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

*Systèmes spatiaux — Management de programme — Matériaux,
éléments mécaniques et procédés*

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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.

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Introduction

This International Standard is intended for application by the management in space programmes and applications.

The formation of this International Standard takes into account the existing International Standard prepared by ISO/TC 176, notably ISO 9000, ISO 9001 and ISO 9004, and the content of ISO 14300-1 and ISO 14300-2.

The purpose of this International Standard is to define the requirements and statements applicable to materials, mechanical parts and processes to satisfy the mission performance requirements.

This International Standard also defines the documentation requirements and the procedures relevant to obtaining approval for the use of materials, mechanical parts and processes in the fabrication of space systems and associated equipment.

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

1 Scope

This International Standard defines the programme management requirements for material, mechanical parts and processes for projects covering mission definition, design, development, production and operations of space systems, including disposal.

This International Standard covers the following:

- management, including organization, reviews, acceptance status and documentation control;
- selection criteria and rules;
- evaluation, validation and qualification, or verification testing;
- procurement and receiving inspection;
- utilization criteria and rules.

This International Standard applies to all space deliverable products and all programme phases.

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

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

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

ISO 9000, *Quality management systems — Fundamentals and vocabulary*

3 Terms and definitions

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

3.1

critical material

material that is new to an individual company or non-validated for the particular application and environment

3.2 critical mechanical part
mechanical part that requires specific attention or control due to fracture mechanics aspects and limited-life aspects, or with which the contractor has no previous experience of using the mechanical part in the specific application and environment or are new or non-qualified

3.3 critical process
process that is declared critical when it is new to an individual company or non-verified for the application in question or has caused problems during previous use that remain unresolved

3.4 material
raw, semi-finished or finished purchased item (gaseous, liquid, solid) of given characteristics from which processing into a functional element of the product is undertaken

3.5 mechanical part
piece of hardware that is not electrical, electronic or electromechanical and that performs a simple (elementary) function or part of a function in such a way that it can be evaluated as a whole against expected performance requirements and cannot be disassembled without destroying this capability

NOTE Only standard parts are subject to the mechanical parts lists; non-standard parts are described through their materials.

3.6 process
set of interrelated or interacting activities that transforms inputs into outputs

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See ISO 9000.

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NOTE In this International Standard, "process" means the manufacturing process of product, i.e. set of interrelated resources and activities which transforms a material or semi-finished product into a semi-finished product or final product.

3.7 request for approval
document by which the supplier or user asks the competent body for permission to use a critical material, part or process

3.8 special process
process where quality cannot be completely ensured by inspection of the end article only

4 Abbreviated terms

The following abbreviated terms are defined and used within this International Standard.

AA	Aluminum Association
AOCS	attitude and orbit control system
ATOX	atomic oxygen
AISI	American Iron and Steel Institute
CDA	Copper Development Association
CDR	critical design review

CFRP	carbon fibre reinforced polymer
CI	configuration item number (as per project definition)
DML	declared materials list
DMPL	declared mechanical parts list
DPL	declared processes list
DRD	document requirements definition
EEE	electrical, electronic and electromechanical
ESA	European Space Agency
GOX	gaseous oxygen
GSE	ground support equipment
LEO	low earth orbit
LOX	liquid oxygen
MIP	mandatory inspection point
MMPP	materials, mechanical parts and processes
NASA	National Aeronautics and Space Administration
NCR	non-conformance report
NRB	non-conformance review board
PA	product assurance
PDR	preliminary design review
PID	process identification document
PMP	parts, materials, processes
QR	qualification review
QRR	qualification review report
RFA	request for approval
SCC	stress corrosion cracking

5 General requirements

5.1 Materials, mechanical parts and processes programme management

5.1.1 Materials, mechanical parts and processes activity diagram

The general activity within the framework of a project is summarized by the flow chart shown in Figures 1 and 2 and Table 1.

5.1.2 Product assurance plan

Suppliers shall provide a material, mechanical parts and processes plan in accordance with ISO 14300-2 and this International Standard. This can form part of the overall project product assurance plan, or exist as a separate document.

5.1.3 Management

The supplier shall appoint a materials, mechanical parts and processes manager who ensures that the requirements laid out in this International Standard are satisfied. This manager shall be the customer's contact as far as application of this International Standard is concerned within the overall PA reporting system. The manager shall periodically inform the customer of the progress of tasks relating to its application. The manager shall ensure conformance to technical and scheduling aspects of the various actions undertaken (status of material validation, part qualification and process verification).

The manager shall ensure that all suppliers apply the requirements of this International Standard.

5.1.4 Customer reviews

To obtain the validation status for materials and qualification status for parts and verification status for processes, the materials, mechanical parts and processes manager shall present to the customer those activities that were performed in order to comply with this International Standard together with results obtained.

The materials, mechanical parts and processes manager shall organize technical review meetings with his or her suppliers at all levels, as appropriate.

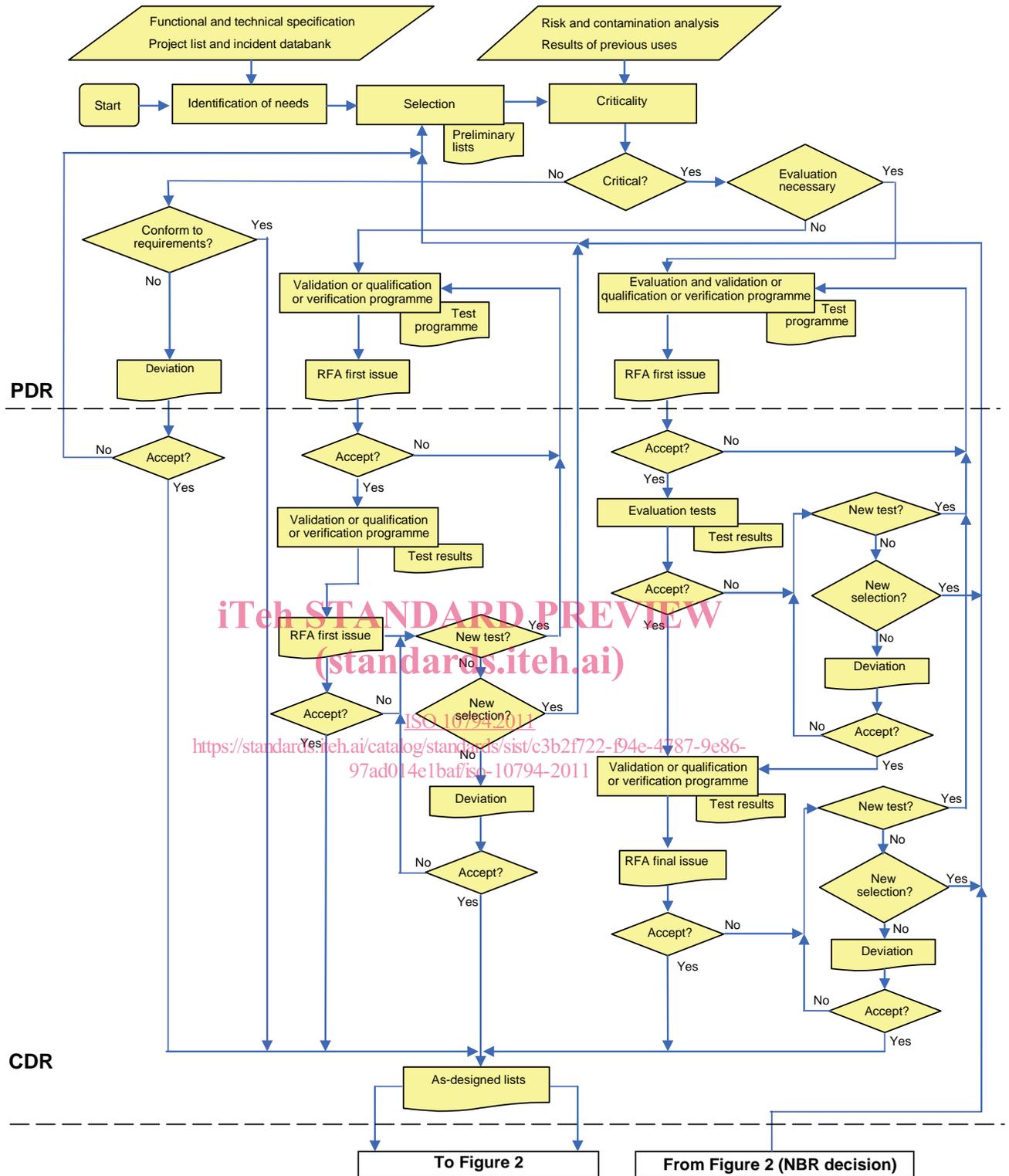


Figure 1 — Materials, mechanical parts and processes flow chart (continued in Figure 2)

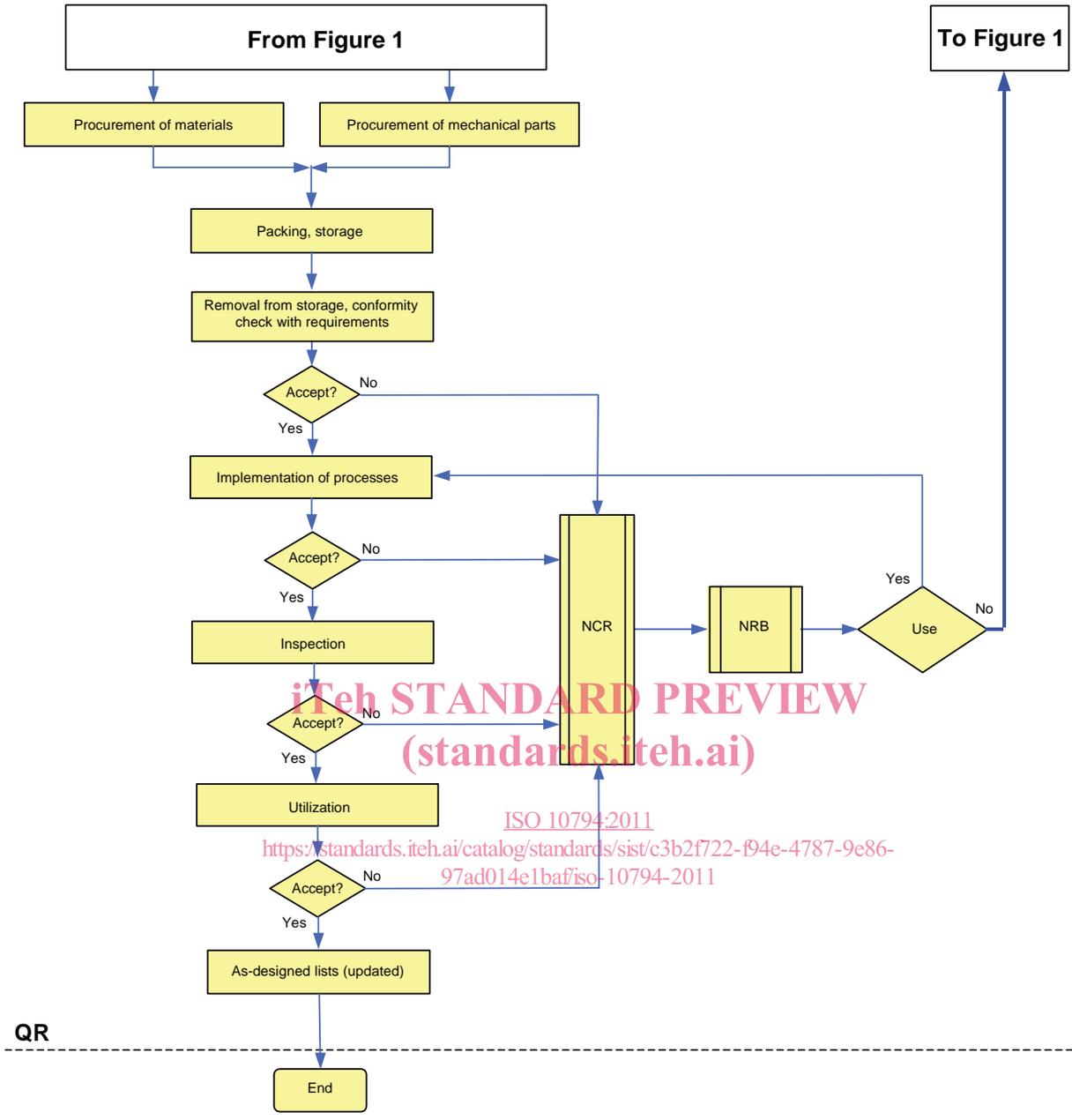


Figure 2 — Materials, mechanical parts and processes flow chart (continued from Figure 1)

Table 1 — Steps to be taken to get approval for materials, mechanical parts and processes

Approval process for materials, mechanical parts and processes (MMPP)						
Phase	Materials		Mechanical parts		Processes	
	Step	Comments	Step	Comments	Step	Comments
Critical analysis	1	—	1	—	1	—
Evaluation (usually by test methods defined by national agency standards)	2	Critical materials are tested, e.g. outgassing, SCC, flammability.	2	Mechanical parts are tested by, for example, vibration, thermal analysis, offgassing and life test.	2	Critical processes are evaluated by testing “technology samples” including all, for example, electrical interconnection processes and painting, adhesive bonding.
Verification/validation/qualification	3	Validation	3	Qualification	3	Verification
Approval	4	By RFA (see Annex E) or DML	4	By RFA (see Annex E) or DMPL/DPL	4	By RFA (see Annex E) or DPL
<p>NOTE 1 Project approval is always by means of the request for approval (RFA) form and the project's declared materials list (DML), declared mechanical parts list (DMPL) and declared processes list (DPL).</p> <p>NOTE 2 The details for approvals of MMPP lists are contained in this International Standard.</p> <p>NOTE 3 To summarize:</p> <p style="padding-left: 40px;">Materials are validated.</p> <p style="padding-left: 40px;">Mechanical parts are qualified.</p> <p style="padding-left: 40px;">Processes are verified.</p> <p>And in addition:</p> <p style="padding-left: 40px;">Skills training schools are customer approved.</p> <p style="padding-left: 40px;">Outside test or evaluation laboratories are customer approved.</p> <p style="padding-left: 40px;">Operators and inspectors for critical processes are trained, certified and monitored.</p>						

5.2 Management and consolidation of the activities

5.2.1 Relationship

The relationship between materials and processes activities and programme phases is shown in Annex A.

5.2.2 Establishing and processing of lists

5.2.2.1 Each supplier and sub-tier supplier shall establish, collect, review and deliver the declared materials, mechanical parts and processes lists including all the items intended for use in the flight equipment. The lists shall reflect the current design at the time of issue. These lists shall contain the materials, mechanical parts and processes used in the current design. The objectives are as follows:

- compliance with all requirements of the programme;
- verification of the results of equipment supplier activities;
- control and monitoring the status of materials, mechanical parts and processes in accordance with programme milestones. For additional information, see informative Annex A.

5.2.2.2 The following constraints should be taken into account:

- requirements originating from the functional specifications;

- requirements and conditions specific to the project;
- maximum use of the materials and processes described in approved data sources, e.g. national agency standards, and items already approved on similar projects;
- use of project related preferred lists, if available.

5.2.2.3 An analysis of the criticality of these preliminary lists shall, after checking the conformity of the materials, mechanical parts and processes against all the project requirements, allow them to be classified into three categories:

- critical items, subject to evaluation, validation, qualification, or verification programmes, for which a request for approval should be drafted according to the method and the formats defined in the RFA DRD. For additional information, see informative Annex E;
- items that are not critical but which do not conform to one or more project requirements (a justified deviation request should be drafted for this category);
- non-critical items.

5.2.3 Management of the lists

The supplier shall document all the MMPP used in the project in accordance with the DRD. The MMPP lists shall be provided in a form that is exchangeable, searchable, sortable and suitable for storage and retrieval (in accordance with the contractual requirements).

The customer shall process the lists for suppliers as necessary to achieve the objectives of exchangeability, searchability, sortability, storability and retrievability for that set of lists, before releasing it for use by the higher-level customer.

These lists shall be updated during the course of the project. The preliminary lists shall include the items from suppliers' preliminary requirements and are used to identify those that are critical (available for the PDR).

The as-designed lists shall include the items from the baseline's various design files (available for the CDR).

Any change after CDR or QR shall be reflected in the list and shall be in accordance with Figure 2.

The materials, mechanical parts and processes manager is responsible within the programme to ensure that all the information required is given and that the approval status is consistent with technical and scheduling objectives and that the data are exchangeable.

Where no project requirements exist for a separate DMPL, the mechanical parts can be entered into a separate section of the DML.

The materials of, for example, bearings, heatermats, and gears that are made up of a few materials, can be listed in the DMPL. The materials (metals and plastics) of complex parts can be listed in the DML with, for example, outgassing, toxicity, flammability, corrosion and stress corrosion values and reference to the DMPL item.

5.2.4 Supplier role and responsibilities

5.2.4.1 The supplier shall be responsible for the following tasks:

- obtaining the correct and complete lists from lower-level suppliers;
- providing provisional and, later, definitive approval for each list;
- submitting the project declared lists for approval prior to initiation of the hardware phase (before critical design review).

The lists established by the suppliers shall include all the information described in this International Standard. Amendments to the lists shall be implemented only through established change procedures.

5.2.4.2 Any of the following documentation shall be made available to the final customer upon request:

- RFA (reference and issue);
- material, mechanical parts or processes justification files;
- evaluation reports;
- deviation requests.

5.3 Technical constraints

Parts and materials shall satisfy the mission's functional constraints. They shall also satisfy both ground environment constraints (e.g. manufacture, tests, storage, maintenance, transport and integration) and flight constraints (launch and orbit). The technical criteria from 6.1 shall be taken into account, according to the mission.

The estimated availability of the parts and products obtained from materials and processes used shall be compatible with the final system's life cycle (tests, storage and mission).

5.4 Cleanliness and contamination control

The supplier shall establish and maintain an effective contamination and cleanliness control programme including, as a minimum, the following:

- cleaning procedures; and
- cleanliness monitoring procedures or methods.

The risks of chemical or particle pollution generated by parts, materials or processes used shall be identified and reduced in accordance with mission requirements (cleanliness or contamination analysis).

For cleanliness- or contamination-critical applications, a specific cleanliness control plan and requirement specification (chemical and particle) shall be established.

5.5 Safety hazardous parts and materials

Parts and materials with hazardous characteristics shall be identified, managed and processed according to customer standards.

5.6 Optical, mechanical or electrical GSE hardware

When optical, mechanical or electrical GSE materials are used in thermal vacuum or interfacing with flight hardware, possible degradation shall be taken into account (e.g. contamination, surface degradation, flammability, electromechanical and chemical effects).