BS ISO 10794:2011

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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 10794:2011.

The UK participation in its preparation was entrusted to Technical Committee ACE/68/-/5, Space systems and operations - Programme management.

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

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ISBN 978 0 580 71579 2

ICS 49.140

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This British Standard was published under the authority of the Standards Policy and Strategy Committee on 31 August 2011.

Amendments issued since publication

Date	Text affected

BS ISO 10794:2011

INTERNATIONAL STANDARD

ISO 10794

First edition
2011-08-01

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

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

Reference number
ISO 10794:2011(E)

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Published in Switzerland

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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.

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.

ISO 10794 was prepared by Technical Committee ISO/TC 20, *Aircraft and space vehicles*, Subcommittee SC 14, *Space systems and operations*.

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.

INTERNATIONAL STANDARD **ISO 10794:2011(E)**

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

See ISO 9000.

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.

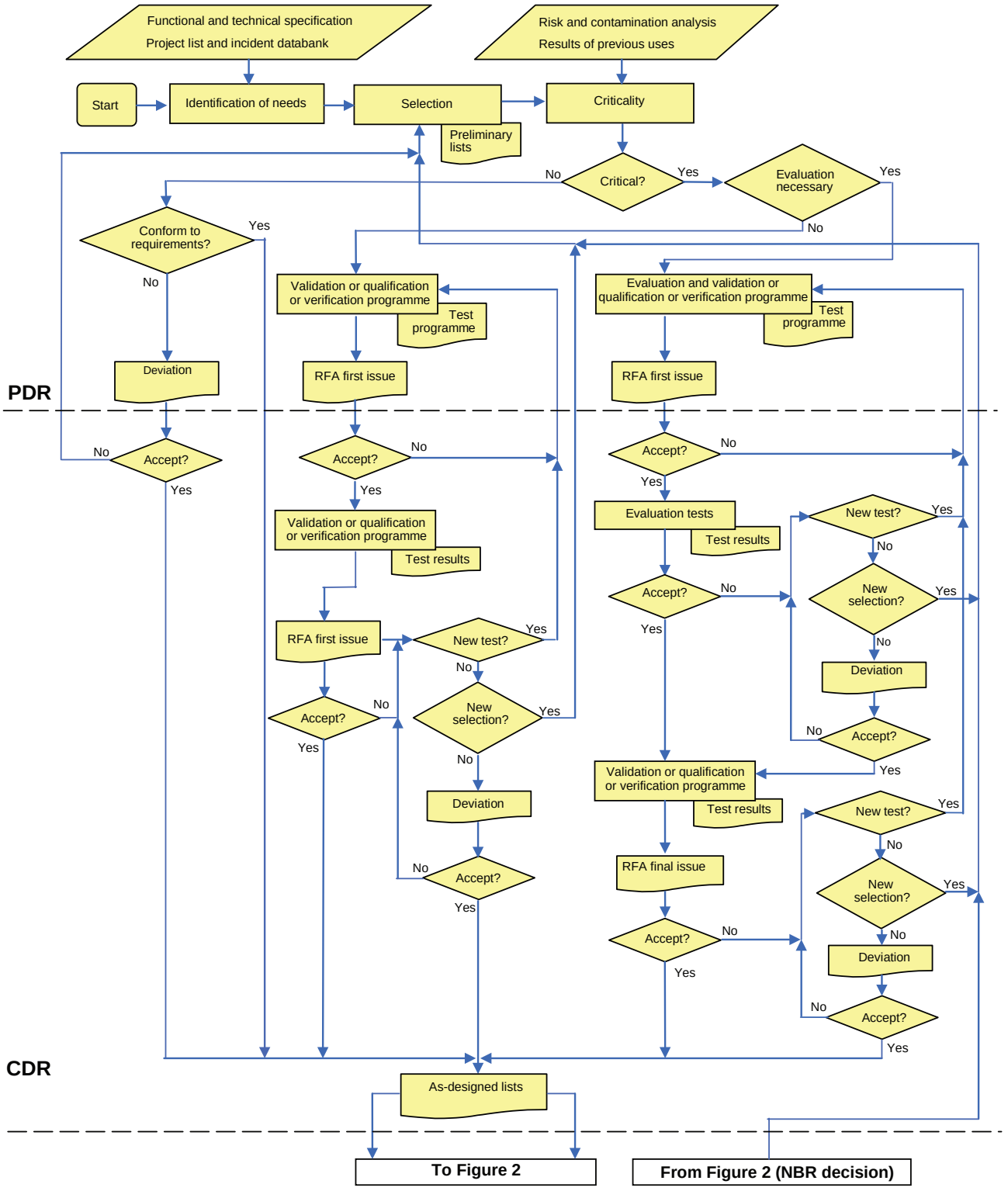

Figure 1 — Materials, mechanical parts and processes flow chart (continued in Figure 2)

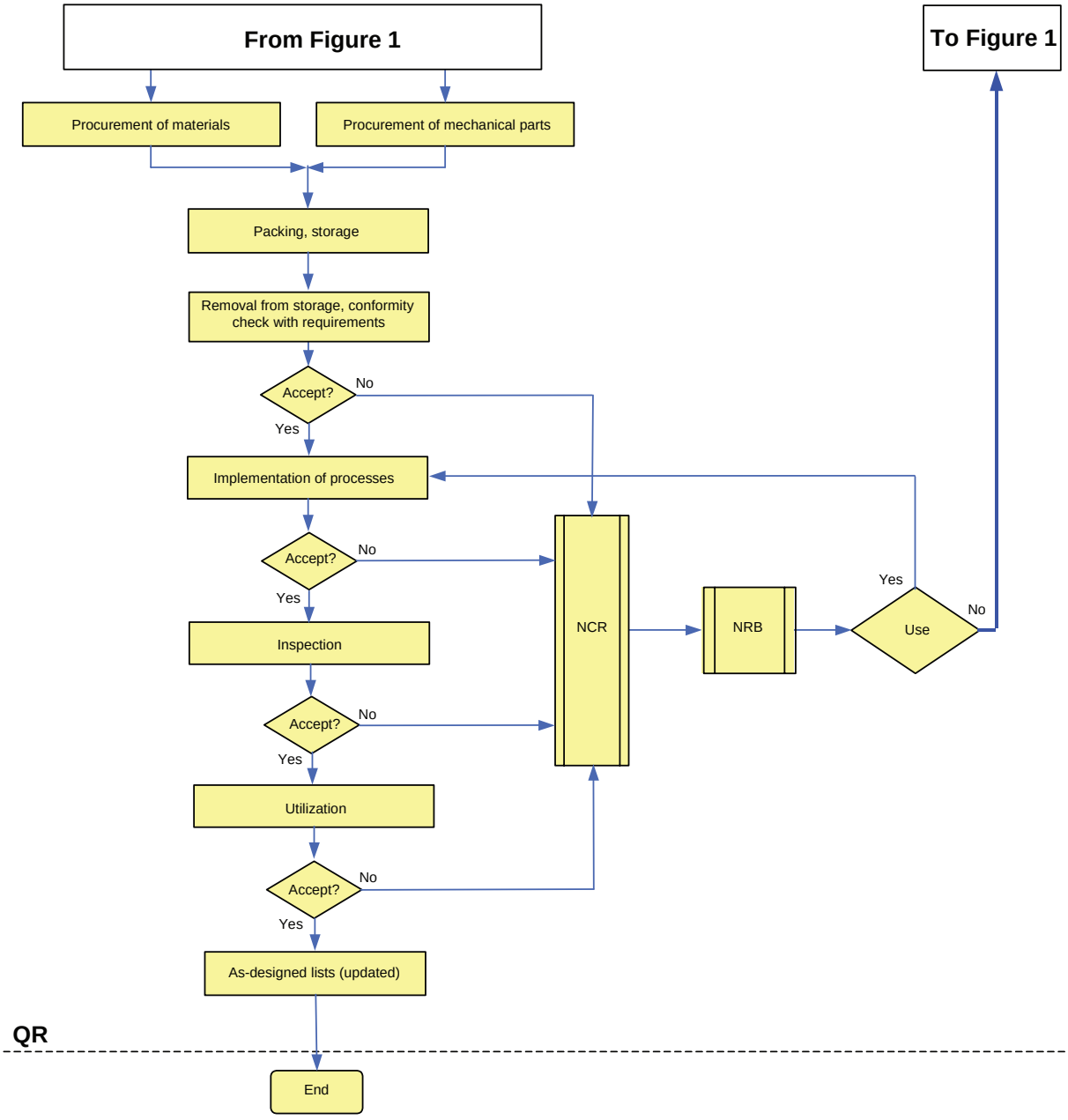

Figure 2 — Materials, mechanical parts and processes flow chart (continued from Figure 1)

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

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 International Standard.

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, certified 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 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).

6 Material control

6.1 Technical criteria for selection of materials

The following requirements shall be taken into account only if the environmental conditions of the mission require their application. The agency- or customer-specific requirements, test methods and accept or reject criteria shall be applied.

a) Temperature: Material properties shall be compatible with the thermal environment to which they are exposed.

b) Thermal cycling: Materials subject to thermal cycling shall be assessed for their ability to withstand induced thermal stress and shall be tested according to approved procedures.

c) Vacuum:

   — Materials selection shall be made in accordance with approved data sources.

   — Outgassing tests shall be carried out according to approved procedures.

d) Offgassing, toxicity, bacterial and fungus growth: Spacecraft and associated equipment shall be manufactured from materials and by processes that shall not cause an unacceptable hazard to personnel or hardware, whether on the ground or in space.

e) Flammability: The materials flammability resistance shall be evaluated for the most hazardous environment envisaged for their use.

f) Radiation: Materials used on the spacecraft external surfaces shall be assessed to determine their resistance to the radiation dosage expected during the mission.

   The genealogy of fluorine resin (PTFE) has weak resistance to the radiation dosage. Therefore, if the material is used inside the spacecraft, it shall be assessed in terms of the resistance to the radiation dosage.

g) Electrical charge and discharge: External surfaces of the spacecraft shall be sufficiently conductive, interconnected and grounded to the spacecraft structure to avoid the build-up of differential charges.

h) Lightning strike: Provision shall be made in the design to ensure that the safety and functionality of the vehicle are not compromised by the occurrence of a lightning strike during launch or return.

i) Corrosion: For all materials that come into contact with atmospheric gases, cleaning fluids or other chemicals, it shall be demonstrated that the degradation of properties during their anticipated service life is acceptable in terms of the performance and integrity requirements.

j) Stress corrosion:

   — Materials used for structural and load-bearing applications (subject to tensile stress) shall be chosen in conformance with approved data sources.

   — Any material not covered by an approved standard shall be tested according to approved procedures.

k) Fluid compatibility:

   — Materials within the system exposed to liquid oxygen (LOX), gaseous oxygen (GOX) or other reactive fluids, both directly and as a result of single-point failures, shall be compatible with that fluid in their application.

— The possibility of hydrogen embrittlement occurring during component manufacture or use shall be assessed. An appropriate material evaluation shall be undertaken, including the assessment of adequate protection and control.

l) Galvanic compatibility: When bimetallic contacts are used, the choice of the pair of metallic materials used shall be taken into account. This also includes metal-to-conductive fibre-reinforced materials contacts.

m) Atomic oxygen:

— All materials considered for use on the external surfaces of spacecraft intended for use in low earth orbit (LEO) altitudes (between 200 km and 700 km) shall be evaluated for their resistance to atomic oxygen (ATOX).

— Test procedures shall be subject to the approval of the customer.

n) Micrometeoroids and debris: The effect of impacts by micrometeoroids and debris on materials shall be reviewed and assessed on a case-by-case basis and their use shall comply with safety evaluation and assessment results concerning design and application criteria or details.

o) Moisture absorption and desorption: Precautions shall be taken to avoid moisture absorption during manufacture and storage of CFRP-type materials.

p) Mechanical contact surface effects (cold welding, fretting, wear): For all solid surfaces in moving contact with other solid surfaces, it shall be demonstrated that the degradation of surface properties over the complete mission is acceptable from a performance point of view.

q) Life: materials shall be selected to ensure sufficient life with respect to the intended application.

r) Magnetic material: The use of the magnetic material should be kept to a minimum in consideration of system requirements.

6.2 Selection

6.2.1 Materials shall be chosen giving preference to the following:

— those successfully used for an identical application in other space programmes that are similar with respect to environment constraints and lifetime to the proposed application;

— those for which satisfactory evaluation results have been obtained on samples representative of the application with a sufficient margin as regards conditions of use;

— those included in approved data sources, for example ESA and NASA data banks.

6.2.2 Whether the materials are already validated or remain to be validated, their selection shall take into account the following criteria:

— continuity of supply;

— reproducibility of characteristics;

— approved supplier/distributor.

6.3 Declared materials list content

The declared materials list (DML) shall be broken down into clear categories to facilitate locating each item in the documentation (an example of such a breakdown is given in the DML DRD). For additional information, see informative Annex B. The DML shall include the following information:

— issue status of DML;

— unique item number (as the reference of the material in the DML) that shall be the same throughout the duration of the project;

— material designation (commercial identification);

— material keys, e.g. AISI; AA; CDA, UNS, ASTM;

— chemical nature and type of product;

— manufacturer's name and procurement specifications or standards;

— summary of processing parameters (e.g. finish, temper condition, mix ratio and curing);

— use and location;

— applicable process identifier from the DPL;

— environmental code;

— size code, test data (e.g. outgassing, stress corrosion cracking, corrosion and test data references);

— approval status (with reference to the approval authority, to test report and similar previous applications).

Any coding or acronyms used within the list shall be defined within the document. An example of a suitable completed DML format is given in Table B.4 in the DML DRD. For additional information, see informative Annex B.

6.4 Criticality analysis

The objective of the analysis is to identify whether further data are required to conform to mission requirements.

a) The supplier shall analyse all the materials contained in his or her preliminary lists with respect to criticality and in correlation with the risk analysis performed.

b) Any material not meeting the project requirements shall be the subject of an RFA that is submitted to the next customer.

c) The RFA shall include the reason and details of the subsequent evaluation and validation that it is necessary to perform. For additional information, see informative Annex E and 5.2.2.

d) Any material when specifically required; marking inks can be excluded.

6.5 Evaluation and validation phases

6.5.1 General

Depending on the results of the criticality analysis, the supplier shall perform either evaluation and qualification phases, or a qualification phase only for all critical parts. The choice between these two approaches takes into account

— knowledge of the part (e.g. new part, new use or change of configuration); and

— extension of the application.

Procurement and validation results, together with associated documents, shall be available for review at the contractor's premises before the start of evaluation or qualification phases.

6.5.2 Evaluation phase

The evaluation shall consider the following as a minimum for each material with unknown characteristics:

— the limits of use;

— the material's physical, chemical or functional characteristics along with their values and tolerances;

— behavioural tendencies and degradation processes depending on environmental parameters (including sensitivity to pollution);

— acceptance criteria.

When evaluation is performed, an evaluation programme (available at PDR, in accordance with Figures 1 and 2) shall be drawn up, implemented and an evaluation report (available before CDR, in accordance with Figures 1 and 2 and Table 1) shall be drawn up.

6.5.3 Validation phase

For all materials with unknown characteristics, a validation programme (available at PDR) shall be drawn up by the supplier and then implemented to check or confirm that the materials satisfy the mission requirements with appropriate margins as necessary to obtain validation status.

Validation status shall depend on the results obtained (validation report) and the review of corresponding documentation (available at CDR).

6.5.4 Approval phase

Provided that the requirements in 6.5.2 and 6.5.3 are satisfied, the material then receives an approval identification in the declared materials list for the project.

If approval is not granted, the supplier in charge of the item shall either

— select another material;

— propose a modified evaluation programme and resubmit for approval; or

— initiate a deviation procedure if the above actions fail to achieve positive results.

6.5.5 Deviation request

All materials not conforming to project requirements, whether at the end of criticality analysis or of evaluation and validation tests, shall form the subject of a duly justified deviation request in accordance with ISO 27025.

6.6 Procurement of materials

6.6.1 Procurement specifications

All materials shall be procured to an internationally or nationally recognized specification or an in-house fully configured procurement specification that defines the material's properties, the material's requirements, the test methods, the acceptance criteria for the specific applications, source inspection and receipt tests and incoming inspection.

Where suppliers do not accept specifications and procurement is by means of a datasheet, the contractor shall introduce internal, in-house receipt inspection to ensure that the validation status of the material is maintained during the subsequent procurements.

Materials with long lead times or long procurement delays (versus the project schedule) shall be identified before the formal subsystem PDR. Procurement shall be thoroughly planned, documented and implemented in a timely manner to obtain reliable product assurance provision at CDR. Back-up plans shall be prepared and initiated whenever there is evidence of possible delays or technical problems.

The material requirements should be explicitly accepted by the material vendor or manufacturer.

6.6.2 Incoming inspection procedure

All materials shall be submitted to an incoming inspection.

If necessary, an incoming inspection procedure shall define the inspections and tests that are carried out, particularly for materials that are known to have variations in their final properties.

6.7 Use of materials

6.7.1 Validation status of materials

The supplier shall verify that all materials with unknown characteristics are validated before being used in the manufacture of qualification or flight products. Any modification, change of condition or configuration of application can invalidate the use of the material and require additional validation testing.

6.7.2 Traceability of materials

The supplier shall apply the traceability rules defined in ISO 27025 to all materials.

Materials should be identified by a unique reference number, code or a lot number to provide traceability in the event of an incident or non-conformance, or a requirement for a technical investigation following failure or damage, to reconstruct the material's history, either individually (individual traceability) or by the manufacturing lot of which it was a part (lot traceability).

6.7.3 Packaging, storage, removal from storage

The supplier shall define provisions for packaging, storage and removal from storage for materials.

Measurements and inspections used to guarantee the material integrity and monitoring during storage and removal from storage shall be identified.

6.7.4 Limited-life materials before implementation

The supplier shall ensure that all materials that have limited-life characteristics have their date of manufacture (when available, otherwise date of delivery) and shelf-life expiry date accurately identified and clearly marked on each lot or batch.

Materials that have exceeded their shelf-life expiry date may be recertified only after the physical and chemical characteristics are inspected and the parameters, subject to deterioration, are evaluated for continued acceptability according to the accept and reject criteria.

6.7.5 Limited-life materials after implementation

Materials with limited life after implementation (such as propellants) shall be identified and controlled, storage and mission life being taken into account. These materials shall be assessed as candidates for the critical items list.

6.7.6 Materials' non-conformances and alerts

Non-conformances and alerts shall be in accordance with ISO 27025.

6.7.7 Health and safety

Material safety data sheet or equivalent shall be available for all materials.

7 Mechanical parts control

7.1 Verification of mechanical parts

The supplier shall verify that all materials and processes used in the mechanical parts satisfy the mission technical requirements.

7.2 Use of mechanical parts

Parts shall be chosen from those successfully used for an identical application in other space programmes similar with respect to environment constraints and lifetime whenever those parts exist.

Type reduction actions shall be implemented at all levels of the programme.

Whether the parts are already qualified or remain to be qualified, their selection shall take into account the following criteria:

— durability of supply;

— reproducibility of characteristics;

— approved supplier/distributor.

7.3 Declared mechanical parts list content

The declared mechanical parts list (DMPL) shall be broken down into distinct categories to enable easy identification of each item in the documentation. (A breakdown is given in the DMPL DRD. For additional information, see informative Annex C.)

The DMPL format shall include the following information:

— item number (as the reference of the part in the DMPL); it shall be the same throughout the duration of the project;

— part designation (commercial identification);

— type of part;

— manufacturer and procurement specifications or standards;

— summary of functions and characteristics;

— use and location;

— environmental code;

— approval status (with reference to the approval authority, to test report and similar previous applications).

Any coding or acronyms used within the list shall be defined within the document. Only those mechanical parts procured to a specification as a finished product shall be entered on the DMPL. An example of a suitable DMPL format is given in the DMPL DRD. For additional information, see informative Annex C.

7.4 Criticality analysis

The objective of the analysis is to identify whether further data are required to conform to mission requirements.

a) The supplier shall analyse all the parts contained in their preliminary lists with respect to criticality and in correlation with the risk analyses performed.

b) Critical parts shall be identified in the DMPL and included in the critical items list.

c) Any critical part shall be the subject of an RFA.

d) The RFA shall include the reason and the details of the subsequent evaluations and validations that will be performed. For additional information, see informative Annex E and 5.2.2.

7.5 Evaluation and qualification phases

7.5.1 General

Depending on the results of the criticality analysis, the supplier shall perform either evaluation and qualification phases, or a qualification phase only for all critical parts. The choice between these two approaches shall take into account

— knowledge of the part (e.g. new part, new use or change of configuration); and

— extension of the application.

Procurement and verification methods, together with associated documents, shall be available for review at the contractor's premises before the start of evaluation or qualification phases.

NOTE Reference can be made to Table 1 for an explanation of the steps involved.

7.5.2 Evaluation phase

The evaluation shall consider the following, as a minimum, for each critical part:

— the limits of use;

— the part's physical or functional characteristics, along with its values and tolerances;

— the behavioural tendencies and degradation processes depending on environment parameters (including sensitivity to pollution); and

— the acceptance criteria.

When an evaluation is performed, an evaluation programme (available at PDR) shall be drawn up and implemented, and an evaluation report (available before CDR) shall be drawn up.

The behaviour of the parameters that will be monitored (e.g. variation and change over time) that were also recorded during the evaluation programme tests shall serve as a reference for the analysis of qualification test results.

7.5.3 Qualification phase

For each critical part, a qualification programme shall be drawn up by the contractor and then implemented to check or confirm whether the parts satisfy mission requirements with appropriate margins.

Qualification status shall depend on the results obtained (qualification report) and the reviews of corresponding documentation (available at CDR).

7.5.4 Approval phase

Provided that the requirements in 7.5.2 and 7.5.3 are satisfied, the mechanical parts then receive an approval identification in the declared mechanical parts list for the project.

If approval is not granted, the supplier in charge of the item shall

— select another mechanical part; or

— propose a modified evaluation programme and resubmit for approval; or

— initiate a deviation procedure if the above actions fail to achieve positive results.

7.5.5 Deviation request

All parts not conforming to project requirements, whether at the end of criticality analysis or of evaluation and qualification tests, shall form the subject of a duly justified deviation request, in accordance with ISO 27025.

7.6 Procurement of mechanical parts

7.6.1 General

Mechanical parts with long lead times or procurement delays (versus the project schedule) shall be identified before the formal subsystem PDR. Procurement shall be thoroughly planned, documented and implemented in a timely manner to obtain reliable product assurance provision at CDR.

Back-up plans shall be prepared and initiated whenever there is evidence of possible delays or technical problems.

7.6.2 Procurement specification

Each part shall be covered by a procurement specification or a standard. These specifications shall define the part characteristics, requirements, tests methods, acceptance criteria, lot acceptance testing, source inspection, receiving inspection tests. The procurement specifications shall be explicitly accepted by the part manufacturer.

7.6.3 Source inspection

For complex parts related to a specific project development, each supplier shall define the nature and frequency of their own source inspection points. Source inspection shall be carried out by the supplier on the premises of the part manufacturer in accordance with ISO 27025.

7.6.4 Incoming inspection procedure

Each part or batch of parts shall be submitted to an incoming inspection. An incoming inspection procedure shall define the inspections and tests to be carried out.

7.7 Use of mechanical parts

7.7.1 Qualification status of parts

The supplier shall ensure that all critical parts are qualified before being used in the manufacture of qualification or flight products. Any modification, change in condition or configuration of application shall invalidate the use of the part and require additional qualification testing.

7.7.2 Traceability of parts

The supplier shall apply the traceability rules in accordance with ISO 27025 to his or her parts. Parts should be identified by a unique reference number or code and a lot number to provide traceability when there is an incident or non-conformance, or for the purposes of technical investigations following failure or damage to reconstruct the part's history, either individually (individual traceability) or by the manufacturing lot it was part of (lot traceability).

7.7.3 Packaging, storage, removal from storage

The supplier shall define provisions for packaging, storage and removal from storage for parts.

Measurements and inspections used to guarantee the part integrity and monitoring during storage and removal from storage shall be identified.

7.7.4 Limited-life parts or parts subject to wearout

Limited-life parts after implementation or those subject to wear out, e.g. mechanisms, pyro initiators and O-rings, shall be identified and controlled, with storage and mission life being taken into account. These parts shall be assessed as candidates to the critical items list; see ISO 27025.

7.7.5 Parts non-conformance and alerts

Non-conformances and alerts shall be in accordance with ISO 27025 and ISO 23461.

8 Process control

8.1 Specifications or procedures

Each process being used in the manufacturing or assembly of a product shall be identified by a specification or procedure. For minor/non-critical applications, a manufacturer's data sheet that describes the process can be used. Reference shall be made to accept and reject criteria.

8.2 Associated materials and mechanical parts

The supplier shall verify that the materials and the mechanical parts used during the implementation of processes satisfy the requirements of this International Standard.

8.3 Selection

8.3.1 Processes shall be chosen from those already verified according to the following order of preference and priority:

— those covered by space agencies or other governmental organization certification for identical conditions of use;

— those for which satisfactory evaluation and verification results have been obtained on samples representative of the application with a sufficient margin as regards conditions of use;

— those already successfully used by the same manufacturer for other space programmes in the same conditions of use.

8.3.2 Whether the processes are already verified or remain to be verified, their selection shall take into account the following criteria:

— quality and reliability;

— inspectability;

— reworkability of the process item;

— reproducibility.

8.4 Declared processes list content

The declared processes list (DPL) shall be broken down into clear categories to facilitate locating each item in the documentation (a breakdown is given in the DPL DRD). For additional information, see Annex D.

The DPL format shall include the following information:

— item number (as the reference of the process in the DPL); it shall be the same throughout the duration of the project;

— process identification;

— process specification (including specification issue, revision or date);

— process description (with associated materials' designation if possible);

— use and location;

— process supplier;

— associated DML item numbers;

— approval status (with reference to the approval authority, to the test report and similar previous applications).

Any coding or acronyms used within the list shall be defined within the document. An example of a suitable DPL format is given in the DPL DRD. For additional information, see Annex D.

8.5 Criticality analysis

The objective of the analysis is to identify whether further data are required to conform to mission requirements.

a) The supplier shall analyse all the processes contained in their preliminary lists with respect to criticality and in correlation with the risk analyses performed.

b) Critical processes shall be identified in the DPL and included in the list of critical items.

c) Any critical process shall be the subject of an RFA.

d) The RFA shall include the reason and the details of the subsequent evaluation and validation to be performed. For additional information, see Annex E and 5.2.2.

e) Special processes can be identified and controlled. Process control shall be ensured by means of adequate procedures or personnel certification or inline process control. Whenever feasible, a statistical process may be carried out.

f) Typical special processes include soldering, brazing, crimping, special optical coatings and welding.

8.6 Evaluation and verification phase

8.6.1 General

Depending on the results of the criticality analysis, the supplier shall perform either evaluation and verification phases, or a verification phase only for all critical processes. The choice between these two approaches shall take into account

— knowledge of the process, e.g. new process, new use or configuration extension; and

— extension of the application.

For confidential processes, the supplier shall prove that the process has been verified, e.g. by presenting a verification certificate from space agencies or other governmental organization that shall check the applicability of this verification.

NOTE Reference can be made to Table 1 for an explanation of the steps involved.

8.6.2 Evaluation phase

The evaluation shall consider the following as a minimum for each critical process:

— the limits of use;

— the values, determined by test samples or technology samples, of relevant parameters and their tolerances; and

— acceptance criteria.

When an evaluation is performed, an evaluation programme (available at PDR) shall be drawn up and implemented, and an evaluation report (available before CDR) shall be drawn up.

8.6.3 Verification phase

For each critical process, a verification programme shall be drawn up by the contractor and then implemented. The verification programme shall be defined in conformance with existing national agency standards of verification. This programme shall check or confirm that the processes satisfy the mission requirements with appropriate margins and that the parameters required for the product design are defined so as to obtain verification status. Verification status shall depend on the results obtained (verification report) and the review of corresponding documentation (available at CDR).

8.6.4 Approval phase

Provided that the requirements in 8.6.2 and 8.6.3 are satisfied, the processes then receive an approval identification in the declared processes list for the project.

If approval is not granted, the supplier in charge of the item shall

— select other processes; or

— propose a modified evaluation programme and resubmit for approval; or

— initiate a deviation procedure if the above actions fail to achieve positive results.

8.6.5 Deviation request

All processes not conforming to project requirements, whether at the end of criticality analysis or of evaluation and verification tests, shall form the subject of a duly justified deviation request, in accordance with ISO 27025.

8.7 Use of a process

8.7.1 Verification status of a process

The supplier shall confirm that all critical processes have been verified before being used in the manufacture of qualification or flight products. Any modification, change in condition or configuration of application can invalidate the use of the process and require additional verification testing.

8.7.2 Reverification of a process

Any prolonged stoppage in manufacturing, any major change of the facilities or procedures or any transfer of production to another entity can invalidate partially or completely the initial verification of a process.

When a process needs to be reverified, a request for approval shall be established and a reverification programme shall be implemented. The RFA format shall include the following information:

— identification details (e.g. when there is a change to the PID);

— characteristics or function;

— location and environment;

— reference of evaluation or verification programmes and reports;

— approval status.

8.7.3 Implementation of a process

Before implementation of a process, the supplier shall ensure that personnel are trained and that environment, means and documentation are adequate.

This verification shall ensure that

— the manufacturing and quality control tools associated with the process are adequate, calibrated and properly maintained and are used under appropriate environmental and cleanliness conditions; see 5.4;

— the personnel are properly trained and certified when applicable;

— the process's specifications, manufacturing and inspection procedures and workmanship standards including clear definition of manufacturing operations and clear acceptance criteria exist;

— visual acceptance criteria are photographically documented, if possible, at the appropriate work and inspection stations.

For planning of manufacturing, assembly and integration operation and inspection, see ISO 27025.

8.7.4 Traceability of processes

Traceability of processes shall be in accordance with ISO 27025.

8.7.5 Process non-conformances and alerts

Non-conformances and alerts shall be in accordance with ISO 27025.

8.7.6 Mandatory inspection points (MIPs)

MIPs shall be in accordance with ISO 27025.

8.7.7 Packaging, storage, removal from storage

The supplier shall define provisions for packaging, storage, and removal from storage for products or semi-finished products before and after implementation of processes.

Annex A
(informative)

Relationship between materials, mechanical parts, processes activities and programme phase

A.1 Feasibility phase — Phase A

In phase A, the materials, mechanical parts and processes product assurance tasks shall be carried out in order to

a) identify main programme constraints on materials, mechanical parts and processes;

b) define the policy;

c) plan the product assurance tasks for the project definition phase.

A.2 Preliminary definition phase — Phase B

In phase B, the materials, mechanical parts and processes product assurance tasks shall be carried out in order to

a) define or identify requirements;

b) identify main new items required and plan corresponding necessary actions for phase C;

c) plan the product assurance tasks for the detailed design, development, manufacturing, integration and test phase and prepare the materials, mechanical parts and processes plan as part of the PA plan;

d) support preliminary design review.

A.3 Detailed definition and production phase — Phase C or D

In phase C or D, the materials, mechanical parts and processes product assurance tasks shall be carried out in order to

a) identify materials, mechanical parts and processes;

b) issue preliminary lists;

c) identify critical items;

d) establish or review an RFA;

e) support mandatory inspection points identification;

f) establish evaluation programme, perform test or review test results;

g) establish validation, qualification, or verification programmes (e.g. perform tests or review test results);

h) support non-conformance processing (NRB, failure review board);

i) establish the as-designed lists;

j) support the critical design review;

k) support the qualification review;

l) establish the final as-designed (updated) lists;

m) support release of manufacture of flight hardware.

A.4 Utilization phase — Phase E

In phase E, the materials, mechanical parts and processes product assurance tasks shall be carried out in order to

a) support the series manufacturing of recurring products;

b) support the investigation of operational phase anomalies;

c) update the as-flown materials lists to incorporate the new materials that can have been added or changed as a result of NCR activities. In particular, the PMP lists should include the actual materials flown on manned and reusable spacecraft and their payloads.

Annex B
(informative)

Declared materials list — Document requirements definition

B.1 General considerations

This document requirements definition (DRD) defines the standard for establishing and managing the declared materials list (DML).

It recommends the format and defines the content within the framework of a project or a programme.

B.2 Applicability

This DRD establishes the data content requirement for the declared materials list.

This DRD does not define format, presentation or delivery requirements for the DML. Format is provided as an example only.

B.3 Description and purposes

The purpose of the DML is to have a detailed record of all the materials used to produce the products of a project or programme.

The data in the DML shall make it possible to assess whether the materials are suitable for a specific application, at the supplier and the customer levels (in the approval status column).

The DRD defines the content of a standardized DML.

B.4 Application and interrelationship

The DML is prepared for each “configuration item” at the relevant stages (e.g. at the start, PDR, CDR and QRR) as defined in the flow chart given in Figures 1 and 2.

The following documents are linked to the DML:

— declared processes list (DPL);

— request for approval (RFA) materials.

B.5 DML preliminary elements

B.5.1 Title

This document shall be entitled [insert the configuration item name] “declared materials list”.

Example: Battery assembly declared materials list (DML), AOCS declared materials list (DML).

B.5.2 Title page

The title page of this document shall identify the project document identification number, title for the document, documents issue and (where relevant) revision status, date of release and release authority.

B.5.3 Change record

The change record shall list the successive issues and their release dates since the first formal issue of the document. This record shall include a brief description of the updates that contributed to each issue or revision.

B.5.4 Content list

The content list shall identify the title and location of every clause, major subclause, figure, table and annex contained in the document.

B.5.5 Foreword

A foreword shall be included in the document, which describes as many of the following items as appropriate:

— identification of the organization that prepared the document;

— information regarding the approval of the document;

— identification of other organizations that contributed to the preparation of the document;

— statement of effectiveness by identifying the documents that are cancelled and replaced in whole or in part;

— statement of significant technical differences between this document and any previous release;

— relationship of the document to other standards or documents.

B.5.6 Introduction

An introduction shall be included to provide specific information or commentary about the technical content.

B.6 Content

B.6.1 Scope and applicability

This clause shall be numbered “1” and shall describe the scope, applicability and purpose of the DML.

B.6.1.1 Scope

This subclause shall be numbered “1.1” and shall contain the following statement:

> “This DML contains all the materials.”

or

> “This DML contains all the materials and mechanical parts intended for use in the flight [insert the configuration item name]. It reflects the current design at the time of issue.”

B.6.1.2 Applicability

This subclause shall be numbered “1.2” and shall contain the following statements:

> “This DML provides a listing of all the materials (and mechanical parts) for review and evaluation for PDR, CDR or QRR (as appropriate). In addition, it is an input to internal or customer review.”

B.6.2 References

This clause shall be numbered “2”.

B.6.2.1 Normative references

This subclause shall be numbered “2.1” and shall contain the following statements:

> “This document incorporates, by dated or undated reference, provisions from other publications. These normative references are cited at appropriate places in the text and publications are listed hereafter. For dated references, subsequent amendments to or revisions of any of these apply to this document only when incorporated into it by amendment or revision. For undated references, the latest edition of the publication referred to applies.
>
> [insert document identifier] [insert document title].”

NOTE Typically, the reference documents are the product assurance requirements, the material mechanical part and processes requirements and lower-level DMLs.

B.6.2.2 Informative references

This subclause shall be numbered “2.2” and shall contain the following statements:

> “The following documents, although not a part of this DML, amplify or classify its contents:
>
> [insert document identifier] [insert document title].”

B.6.3 Definitions and abbreviations

This clause shall be numbered “3” and shall contain the following subclauses.

B.6.3.1 Definitions

This subclause shall be numbered “3.1” and shall list any applicable project dictionary or glossary, and all unusual terms or terms with a meaning specific to the DML with a definition for each term.

If a project dictionary or glossary is applicable, insert the following sentence:

> “The definitions of [insert title and identifier of applicable dictionaries or glossaries] apply to this document.”

And/or insert the following sentence:

> “The following terms and definitions are specific to this document:
>
> [insert term] [insert definition].”

B.6.3.2 Abbreviations

This subclause shall be numbered “3.2” and shall list all abbreviations used in the DML with a fully spelled-out meaning or phrase for each abbreviation.

B.6.4 Declared materials list

This clause shall be numbered “4” and shall contain the following information:

a) Materials groups:

1) This clause shall contain the following statements:

— “Materials are classified into 20 groups depending on their type or their main use; see Table B.1.”

— “Primers are classified in the group of their associated component.”

— “Where no project requirement exists for a separate DMPL, mechanical parts are entered on the DML as a separate group with the corresponding numbers.”

2) If new groups are created, for a given project, these shall have numbers over 21.

Table B.1 — Material group numbers

Group number	Description
1	Aluminium and aluminium alloys
2	Copper and copper alloys
3	Nickel and nickel alloys
4	Titanium and titanium alloys
5	Steels
6	Stainless steels
7	Filler metals: welding, brazing soldering
8	Miscellaneous metallic materials
9	Optical materials
10	Adhesives, coatings, varnishes
11	Adhesive tapes
12	Paints and inks
13	Lubricants
14	Potting compounds, sealants, foams
15	Reinforced plastics [including printed circuit boards (PCBs)]
16	Rubbers and elastomers
17	Thermoplastics (e.g. non-adhesive tapes and foils [MLI])
18	Thermoset plastics (including PCBs)
19	Material aspects of wires and cables
20	Miscellaneous non-metallic materials, e.g. ceramics

b) Contents of the DML

This subclause refers to the information which shall be included in the DML (see Table B.4).

The header information identifies the list as the declared materials list and includes the issue number and date of issue. It may include the relevant CI number (configuration item number as per project definition). The materials group number may also be included here.

The numbers below refer to the column numbers in Table B.4.

1) Item number

This consists of the material group identifier and the user code. It takes the form of: <group number>.<identifier within the group>.<running number>.<user code>

EXAMPLE 1 11.5.1.KOF.

Characteristics of the item number are the following.

— The user shall be identified by an agreed user code for the project.

— There is only one per item number per material type.

— The item number does not change during the life of the materials list (sub-items are permitted when deemed necessary).

2) Commercial identification or standardized designation

The correct and standard designation shall be entered such as the trade name plus number.

EXAMPLE 2 ARALDITE AY 105.

If no trade name exists, then the manufacturer's name plus number shall be entered.

EXAMPLE 3 SCHOTT BK7.

For metal alloys, the Aluminum Association (AA) system is recommended for aluminium alloys, and the American Iron and Steel Institute (AISI) system for steel. For other metals or alloys, the main constituent is entered first except in the case of a traditional name (e.g. brass or bronze).

For each material, as designated above, a unique item number shall be given. If several lines are used for different applications or processing, sub-item numbers shall be added.

3) Chemical nature and product type

EXAMPLE 4 Epoxy resin, polyurethane adhesive, Ti6Al4V.

For metallic materials, the condition as procured (e.g. rolled and heat treatment) shall be added, if applicable. Where a semi-finished product is procured, the relevant state (e.g. form, plate and sheet) shall be given.

The thickness of the material can be an important parameter (e.g. the impact on flammability, SCC and heat treatment) and shall be given.

4) Procurement information

The name of the manufacturer and name of the distributor shall be given, if different.

The reference of the procurement specification with issue, revision and date shall be given. It may be replaced by a national or international specification or standard, if this exists, and identifies the source of procurement, if relevant. Indication of issue or date is not applicable when datasheets are used in accordance with 7.6.1.

5) Processing parameters

A summary of the process parameters applied by the user of the process shall be listed, e.g. mixture proportions, cure temperature, special cleaning agent, surface treatment, thermal treatment and temperature, and reference to specification number.

6) Use and location

The codes entered shall define the location of the material with respect to

— the subsystem;

— the particular piece of equipment (box or item);

— the use of the equipment, e.g. a structural element, thermal control, electrical insulation.

If the CI number is not included in the list header, then a suitable abbreviation of the relevant subsystem is included.

Any restrictions that apply to the use of a particular material shall be included in the corresponding comment column.

7) Environmental code

The environmental code is defined in accordance with Table B.2.

Table B.2 — Environmental code

Environmental code			
Radiation/UV/ATOX (R)[a]		**Ambience (A)**	**Temperature (T)**[b,c]
G: Geostationary	S: Outside shadow	V: Vacuum	1: 0 to 100 K
L: Low orbit	L: Outside light	H: Hermetic	2: 101 to 200 K
B: Radiation belt		M: Manned	3: 201 to 300 K
I: Interplanetary		E: Elevated pressure	…
P: Planetary			

[a] For all materials, a letter is selected from the left-hand column. For materials on the surface of the spacecraft, the letter “L” or “S” is added.

[b] Thermal cycling to be indicated by two values, e.g. 3/5.

[c] “RT” (room temperature) can be accepted as a code between 283 K (10 °C) and 313 K (40 °C). Materials that are at a boundary between environments shall be described by two sets of codes.

8) Size code

The size code is indicated by an alphanumeric combination, such as A5, V2 or M3 as shown in Table B.3.

Table B.3 — Size code

Size code	Value
0	$0 < A$ or V or $M \leq 1$
1	$1 < A$ or V or $M \leq 10$
2	$10 < A$ or V or $M \leq 100$
3	$100 < A$ or V or $M \leq 1\ 000$
4	...
where A is the area, expressed in square centimetres; V is the volume, expressed in cubic centimetres; M is the mass, expressed in grams.	

9) Validation references, justification for approval and prime comments

Reference shall be made to relevant test data that demonstrate the acceptability of the material under the environmental conditions and the application relevant to the particular project concerned. Specifically, in column 9.1, corrosion (CORR), stress corrosion (SCC), flammability (FLAM), offgassing (OFFG) and outgassing (OUTG) data or report references are entered.

Standard abbreviations shall be used to summarize the acceptance status of a material for a particular property.

Column 9.2 is the justification for approval.

Table B.4 — Example of a realized DML

Declared materials list DML									
Programme name: *ABCDEFG*				CI no.: 12345676890 Group (Title): *abcdefg*		Doc no.: 001 Issue/Revision: 1/4		Date: 01.10.2000 Page: 1	
1	2	3	4	5	6	7	8	9	
								9.1	9.2
Item no. and user code	Commercial identification or standardized designation	1) Chemical nature 2) Product type	1) Manufacturer/ supplier name 2) Procurement spec. Issue/RevDate	1) Summary of process parameters 2) Applicable process identification	1) Subsystem 2) Equipment 3) Use	1) R 2) A 3) T	1) A 2) V 3) M	Acronym/rating/Validation Ref. for applicable properties	1) Justification for approval 2) Prime comments
1.2.1.TXES	AZ5GU	1) Al.Zn5.6 Mg2.5 Cdu1.6, Cr0.3 eq. AA7075 2) Plate	1) Almet Pechiney 2) CRB 527 01/02/ 01.02.1996	1) T7351 and Iridit 14 heat treatment 2)	1) PL 2) E4 package 3) Structure	1) LS 2) V 3) 3	1) 2) 3) M3	—	1) Used on ETS2 2)
10.1.1.ETCA	DC93500	1) Silicon 2) Two parts	1) Dow Corning 2) E3846MC10S 02/02/1984	1) Mixture: 10/1 in g Curing: 4h/65 °C 2)	1) PCU 2) Experiment tray 3) Part potting	1) G 2) V 3) 3-4	1) 2) 3) M3	—	1) ECSS–Q-70–01 2)
11.5.1.KOF	ECCOFOAM EPH	1) Poly-urethane 2) Resin/ Catalyst 1202H	1) Emerson and Cuming 2) SP/FOK/05/684 03/01/ 25.06.1992	1) Resin/Cat: 100/65g 4h/40 °C +48h/100 °C 2)	1) GP 2) Platform 3) Package potting	1) LS 2) M 3) 3-4	1) 2) V3 3)	—	1) DU–96–352 2) Used at T > 100 °C (Risk of distortion beyond)

Annex C
(informative)

Declared mechanical parts list — Document requirements definition

C.1 General considerations

This document requirements definition (DRD) defines the standard for establishing and managing the declared mechanical parts list (DMPL).

It recommends the format, and defines the content within the framework of a project or a programme.

C.2 Applicability

This DRD establishes the data content requirement for the DMPL. This DRD does not define format, presentation or delivery requirements for the DMPL. Format is provided as an example only.

C.3 Description and purposes

The purpose of the DMPL is to have a detailed record of all the mechanical parts used to produce the products of a project or programme.

The data in the DMPL shall make it possible to assess whether the mechanical parts are suitable for a specific application, at the supplier and customer levels (in the approval status column).

The DRD defines the content of a standardized DMPL.

C.4 Application and interrelationship

The DMPL is prepared for each “configuration item” at the relevant stages (e.g. start, PDR, CDR and QRR) as defined in the flow chart given in Figures 1 and 2.

The request for approval (RFA) mechanical parts is a document linked to the DMPL.

C.5 DMPL preliminary elements

C.5.1 Title

This document shall be titled:

[insert the configuration item name] “declared mechanical parts list”.

EXAMPLE 1 Battery assembly declared mechanical parts list (DMPL).

EXAMPLE 2 AOCS declared mechanical parts list (DMPL).

C.5.2 Title page

The title page of this document shall identify the project document identification number, title for the document, documents issue and (where relevant) revision status, date of release and release authority.

C.5.3 Change record

The change record shall list the successive issues and their release dates since the first formal issue of the document. This record shall include a brief description of the updates that contributed to each issue or revision.

C.5.4 Content list

The content list shall identify the title and location of every clause, major subclause, figure, table and annex contained in the document.

C.5.5 Foreword

A foreword shall be included in the document that describes as many of the following items as appropriate:

— identification of the organization that prepared the document;

— information regarding the approval of the document;

— identification of other organizations that contributed to the preparation of the document;

— information regarding the status and wider implications of the document, identifying the documents that are cancelled and replaced in whole or in part;

— statement of significant technical differences between this document and any previous release;

— relationship of the document to other standards or documents.

C.5.6 Introduction

An introduction shall be included to provide specific information or commentary about the technical content.

C.6 Content

C.6.1 Scope and applicability

This clause shall be numbered “1” and shall describe the scope, applicability and purpose of the DMPL.

C.6.1.1 Scope

This subclause shall be numbered “1.1” and shall contain the following statement:

> “This DMPL contains all the mechanical parts intended for use in the flight [insert the configuration item name]. It reflects the current design at the time of issue.”

C.6.1.2 Applicability

This subclause shall be numbered “1.2” and shall contain the following statements:

> “This DMPL provides a listing of all the mechanical parts for review and evaluation for PDR, CDR or QRR (as appropriate). In addition, it is an input to internal or customer review.”

C.6.2 References

This clause shall be numbered “2”.

C.6.2.1 Normative references

This subclause shall be numbered “2.1” and shall contain the following statements:

> “This document incorporates, by dated or undated reference, provisions from other publications. These normative references are cited at appropriate places in the text and publications are listed hereafter. For dated references, subsequent amendments to or revisions of any of these apply to this document only when incorporated into it by amendment or revision. For undated references, the latest edition of the publication referred to applies.
>
> [insert document identifier] [insert document title].”

NOTE Typically, the reference documents are the product assurance requirements, the material mechanical part and processes requirements and lower-level DMPLs.

C.6.2.2 Informative references

This subclause shall be numbered “2.2” and shall contain the following statements:

> “The following documents, although not a part of this DMPL, amplify or classify its contents:
>
> [insert document identifier] [insert document title].”

C.6.3 Definitions and abbreviations

This clause shall be numbered “3” and shall contain the following subclauses.

C.6.3.1 Definitions

This subclause shall be numbered “3.1” and shall list any applicable project dictionary or glossary, and all unusual terms or terms with a meaning specific to the DMPL with a definition for each term.

If a project dictionary or glossary is applicable, insert the following sentence:

> “The definitions of [insert title and identifier of applicable dictionaries or glossaries] apply to this document.”

And/or insert the following sentence:

> “The following terms and definitions are specific to this document:
>
> [insert term] [insert definition].”

C.6.3.2 Abbreviations

This subclause shall be numbered “3.2” and shall list all abbreviations used in the DMPL with a fully spelled-out meaning or phrase for each abbreviation.

C.6.4 Declared mechanical parts lists

This clause shall be numbered “4” and shall be established as follows:

a) Mechanical parts groups

1) This clause shall contain the following statements:

— “Mechanical parts are classified into 11 groups depending on their type or their main use” (see Table C.1).

— If, for a given project, it is considered necessary to create new groups, these shall have numbers over 61.

— Items that appear in the EEE parts list should not be repeated here.

EXAMPLE 1 Heaters, some valves, thermostats, relays, transformer coils and solenoids.

Table C.1 — Mechanical part group numbers

Group number	Description
51	Spacing parts (e.g. washers and spacers)
52	Connecting parts (e.g. bolts, nuts, rivets, inserts and clips)
53	Bearing parts (e.g. ball-bearings and needle bearings)
54	Separating parts (e.g. pyrotechnics, springs and cutters)
55	Control parts (e.g. gears)
56	Fluid handling parts (e.g. diffusers)
57	Heating parts
58	Measuring instruments (e.g. gauges and thermocouples)
59	Optical passive equipment
60	Magnetic parts
61	Other parts

b) Contents of the DMPL

This subclause refers to the information that shall be included in the DMPL (see Table C.3).

The header information identifies the list as the declared materials list and includes the issue number and date of issue. It may include the relevant CI number (configuration item number as per project definition). The materials group number may also be included here.

The numbers below refer to the column numbers in Table C.3.

1) Item number

This consists of the mechanical part identifier and the user code. It takes the form of <group number>.<identifier within the group>.<running number>.<user code>

EXAMPLE 2 7.2.1.ACSA.

Characteristics of the item number are the following.

— The subcontractor shall be identified by an agreed user code for the project.

— There is only one item number per mechanical part type.

— The item number does not change during the life of the mechanical parts list.

2) Commercial identification

The correct and standard designation shall be entered such as the trade name plus number. If no trade name exists, then the manufacturer's name and number shall be entered.

3) Type of part

Material and surface treatment (if applicable) shall be described.

4) Procurement information

Name of the manufacturer and name of the distributor shall be given if different.

Reference of the procurement specification with issue, revision and date shall be given. It may be replaced by a national or international specification or standard if this exists and identifies the source of procurement if relevant.

5) Elementary function, main characteristics

The function of the mechanical part shall be entered.

The main characteristics of the mechanical part shall be entered.

EXAMPLE 3 Number of revolutions per minute for a ball-bearing.

6) Use and location

The codes entered shall define the location of the mechanical part with respect to

— the subsystem;

— the particular piece of equipment (box or item);

— the use of the equipment.

7) Environmental code

The environmental code is defined in accordance with Table C.2.

Table C.2 — Environmental code

Environmental code			
Radiation/UV/ATOX (R)[a]		**Ambience (A)**	**Temperature (T)**[b,c]
G: Geostationary	S: Outside shadow	V: Vacuum	1: 0 to 100 K
L: Low orbit	L: Outside light	H: Hermetic	2: 101 to 200 K
B: Radiation belt		M: Manned	3: 201 to 300 K
I: Interplanetary		E: Elevated pressure	1/4
P: Planetary			

[a] For all mechanical parts, a letter is selected from the left-hand column. For mechanical parts on the surface of the spacecraft, the letter "L" or "S" is added.

[b] Thermal cycling to be indicated by two values, e.g. 3/5.

[c] "RT" (room temperature) can be accepted as a code between 283 K (10 °C) and 313 K (40 °C).

8) Criticality

Enter "C" for critical or "N" for non-critical. If a mechanical part is considered critical, the reason for the criticality and methods of control shall be entered.

9) Supplier reference and prime comments

The supplier reference and prime comments shall be used to enter any additional information that can be necessary in order to obtain customer approval.

This information comprises reference and issue of the RFA or approval, mechanical parts justification file, evaluation reports and deviation requests.

Reference shall be made to the relevant test data that demonstrate acceptability of the mechanical part under the environment conditions and the application relevant to the particular project concerned.

Standard abbreviations shall be used to summarize the acceptance status of a mechanical part for a particular property. These shall be defined by the customer.

In order to justify the use of a material for flammability resistance, the material thickness and height of oxygen share shall be listed.

Table C.3 — Example of realized DMPL

Declared mechanical parts list DMPL									
Programme name: *ABCDEFG*			CI no.: 12345676890 Group (Title): *abcdefg*	Doc no.: 001 Issue/Revision: 1/4		Date: 01.10.2000 Page: 1			
1	2	3	4	5	6	7	8	9	
								9.1	9.2
Item no. and user code	Commercial identification	Type of part	1) Procurement specification 2) Issue/Revision/Date	1) Elementary function 2) Main characteristics	1) Subsystem 2) Equipment 3) Use	1) R 2) A 3) T	1) Criticality 2) Reason and method of control	Supplier reference	Prime comments
51.2.1.A CSA	ESA003521000 120	Copper/AL bimetal ring	1) AIEV 2) From catalogue	1) Separator ring 2) Heat conductor	1) TC 2) Plate interface 3) Spacing and heat inspection	1) G 2) V 3) 3-4	1) N 2)	Used on all projects	—
52.2.1.A SAD	A0090TX...XA	Ti6Al4V screws > M4	1) White area 2) ASNA0090 DSN2413	1) Assembly 2)	1) PTANK 2) plate 3) fixing	1) G 2) V 3) 3-4	1) N 2)	Used on TC2	—
60.1.1.A CSA	42908TC/F	Ferrite cores magnetic	1) Magnetics, Data sheet 2) SP/MAGN/003 01.02/03.06.1999	1) Coil core of transformer 2) Magnetic component	1) TC 2) South face 3) Heat regulation	1) G 2) V 3) 3-4	1) °C 2) to be qualified	—	—

Annex D
(informative)

Declared processes list — Document requirements definition

D.1 General considerations

This document requirements definition (DRD) defines the standard for establishing and managing the declared processes list (DPL).

It recommends the format, and defines the content within the framework of a project or a programme.

D.2 Applicability

This DRD establishes the data content requirement for the DPL.

This DRD does not define format, presentation or delivery requirements for the DPL. The format is provided as an example only.

D.3 Description and purposes

The purpose of the DPL is to have a detailed record of all the processes used to produce the products of a project or programme.

The data in the DPL shall make it possible to assess whether the processes are suitable for a specific application, at the supplier and customer levels (in the approval status column).

The DRD defines the content of a standardized DPL.

D.4 Application and interrelationship

The DPL is prepared for each “configuration item” at the relevant stages (e.g. start, PDR, CDR and QRR) as defined in the flow chart given in Figures 1 and 2.

The following documents are linked to the DPL:

— declared materials list (DML);

— request for approval (RFA) processes.

D.5 DPL preliminary elements

D.5.1 Title

This document shall be titled:

[insert the configuration item name] “declared processes list”.

EXAMPLE 1 Battery assembly declared processes list (DPL).

EXAMPLE 2 AOCS DPL.

D.5.2 Title page

The title page of this document shall identify the project document identification number, title for the document, document issue and (when applicable) revision status, date of release and release authority.

D.5.3 Change record

The change record shall list the successive issues and their release dates since the first formal issue of the document. This record shall include a brief description of the updates which contributed to each issue or revision.

D.5.4 Content list

The content list shall identify the title and location of every clause, major subclause, figure, table and annex contained in the document.

D.5.5 Foreword

A foreword shall be included in the document that describes as many of the following items as appropriate:

— identification of the organization that prepared the document;

— information regarding the approval of the document;

— identification of other organizations that contributed to the preparation of the document;

— information regarding the status and wider implications of the document, identifying the documents that are cancelled and replaced in whole or in part;

— statement of significant technical differences between this document and any previous release;

— relationship of the document to other standards or documents.

D.5.6 Introduction

An introduction shall be included to provide specific information or commentary about the technical content.

D.6 Content

D.6.1 Scope and applicability

This clause shall be numbered “1” and shall describe the scope, applicability and purpose of the DPL.

D.6.1.1 Scope

This subclause shall be numbered “1.1” and shall contain the following statement:

> “This DPL contains all the processes intended for use in the flight [insert the configuration item name]. It reflects the current design at the time of issue.”

D.6.1.2 Applicability

This subclause shall be numbered “1.2” and shall contain the following statements:

> “This DPL provides a listing of all the processes for review and evaluation for PDR/CDR/QRR (as appropriate). In addition, it is an input to internal or customer review.”

D.6.2 References

This clause shall be numbered “2”.

D.6.2.1 Normative references

This subclause shall be numbered “2.1” and shall contain the following statements:

> “This document incorporates, by dated or undated reference, provisions from other publications. These normative references are cited at appropriate places in the text and publications are listed hereafter. For dated references, subsequent amendments to or revisions of any of these apply to this document only when incorporated into it by amendment or revision. For undated references, the latest edition of the publication referred to applies.
>
> [insert document identifier] [insert document title].”

NOTE Typically, the reference documents are the product assurance requirements, the material mechanical part and process requirements and lower-level DPLs.

D.6.2.2 Informative references

This subclause shall be numbered “2.2” and shall contain the following statements:

> “The following documents, although not a part of this DPL, amplify or classify its contents:
>
> [insert document identifier] [insert document title].”

D.6.3 Definitions and abbreviations

This clause shall be numbered “3” and shall contain the following subclauses.

D.6.3.1 Definitions

This subclause shall be numbered “3.1” and shall list any applicable project dictionary or glossary, and all unusual terms or terms with a meaning specific to the DPL with a definition for each term.

If a project dictionary or glossary is applicable, insert the following sentence:

> “The definitions of [insert title and identifier of applicable dictionaries or glossaries] apply to this document.”

And/or insert the following sentence:

> “The following terms and definitions are specific to this document:
>
> [insert term] [insert definition].”

D.6.3.2 Abbreviations

This subclause shall be numbered “3.2” and shall list all abbreviations used in the DPL with a fully spelled-out meaning or phrase for each abbreviation.

D.6.4 Declared processes list

This clause shall be numbered “4” and shall be established as follows:

a) Process groups

1) This clause shall contain the following statements.

— Processes are classified into 17 groups depending on their type or their main use; see Table D.1.

— If, for a given project, it is considered necessary to create new groups, these shall have numbers over 17.

Table D.1 — Process group numbers

Group number	Description
1	Adhesive bonding
2	Composite manufacture
3	Encapsulation/moulding
4	Painting/coating
5	Cleaning
6	Welding/brazing
7	Crimping/stripping/wire wrapping
8	Soldering
9	Surface treatments
10	Plating
11	Machining
12	Forming
13	Heat treatment
14	Special fabrication: processes developed specifically for the programme
15	Marking
16	Miscellaneous processes
17	Inspection procedures

b) Contents of the DPL

This subclause refers to the information which shall be included in the DPL (see Table D.2).

The header information identifies the list as the declared materials list and includes the issue number and date of issue. It may include the relevant CI number (configuration item number as per project definition). The materials group number may also be included here.

The numbers below refer to the column numbers in Table D.2.

1) Item number

This consists of the process identifier and the user code. It takes the form of <group number>.<identifier within the group>.<running number>.<user code>

EXAMPLE 1.2.1.SSEX.

Characteristics of the item number are the following.

— The subcontractor shall be identified by an agreed user code for the project.

— There is only one item number per process type.

— The item number does not change during the life of the process list.

2) Process identification

The correct and standard identification of the process shall be indicated, e.g. the process name or title: bonding, coating or soldering.

3) Specification

The name or abbreviation of the process executor shall be identified.

A reference shall be made to the associated procedure, e.g. national, international, EN, ISO, ECSS or company in-house, together with the issue, revision and date.

4) Process description

A short description of the process shall be entered.

5) Use and location

The codes entered shall define the location of the process with respect to

— the subsystem,

— the particular piece of equipment (box or item),

— the use of the equipment (e.g. a structural element, thermal control, electrical insulation).

6) (This column number is not used.)

7) Associated item numbers

The associated material list (DML) or mechanical parts list (DMPL) with the process shall be entered.

8) Criticality

Enter “C” for critical or “N” for non-critical.

If a process is considered to be critical, references to the relevant RFA shall be entered.

9) Supplier reference and prime comments

The supplier reference and approval columns shall be used to enter any additional information that can be necessary to obtain customer approval.

Table D.2 — Example of realized DPL

Declared processes list DPL								
Programme name: *ABCDEFG*		**CI no.: 1234567890** **Group (Title): *abcdefg***	**Doc no.: 001** **Issue/Revision: 1/5**	**Date: 14.05.2000** **Page: 1**				
1	**2**	**3**	**4**	**5**	**7**	**8**	**9**	
							9.1	**9.2**
Item no. and user code	Process identification	1) User name 2) Associated procedure issue/revision/date	Process description	1) Subsystem code 2) Equipment code 3) Use	Associated DML or DMPL item number	1) Criticality 2) Reason for criticality	Supplier reference	Prime comments
1.2.1.SSEX	Bonding	1) EREMS 2) E/SQ/PI/012 02/01/02.08.1984	Applying a spot of glue with a stainless steel dispenser	1) BE3 2) C5 board 3) To fix parts	6.1.2.ETC	1) N 2)	Used on ANTARES	—
4.3.1.KOF	Coating	1) CERCO 2) E/SQ/PI/023 02/01/08.12.1985	Coating by paintbrush or by immersion in the resin	1) BE3 2) C1 C2 boards 3) Protection of CI and EEE parts	2.1.1.KOF	1) N 2)	Used on PASTEC, ANTARES	—
8.3.1.KOF	Vapour phase soldering of SMDs	1) EREMS 2) E/SQ/PI/026 01/02/09.09.1997	ECSS-Q-70-38	1) BE3 2) C3 3)	15.1.1.AST	1) C 2)	QM/04L123/ BD/MH Table 1	—

Annex E
(informative)

Request for approval (RFA) — Document requirements definition

E.1 General considerations

This document requirements definition (DRD) defines the standard for establishing and managing a request for approval (RFA).

It recommends the format, and defines the content within the framework of a project or a programme.

E.2 Applicability

This DRD establishes the data content requirement for a request for approval.

This DRD does not define format, presentation or delivery requirements for the RFA. Format is provided as an example only.

E.3 Description and purposes

The objective of an RFA is to enable the supplier to request from the customer permission to use a critical mechanical part, material or process.

The information provided by the supplier shall make it possible for the customer to assess whether the critical mechanical part, material or process is suitable for a specific application.

E.4 Application and interrelationship

The RFA is prepared for each critical mechanical part, material or process at the relevant stages as defined in the flow chart given in Figures 1 and 2.

The following documents are linked to the RFA:

— declared mechanical parts list;

— declared materials list;

— declared processes list.

E.5 Content of the RFA

The RFA shall be completed by the supplier (items 1 to 10, 13 and 14) and the customer (items 11, 12 and 15) as described below. Refer to Figures E.1 and E.2 for an example RFA.

1) the header information, which shall identify the document as a request for approval together with the project logo and project name, RFA reference, issue revision and date;

2) originator's name and reference;

3) location of subsystem and equipment codes;

4) brief description of the item;

5) PMP information, including the DML, DMPL or DPL item number and list reference;

6) item status shall be entered for

   — manufacturer's name and qualification reference,

   — supplier's name and qualification status,

   — product or material specification,

   — procurement specification,

   — process or handling specification,

   — other related process or handling specifications,

   — verification or qualification specification,

   — report on verification or qualification;

7) reason for the RFA shall be entered;

8) application and exact location of the item shall be entered here; the reference in the CIL shall be given;

9) evaluation and validation programme, including reference and details of main tests;

10) subcontractor supplier approval for the first issue of the RFA;

11) customer initial decision shall be entered on first issue of the RFA providing

   — the decision concerning the proposed material,

   — the requirement to perform tests (deviation request as necessary),

   — the decision concerning the proposed test programme;

12) customer's and final customer's (if applicable) signature;

13) justification results obtained with reference to the supplier's validation report and conclusion;

14) subcontractor supplier approval on RFA final issue;

15) final approval status at all the levels of the final issue of the RFA by the customer and final customer (if defined in the contract).

1	**Company:**	**Project:**	**Reference: RFA-**							Page 1 of 2		
			Issue									
			Revision									
			Date									

Request for approval (RFA)

2	Originator: Originator reference:	**3**	Subsystem: Equipment:
4	Item description:	**5**	PMP list item number: PMP list reference:

6	**Item status**	
Manufacturer:		Manufacturer qualification reference:
Supplier:		Qualification status:
Product/material specification:		Procurement specification:
Process/handling specification:		Related specification:
Verification/qualification specification:		Report:
7	**Reason for RFA**	
8	Application/location details:	CIL reference:
9	**Evaluation/validation programme (title, reference)**	

Tests

Plan, procedures, schedule to be attached

Figure E.1 — Example of an RFA (Page 1 of 2)

1	**Company:**	**Project:**	**Reference: RFA-**							Page 2 of 2		
			Issue									
			Revision									
			Date									
Request for approval (RFA)												
10		**Materials and processes responsible**	**PA responsible**	**Project responsible**								
	Supplier approval on RFA first issue											
11	Decision on RFA first issue: - Request refused: - Submit deviation: - Proceed with validation programme:		Comments:									
12	**Decision**	**Materials and processes responsible**	**PA responsible**	**Project responsible**								
	Customer agree/disagree											
	Final customer (if applicable) agree/disagree											
13	**Justification results** Validation report (title and reference) Conclusion: **Validation report to be attached**											
14	Supplier approval on RFA final issue	**Materials and processes responsible**	**PA responsible**	**Project responsible**								
15	Decision on RFA final issue	**Materials and processes responsible**	**PA responsible**	**Project responsible**								
	Customer agree/disagree											
	Final customer (if defined in the contract) agree/disagree											

Figure E.2 — Example of an RFA (Page 2 of 2)

Bibliography

[1] ISO 9001, *Quality management systems — Requirements*

[2] ISO 9004, *Managing for the sustained success of an organization — A quality management approach*

[3] ISO 14300-1, *Space systems — Programme management — Part 1: Structuring of a project*

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