's competence, qualification and availability;

4) the ground support equipment (GSE) dedicated to the test and infrastructure readiness;

5) the test specimen (in case the responsibility has been contractually transferred to the space test centre);

6) the results from pre-tests (dry-runs, rehearsals); and

7) the final test preparation actions status.

e) All open actions coming from the FRR shall be identified and closed before the test execution.

f) The space test centre shall present a declaration of facility readiness to the TRR board convened to release the test activity.

NOTE The declaration of facility readiness can also be called a facility readiness report.

g) The facility shall not be declared ready until so authorized by the quality representative.

h) Space test centre representatives shall participate in test readiness review (TRR) and post-test review (PTR).

NOTE Records of TRR and PTR are normally provided to the space test centre by the customer.

i) The space test centre shall establish and maintain documented information for the inspection of the test facility and the test set-up during the test execution to verify that the applicable requirements are met.

j) The space test centre shall present the preliminary test facility data to the PTR board including, as a minimum:

1) test facility data packages;

2) non-conformances and related dispositions; and

3) a declaration that test facility data meet customer requirements.

9.5.2 Control and non-conformances

a) The non-conformance control programme shall be performed in conformance with requirements to ISO 23461.

b) The non-conformance control programme shall be documented and supported by procedures and instructions.

c) The space test centre shall specify the responsibilities and the authorities for the treatment of non-conformances relevant to the space test centre.

d) All test personnel shall be able to identify a non-conformance and issue a non-conformance report (NCR).

e) Space test centre NCRs affecting the test specimen and any other customer property or the test programme shall be notified to the customer.

f) The treatment and dispositions of the NCRs affecting the test specimen shall be performed in an evaluation board with participation of the customers test representative, the test leader and the QA representatives.

g) The analysis of the non-conformances for test facilities or test service shall provide for lessons learned from the NCRs and their dissemination.

9.5.3 Lessons learned review

a) The space test centre shall review the lessons learned coming from its activities.

b) The space test centre shall establish and maintain a documented information for the management of lessons learned, defining:

1) the use of lessons learned as input to its future activities; and

2) the use of the outcome from the lessons learned review to determine appropriate actions.

10 Safety

10.1 Safety programme

10.1.1 General

a) The space test centre, in cooperation with the designated safety representative, shall establish a safety programme to assure the safety of all space test centre personnel, including the customer and visitors, the test specimen, the test facilities and its associated infrastructure.

b) The space test centre safety programme shall include, as a minimum:

1) systematic hazard identification, elimination or reduction;

2) a safety risk assessment, including an approved action plan to implement the prevention measures associated to safety;

3) systematic identification, control and maintenance of safety critical items, and of all applicable safety equipment;

4) documented space test centre safety and emergency procedures and instructions;

5) applicable safety training of space test centre personnel;

6) applicable safety briefings of customers and visitors;

7) systematic verification of safety requirements implementation by means of safety inspections and audits; and

8) identified resources to meet national requirements, space test centre requirements or customer requirements for medical, safety and emergency services.

NOTE These requirements can be developed in-house or provided by supplier organizations or local services.

10.1.2 Accidents, incidents and emergencies

a) The space test centre safety programme shall include, as a minimum, the following procedures in case of accident, incident and emergency:

   1) the general emergency procedure for the space test centre;

   2) the procedures to be followed in case of accident or incident; and

   3) the description of the responsibilities and authorities in all procedures for accidents, incidents and emergencies.

10.2 Safety policy and objectives

a) The space test centre management shall define the safety policy, including a commitment to safety.

b) The space test centre management shall periodically review its safety policy.

c) The space test centre shall demonstrate that the safety policy is known and supported by all personnel.

d) The space test centre management shall identify safety objectives.

e) The space test centre shall demonstrate that the safety objectives specified in the requirement 10.2 d) are reviewed periodically.

10.3 Safety manual of the space test centre

a) The space test centre, in cooperation with safety assurance, shall establish and maintain a safety manual that shall include the following information:

   1) the applicable international and national standards on which it is based;

   2) the applicable health and safety requirements in the space test centre;

   3) the environmental safety requirements impacting the space test centre;

   4) the space test centre safety policy and objectives specified in 10.2;

   5) the responsibilities and authorities of all space test centre personnel with regards to safety;

   6) the applicable safety procedures and instructions;

   7) the applicable procedures in case of accident, incident and emergencies specified in 10.1.2.

10.4 Safety management of test campaigns

a) The space test centre shall identify all hazardous items and operations specific to the test campaign.

b) Information on hazardous items and operations specific to the test campaign shall include a safety questionnaire completed by the customer or by the space test centre in cooperation with the customer, containing at the minimum the information specified in the DRD from Annex A.

c) The space test centre shall agree with the customer the delivery conditions of the safety questionnaire filled in by the customer.

d) The information from the questionnaire shall be recorded and processed as input data for the design and verification of the test process, in addition to the standard safety precautions.

NOTE Delivery conditions are for example the format of the questionnaire, the time of delivery.