BS ISO 10794:2018

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

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# National foreword

This British Standard is the UK implementation of ISO 10794:2018. It supersedes BS ISO 10794:2011, which is withdrawn.

The UK participation in its preparation was entrusted to Technical Committee ACE/68, Space systems and operations.

A list of organizations represented on this committee can be obtained on request to its secretary.

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Published by BSI Standards Limited 2018

ISBN 978 0 580 97240 9

ICS 49.140

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This British Standard was published under the authority of the Standards Policy and Strategy Committee on 31 May 2018.

**Amendments/corrigenda issued since publication**

| Date | Text affected |
|---|---|

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INTERNATIONAL STANDARD

# ISO 10794

Second edition
2018-05

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

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

Reference number
ISO 10794:2018(E)

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# Contents

Page

**Foreword** ... **v**
**Introduction** ... **vi**
**1 Scope** ... **1**
**2 Normative references** ... **1**
**3 Terms and definitions** ... **1**
**4 Abbreviated terms** ... **2**
**5 General requirements** ... **3**
5.1 Materials, Mechanical Parts and Processes Programme (MMPP) management requirement ... 3
5.1.1 Overview ... 3
5.1.2 MMPP plan ... 3
5.1.3 Management ... 4
5.1.4 Material, Mechanical Parts, Processes Control Board (MPCB) ... 4
5.2 Management and consolidation of the activities ... 7
5.2.1 Relationship ... 7
5.2.2 Establishing and processing of lists ... 7
5.2.3 Management of the lists ... 8
5.2.4 Supplier role and responsibilities ... 9
5.3 Technical constraints ... 9
5.4 Cleanliness and contamination control ... 9
5.5 Safety hazardous parts and materials ... 9
5.6 Optical, mechanical or electrical GSE hardware ... 10
**6 Material control** ... **10**
6.1 Technical criteria for selection of materials ... 10
6.2 Selection ... 14
6.3 Declared materials list content ... 15
6.4 Criticality analysis ... 15
6.5 Evaluation and validation phases ... 16
6.5.1 General ... 16
6.5.2 Evaluation phase ... 16
6.5.3 Validation phase ... 16
6.5.4 Approval phase ... 16
6.5.5 Deviation request ... 16
6.6 Procurement of materials ... 17
6.6.1 Procurement specifications ... 17
6.6.2 Incoming inspection procedure ... 17
6.7 Use of materials ... 17
6.7.1 Validation status of materials ... 17
6.7.2 Traceability of materials ... 17
6.7.3 Packaging, storage, removal from storage ... 17
6.7.4 Limited-life materials before implementation ... 17
6.7.5 Limited-life materials after implementation ... 18
6.7.6 Materials' non-conformances and alerts ... 18
6.7.7 Health and safety ... 18
**7 Mechanical parts control** ... **18**
7.1 Verification of mechanical parts ... 18
7.2 Selection ... 18
7.3 Declared mechanical parts list ... 18
7.4 Criticality analysis ... 19
7.5 Evaluation and qualification phases ... 19
7.5.1 General ... 19
7.5.2 Evaluation phase ... 19

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Document Sharing Hub
Full document details: BS ISO 10794:2018

7.5.3 Qualification phase ... 20
7.5.4 Approval phase ... 20
7.5.5 Deviation request ... 20
7.6 Procurement of mechanical parts ... 20
7.6.1 General ... 20
7.6.2 Procurement specification ... 20
7.6.3 Source inspection ... 20
7.6.4 Incoming inspection procedure ... 21
7.7 Use of mechanical parts ... 21
7.7.1 Qualification status of mechanical parts ... 21
7.7.2 Traceability of mechanical parts ... 21
7.7.3 Packaging, storage, removal from storage ... 21
7.7.4 Limited-life mechanical parts or parts subject to wearout ... 21
7.7.5 Mechanical parts non-conformances and alerts ... 21

**8 Process control ... 21**
8.1 Specifications or procedures ... 21
8.2 Process selection and training ... 21
8.3 Declared processes list content ... 22
8.4 Criticality analysis ... 23
8.5 Evaluation and verification phase ... 23
8.5.1 General ... 23
8.5.2 Evaluation phase ... 23
8.5.3 Verification phase ... 23
8.5.4 Approval phase ... 24
8.5.5 Deviation request ... 24
8.6 Use of a process ... 24
8.6.1 Verification status of a process ... 24
8.6.2 Re-verification of a process ... 24
8.6.3 Implementation of a process ... 24
8.6.4 Traceability of processes ... 25
8.6.5 Process non-conformances and alerts ... 25
8.6.6 Mandatory inspection points (MIPs) ... 25
8.6.7 Packaging, storage, removal from storage ... 25

**Annex A** (informative) **Relationship between materials, mechanical parts,processes activities and programme phase ... 26**

**Annex B** (normative) **Declared materials list — Document requirements definition ... 28**

**Annex C** (normative) **Declared mechanical parts list — Document requirements definition ... 33**

**Annex D** (normative) **Declared processes list — Document requirements definition ... 38**

**Annex E** (normative) **Request for approval (RFA) — Document requirements definition ... 42**

**Bibliography ... 46**


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Full document details: BS ISO 10794:2018

# 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).

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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*.

This edition of ISO 10794:2018 cancels and replaces the edition ISO 10794:2011, which has been technically revised and includes the following changes:

— bacterial and fungus growth has been added;

— Hydrogen embrittlement has been added; and

— manned environment has been added.

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# Introduction

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

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

This document specifies the requirements and statements applicable to materials, mechanical parts and processes to satisfy the mission performance requirements.

This document also specifies 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 document 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 document 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; and

— utilization criteria and rules.

This document applies to all space deliverable products and all programme phases.

## 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 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.

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

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

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

**3.1**
**critical material**
material that is new to an individual company or non-validated for the particular application and environment, or that has caused problems during previous use that remain unresolved

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**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, or that has caused problems during previous use that remain unsolved

**3.3**
**critical process**
process 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**
**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 requirements of performance and cannot be disassembled without destroying this capability

**3.5**
**process**
set of interrelated or interacting activities that transforms inputs into outputs

Note 1 to entry: See ISO 9000.

Note 2 to entry: In this document, "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.

**3.6**
**request for approval**
document by which the supplier or user asks the competent body for permission to use a critical material, part or process

**3.7**
**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 document.

**AA** Aluminium 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


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**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

**MPCB** Material, Mechanical Parts and Process Control Board

**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

**RFD** request for deviation

**SCC** stress corrosion cracking

# 5 General requirements

## 5.1 Materials, Mechanical Parts and Processes Programme (MMPP) management requirement

### 5.1.1 Overview

The general MMPP activity within the framework of a project is summarized in Figures 1 and 2.

### 5.1.2 MMPP plan

The suppliers shall prepare, maintain and implement a MMPP plan, as part of the overall PA plan in accordance with ISO 14300-2 and this document, or exist as a separate document.

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The MMPP plan shall be submitted to the customer for approval.

### 5.1.3 Management

The supplier shall appoint a MMPP manager. The MMPP Manager shall ensure that the Materials, Mechanical Parts and Processes used to manufacture a spacecraft or a launcher satisfy both the ground and flight functional requirements and constraints of the project. To obtain the validation status for materials and qualification status for parts and verification status for processes, the MMPP manager shall present to the customer activities which were performed in conformance with this document together with results obtained.

### 5.1.4 Material, Mechanical Parts, Processes Control Board (MPCB)

The MMPP manager shall organize Material, Mechanical Parts and Processes Control Board (MPCB) with his or her suppliers at all levels, as appropriate. The MPCB activity shall start not later than at PDR. The MMPP Manager shall agree with the customer on the MPCB's activities at PDR. Minimum tasks of the MPCB shall be as follows:

— coordination of the initiation and approval of RFA's in conformance with DRD from the Annex E by involving the relevant technical discipline;

— review and approval of test programme and related results;

— review of preliminary Declared Materials, Mechanical Parts and Processes Lists and of any available evidence to support the approval, by the PDR;

— review and approval of Declared Materials, Mechanical Parts and Processes Lists and of the evidence for the approval by the CDR; and

— review and approval of any change to the approved Declared Materials, Mechanical Parts and Processes Lists.


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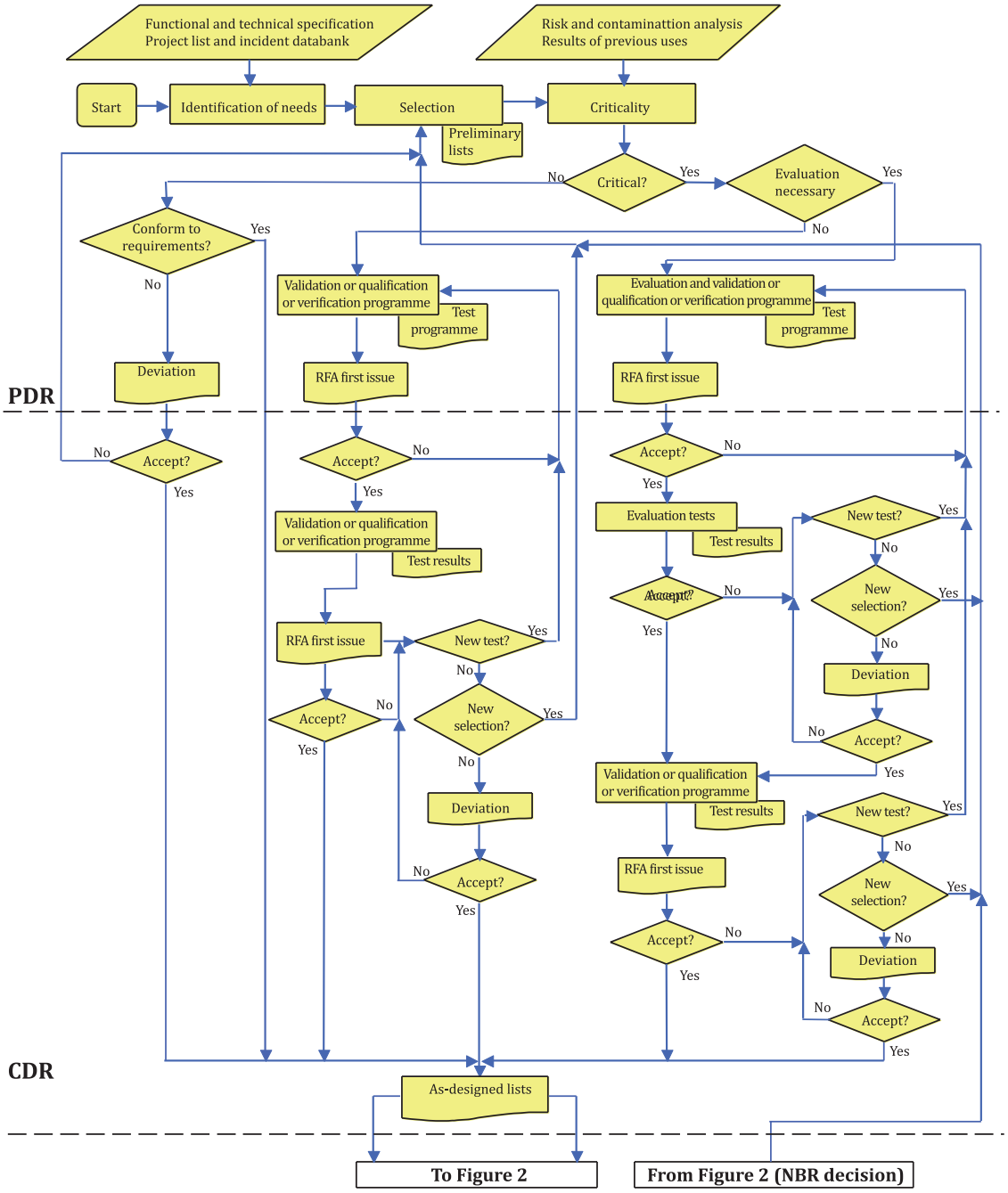


**Figure 1 — Materials, mechanical parts and processes flow chart (continued in Figure 2)**

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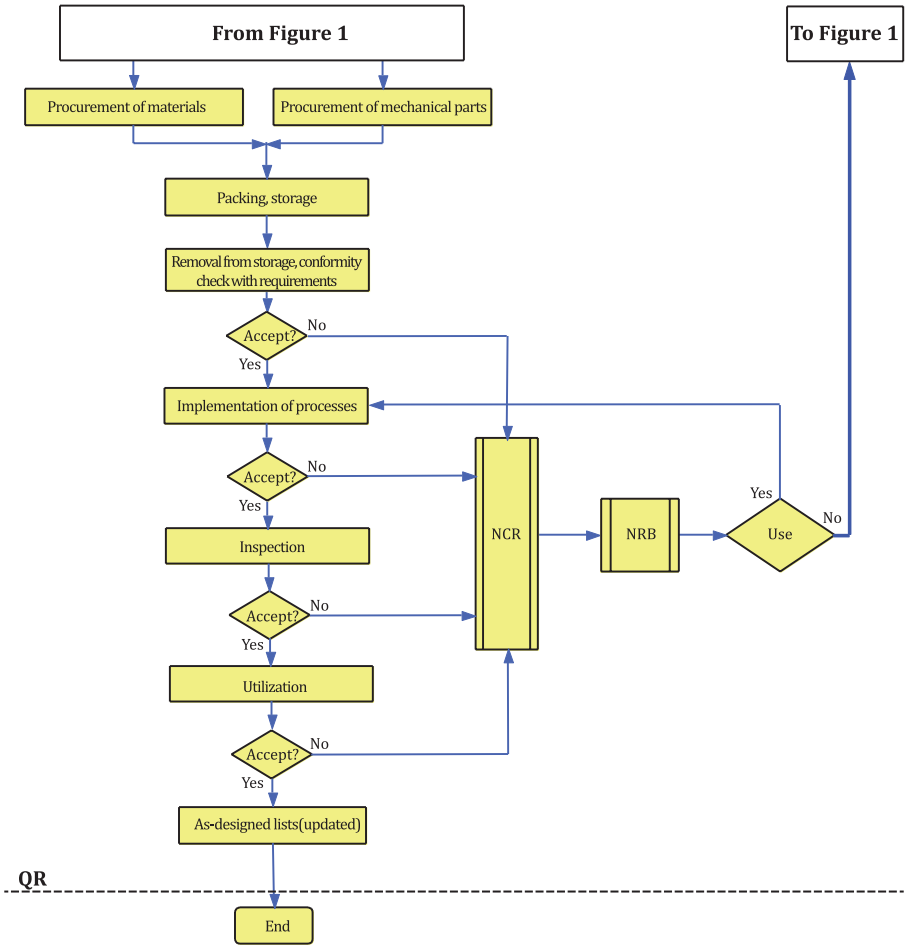


**Figure 2 — Materials, mechanical parts and processes flow chart (continued from Figure 1)**


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**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 |

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).

NOTE 2 The details for approvals of MMPP lists are contained in this document.

NOTE 3 To summarize: Materials are validated.
Mechanical parts are qualified.
Processes are verified.
And in addition: Skills training schools are customer approved.
Outside test or evaluation laboratories are customer approved.
Operators and inspectors for critical processes are trained, competent and monitored.

## 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 lower-level 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; and

— control and monitoring the status of materials, mechanical parts and processes in conformance with programme milestones. For additional information, see informative Annex A.

**5.2.2.2** The following constraints should be assessed:

— requirements originating from the functional specifications;

— requirements and conditions specific to the project;

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— maximum use of the materials and processes described in approved data sources, e.g. national agency standards, and items already approved on similar projects; and

— use of project related preferred lists, if available.

**5.2.2.3** An analysis of the criticality of these preliminary lists shall be performed as such that, 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;

— items that are not critical but which do not conform to one or more project requirements; and

— non-critical items.

For items classified as critical, a request for approval shall be submitted in conformance with Annex E. For items classified as not critical but which are not in conformance with one or more project requirements, a justified deviation request should be drafted.

### 5.2.3 Management of the lists

The supplier shall document all materials in the Declared materials list in conformance with Annex B.

The supplier shall document all mechanical parts in the Declared mechanical parts list in conformance with Annex C.

The supplier shall document all processes in the Declared process list in conformance with Annex D.

The supplier shall process the lists of lower-level suppliers to ensure exchangeability, traceability, searchability, sortability, storability and retrievability for that set of lists, before submitting it to the 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 MMPP manager is responsible within the programme to ensure that all the information needed 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, screw and nuts 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.

The supplier shall establish, collect, review and deliver the declared materials, mechanical parts and processes lists in an electronic format in conformance with Annex B, Annex C, and Annex D.

The supplier shall demonstrate that the lists have been formally approved prior to their delivery to the customer.


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### 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; and

— submitting the project declared lists for approval prior to initiation of the hardware phase, before CDR.

The lists specified in the requirement by the suppliers shall include all the information described in this document. Amendments to the lists shall be implemented through established change procedures.

**5.2.4.2** The following documentation shall be delivered to the customer upon request:

— RFA with reference and issue in conformance with DRD in Annex E;

— evaluation reports; and

— deviation requests.

The material, mechanical parts or process justification files shall be made available to the customer upon request either on the supplier site, or by any other process agreed by both parties.

NOTE For example, by non-disclosure agreement.

## 5.3 Technical constraints

Mechanical parts, materials and processes shall satisfy the mission's functional requirements and constraints. Mechanical parts, materials and processes shall satisfy both ground environment constraints (e.g. manufacture, tests, storage, maintenance, transport and integration) as well as flight requirements and flight constraints (launch and orbit).

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

## 5.4 Cleanliness and contamination control

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

— 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 chemical and particle requirement specification and a specific cleanliness control plan shall be established.

## 5.5 Safety hazardous parts and materials

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

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