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Space systems — Configuration management

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Foreword

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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).

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For an explanation of 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 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*.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Introduction

The space system is a complex system and needs configuration management to ensure its success. Configuration management establishes and maintains a consistent record of a product's functional and physical characteristics compared to its design and operational requirements in order to allow personnel that are involved to know, at any time, the technical description of a product using approved documentation, and the operational possibilities and limitations of each product time.

Space systems — Configuration management

1 Scope

This document defines the contents, methods and requirements of configuration management for space projects, and the responsibilities and authorities of related parties. It can be used together with ISO 14300-1:2011, Clause 10.

This document is applicable to the configuration management of space projects from the mission analysis phase to the disposal phase.

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

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

ISO 10007, *Quality management — Guidelines for configuration management*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 14300-1, ISO 10007 and ISO 10795 and the following apply.

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

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

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

3.1
configuration
interrelated functional and physical characteristics of a product or service defined in configuration information

3.1.1
functional characteristic
performance parameter and design constraint to be realized or required, including operational and logistic parameters and their respective tolerances

Note 1 to entry: Functional characteristics include all performance parameters such as range, speed, lethality, reliability, maintainability and safety.

3.1.2
physical characteristic
quantitative and qualitative expression of a product and its tolerance

EXAMPLE Mechanical, electrical, chemical or biological characteristic.

3.2
configuration management
activity for establishing and maintaining consistent records of the status of and changes to the performance parameters of a product and its functional and physical attributes compared to the product design and operational requirements

Note 1 to entry: Configuration management is applied throughout the entire life of the product (i.e. development, production, deployment, operation and disposal).

3.3
configuration item
aggregation of hardware, software, processed materials, services or any of its discrete portions, that is designated for configuration management and treated as a single entity in the *configuration management* (3.2) process

Note 1 to entry: A configuration item can contain other configuration item(s).

3.4
configuration document
document that defines the requirements for the function, design, build, production and verification for a *configuration item* (3.3)

Note 1 to entry: For space systems, configuration documents can include documents relating to the operation and disposal of the configuration item.

3.5
configuration baseline
approved status of requirements and design of a product at a project key milestone that serves as the reference for activities throughout the life cycle of the product

3.6
change control
activity for controlling the changes or deviation/waiver to the product after the formal approval of its *configuration baseline* (3.5)

3.7
change
official numerically issued alterations to a document or any portion thereof, usually brought about by changed conditions or more complete information

Note 1 to entry: "Class 1" (Major) are changes that impact the contractual/technical agreement reached between the project and its customer. It is necessary that such changes be submitted to the customer for review and approval before implementation.

Note 2 to entry: "Class 2" (Minor) are changes that do not impact the customer contract and that are necessary for the project and its supply chain to meet the technical/contractual requirements and provisions. Such changes can be implemented after configuration control board (CCB) approval.

4 General

4.1 Configuration management establishes and maintains a consistent record of product functional and physical characteristics compared to its design and operational requirements. Configuration management shall be applied throughout the entire life cycle of the product and improved as the project develops.

4.2 Establish the CCB consisting of representatives of related fields on the basis of the complexity of the configuration item and its position in the project breakdown structure. The CCB consists of permanent representatives of all programme or project disciplines necessary for the review and evaluation of changes. The members of the CCB are with the decision-making authority.

4.3 Each supplier produces a configuration management plan (CM plan) responding to the customer's configuration management requirements. The CM plan shall specify the objectives, missions, responsibilities and requirements of each phase during the entire life cycle and make necessary revisions according to the specific circumstances as the project develops.

4.4 Configuration management interfaces with engineering, product assurance, manufacturing and production and contributes to the programme or project organization and their schedule for execution by identifying all constraints related to the business agreement provisions.

5 Configuration management planning

5.1 General

Configuration management planning is aimed at-specific configuration items. Effective configuration management planning coordinates configuration management activities in a specific context over the product life cycle and shall be performed at the initial phase of the project.

Configuration management planning shall:

a) ensure the configuration management process can comprehensively and accurately record and control the evolution of product configuration;

b) ensure the participating personnel know the correct configuration documents of a product at any time;

c) ensure the configuration documents used are complete, correct, controlled and approved;

d) ensure the traceability of the configuration evolution;

e) ensure the consistency of internal and external interfaces of a product;

f) ensure the consistency of the configuration of the inspected product and requirements of the technical documents.

5.2 Configuration management plan

5.2.1 Configuration management plan is a document specifying the organization and its responsibilities, the procedure, resources and means to implement configuration management. The output of configuration management planning is a configuration management plan. The configuration management plan prepared by the supplier shall be submitted to the customer for approval in response to a requirement from customer.

5.2.2 For a configuration item, the configuration management plan shall:

a) meet the requirements of the contract;

b) establish the overall objective and phase objectives for the implementation of configuration management;

c) specify the responsibilities and authorities for the implementation of configuration management;

d) establish the procedure and means to implement configuration management;

e) comply with the configuration requirements defined by the customer;

f) clarify the interface control requirements;

g) ensure that the process of the configuration management is under control.

5.2.3 Annex A provides the structure and basic contents of the configuration management plan.

5.3 Configuration management interfaces

Configuration management is an integral part of project management. Configuration management processes shall interface with engineering management, product assurance, product manufacturing and information/documentation management. For the definition and phasing of configuration management activities, configuration management should also take into account the contractual provision and schedule.

6 Configuration identification

6.1 General

Configuration identification incrementally establishes and releases controlled documentation for the purpose of identifying configuration characteristics of a product until it is fully defined with respect to its intended functional and physical characteristics. Configuration identification establishes and maintains a documentation basis for configuration control, status accounting, verification and audit, and is the basis for the implementation of configuration management. The management of the configuration documents should be incorporated into the information/document management process, and the relationship is detailed in Annex B.

6.2 Main activities of configuration identification

Main activities of configuration identification are:

a) select configuration items on the basis of the project breakdown structure and product tree; processes and requirements of project breakdown structures are performed according to ISO 27026;

b) determine configuration documents produced at different phases (including internal and external interface documents) and form the preliminary configuration documents list;

c) specify identifiers for configuration items and configuration documents;

d) produce configuration documents based on the approved configuration documents list;

e) establish the configuration baseline;

f) document the configuration change information and provide its identifier.

6.3 Product tree

6.3.1 The supplier shall break down the task of the project, starting from the functional requirements and according to certain logic and requirements defined by Level 1 customer. On the basis of the project breakdown structure, the supplier shall determine the project structure levels and the corresponding work, and complete the respective product trees in accordance with functional requirements for each product.

6.3.2 The product tree, based on the approved final function, breaks down the system into successive levels and defines the top-down architecture framework of a product, such as system level, subsystem level, unit level etc.

6.3.3 The supplier shall ensure that the product tree can comprehensively describe the product's successive breakdown, the product's compositions and their positions and the necessary configuration items for the delivering of the product function.

6.3.4 The product tree is established on the basis of historical information or knowledge gained through the project. The product tree shall be updated under configuration control.

6.4 Configuration item

6.4.1 The selection of configuration items is conducted on the basis of the project breakdown structure and product tree. Configuration items correspond with the structure of product tree and are identified at various levels of the product tree.

6.4.2 Configuration items fall into two categories, developed configuration item and non-developed configuration item. A developed configuration item is subject to development and fully or partially designed for the programme or project, while a non-developed configuration item is a standardized or "off-the-shelf" product that is not developed specifically for the programme or project. Both of the two categories shall by managed by the requirements of configuration management.

6.5 Selection of configuration items

6.5.1 Select configuration items as early as possible. Configuration items of upper levels (system and subsystem level) shall be selected at the early definition phase; configuration items of lower levels (unit level) shall be selected at the initial stage of its life cycle.

6.5.2 The number of configuration items selected shall take into account the management effect, cost, risks, including safety and security, and development time etc., in order to maximize the project control capacity of the organization.

6.5.3 The organization shall determine configuration items according to certain selection criteria. The selected configuration items usually are:

a) items whose functional and physical characteristics can be separately managed;

b) items of system level, sub-system level or developed cross-unit and cross-sector;

c) items that have critical characteristics from a safety, risk and mission success point of view;

d) items that incorporate new design, technology or methods;

e) items interfacing with other items;

f) items designated for separate procurement;

g) items that are critical for use and security.

6.5.4 For configuration items controlled by the customer and their related baseline review, the customer and supplier shall make mutual consultation to determine the principles to be defined in the configuration management plan.

6.5.5 A list of confirmed configuration items shall be submitted to the customer for approval. The list shall indicate the structure (system, subsystem and unit), names and identifiers of the configuration items.

6.5.6 Review and update configuration items as the project develops.

6.6 Configuration documents list

6.6.1 Each supplier shall determine the configuration documents related to design, manufacturing, testing, operation, maintenance, storage, etc. (including internal and external interface documents) to be

prepared during the entire life cycle of the product. The configuration documents list shall be improved and updated with the progress of configuration identification activities.

6.6.2 The configuration documents list shall include:

a) document title and identifier;

b) type of document;

c) phases during the life cycle;

d) expected release time (determined by the phases and supplier's schedule);

e) preparation company and document status;

f) classification (open, classified), etc.

6.6.3 The configuration documents list prepared by the supplier shall be submitted to the customer for approval.

6.7 Identification marking

6.7.1 General

For confirmed configuration items, their identification marking mainly includes configuration item identifiers and configuration document identifiers.

6.7.2 Configuration item identifier

6.7.2.1 Configuration item identifier is a code to indicate the item (product) designation and type, and shall be produced by the customer, supplier or related parties according to its sources and breakdown structure (such as system, subsystem, unit, etc.).

6.7.2.2 A configuration item identifier shall be unique. A configuration item identifier shall include:

a) model identifier;

b) serial number;

c) configuration item identifier;

d) manufacturer identifier;

e) product name, etc.

6.7.2.3 Identifiers for standard products and off-the-shelf products shall comply with relevant standards and requirements.

6.7.3 Configuration document identifier

6.6.3.1 Configuration document identifier is a code to indicate the entity described and the document type and is usually produced by the supplier according to internal regulations.

6.7.3.2 A configuration document identifier shall be unique.

NOTE To avoid the possible existence of the same identifier for different products (items), a common practice is to prefix the identifier with an enterprise identifier.

6.7.3.3 A configuration document identifier usually includes: name of the publisher, document identifier, phase identifier, status identifier, document change or revision identifier, etc., and it shall be marked at certain positions of technical documents (such as the title bar):

a) name of the publisher: name or name abbreviation of the document publisher;

b) document identifier: document number consists of product identifier, entity code, code and document category number, where:

   1) product (item) identifier is the symbol specified to distinguish different products;

   2) entity code is the code specified to distinguish the technical documents for different types of products, generally including the model product code, design serial No., etc.;

   3) code is the code specified in accordance with specific rules and on the basis of the hierarchal relation or technical characteristics of products;

   4) document category number is the code specified to distinguish the different types of documents;

   5) enterprise code is the code specified by supplier to distinguish different suppliers.

   Documents describing the same configuration item shall be numbered consecutively.

c) phase identifier: to identify the phase where the formed document is located in the product's entire life cycle; see ISO 14300-1 for phase division;

d) status identifier: to indicate the status of entity, such as M for model satellite, F for mission satellite;

e) document change implementation identifier: implementation document change identifier includes the change to the number of implementation document and change to the marks.

6.8 Configuration document

6.8.1 Organization shall prepare a complete set of configuration documents according to the configuration documents list required by each phase during the life cycle.

6.8.2 During the project's development, document all functional characteristics, physical characteristics, interfaces, changes and other information of each configuration item, and assign them with unique identifiers.

6.8.3 The information of a configuration item is usually described in the following documents:

a) specification: a document defining requirements, including functional specification and technical specification (such as the system specification, development specification, product specification, process specification, material specification, etc.) Functional specification and technical specification are prepared in accordance with ISO 21351;

b) drawing: a document showing the product structure, composition, shape and other information using graphics and (or) the specified symbols, including drawings and diagrams;

c) list: a document describing the composition and quantity of products or documents using tables or lists, including summary lists, supporting lists and complete-set document list, etc.;

d) procedure and manual: a document specifying the approaches and requirements to carry out an activity or a procedure, such as the operation procedure, operation and maintenance manual, etc.

6.8.4 The realization of objectives during project development is usually defined by three types of configuration documents: functional configuration document, development configuration document and product configuration document.

6.8.4.1 The functional configuration document defines the customer's mission demand, specifying the overall functional requirements, mission requirements, interface requirements, design constraints, acceptance and operation requirements. The functional configuration document is usually expressed in the form of functional specification and (or) system specification.

The functional configuration document usually includes:

a) mission definition;

b) performance, risk, requirements and objective;

c) functional and physical characteristics of the main system or sub-system;

d) internal and external interface requirements;

e) design criteria, conditions and operation constraints;

f) test and reliability requirements;

g) organization, cost, schedule, etc.

6.8.4.2 The development configuration document defines functional requirements, mission requirements, interface requirements, design constraints, acceptance and operation requirements for compositions and items assigned from an upper level configuration item. The development configuration document is usually expressed in the form of development specification.

The development configuration document usually includes:

a) requirements of functional characteristics of the system, sub-system or unit;

b) major physical characteristics of the system, sub-system or unit;

c) internal and external interface requirements of the system, sub-system or unit;

d) requirements for all tests or reviews necessary to verify the design;

e) design criteria, design constraints, etc.

6.8.4.3 The product configuration document defines functional characteristics, physical characteristics, inspections and acceptance requirements of a specific item. The product configuration document includes a complete-site of technical documents describing design, manufacturing, acceptance, operation, support and interfaces of the delivered products. The product configuration document is usually expressed in the form of product specification, material specification, procedure specification, drawings, diagrams, lists, etc.

6.8.4.4 Functional, development and product configuration documents are prepared, reviewed and maintained during each phase of the life cycle. The three types of documents are gradually expanded and detailed, coordinate and traceable.

6.8.4.5 When conflicts arise among functional, development and product configuration documents, their order of precedence is: functional configuration document, development configuration document and product configuration document.

6.9 Configuration baseline

6.9.1 The project is usually divided into several phases in order to achieve the overall objective. Each phase has its own objective and task. For configuration management, the objective of each phase is realized through the establishment of a configuration baseline.

6.9.2 A configuration baseline comprises the documentation that is formally approved at certain points during the project's development. The documentation is designated as the baseline for subsequent development and production activities. The baseline is determined together by the supplier and the customer and shall be used as the starting point for configuration control.

6.9.3 During the life cycle of the product, configuration baselines are elaborated in the following sequence:

a) from the feasibility phase (phase A), establish the functional baseline at the early definition phase (phase B). The functional baseline is complete when the documentation of overall requirements on the function, performance and interface index are approved by the customer;

b) from the early definition phase (i.e. after the establishment of the functional baseline), establish the development baseline at the late definition phase (phase B). The development baseline is complete when the documentation of requirements on the function, performance and interface of the lower level configuration item is confirmed by the supplier;

c) the product baseline is established in the late production phase (phase D) and after the product qualification. The product baseline includes the documentation and approved changes necessary for product manufacturing, assembly, testing, acceptance and operation.

6.9.4 For systems, sub-systems and lower levels, new configuration control points can be added based on the item's complexity and the mission's progress. For example, the design baseline can be established from the early development phase (phase C) and after the critical design review. The design baseline includes technical specifications and design data documents prepared by the supplier and corresponding documents of configuration items of lower levels.

6.10 Configuration change documentation

6.10.1 When a baseline is established, all changes after it shall be documented and each document shall have a unique identifier to keep consistency between documents and entities.

6.10.2 The configuration change documentation includes change request, change proposal, application for deviation and waiver and related implementation documents after approval.

6.10.3 Identifiers for implementation documents shall usually include change implementation document number, change frequency and change places, etc.

6.11 Publication and maintenance of the configuration documentation

Submit the approved configuration documents by the specified time for publication. The supplier shall keep and control the original copies of all configuration documents.

7 Configuration control

7.1 General

Configuration control is the process for controlling the evolution of, or deviation/waivers from agreed baselines. It includes the preparation, justification, evaluation, disposition and implementation of engineering and contractual changes, deviations and waivers.

7.2 Configuration control requirements

7.2.1 In order to keep consistency between configuration documents and entities, the supplier shall perform configuration change control for controlling the evolution of, or deviation/waivers from agreed baselines.

7.2.2 Configuration control starts when the functional baseline is established, and is performed during the project's entire life circle. Configuration control generally includes:

a) determining the category of configuration control;

b) determining the procedure of configuration control implementation, responsibilities, methods and requirements;

c) implementing control over configuration changes;

d) tracking and verifying the implementation of approved changes.

7.2.3 For any changes, deviation or waiver, describe its effect on higher level and relevant configuration items. Related changes of several products resulting from a common need for change shall be processed simultaneously. Changes related to an element common to several products shall be presented to all the concerned parties for effect assessment.

7.3 Change

Change refers to an alteration made on formally approved configuration documents during the project's development. The customer and the supplier can both propose a "change request". For a "change request" proposed by the customer, notify the supplier in written form and get the supplier's reply in the form of an approved "change proposal" in a certain time period before implementation. For a "change proposal" which will affect contract and/or technical requirements, submit it to the customer-level configuration control board for review and approval before implementation.

7.3.1 Change classification

7.3.1.1 Changes fall into two categories: class I change and class 2 change. The supplier may further detail the changes according to the management requirements and on the premise that the changes are under control.

7.3.1.2 Class 1 changes include:

a) Changes specified by the customer and affecting contract requirements:

   1) cost;

   2) warranty clause;

   3) delivery requirements;

4) arrangement of major events.

b) Changes to functional and (or) development configuration documents. As a result, the following requirements exceed specified values:

1) functional and performance definitions;

2) reliability, maintainability, safety, survivability, environment adaptability and electromagnetic compatibility etc.;

3) interface characteristics;

4) critical physical characteristics, such as structure size, mass, moment of inertia;

5) other requirements having a direct impact on the success of the project.

c) Changes to product configuration documents that have a significant impact on the following:

1) functional and (or) development configuration documents as specified in a) and b) above;

2) support equipment and application software;

3) interchangeability of configuration items and their compositions;

4) delivered operation and maintenance manual;

5) already delivered items, etc.

Class 1 changes shall be submitted to the configuration control board at appropriate level for review. Class 1 change can only be implemented after an approval is obtained from the configuration control board.

7.3.1.3 Class 2 changes do not fulfil the criteria for class 1 changes and are necessary for the supplier to meet the contract and/or technical requirements and regulations. The supplier shall implement internal control for class 2 changes.

7.3.2 Change procedure

7.3.2.1 Determine the necessity of change

Any change to a configuration item shall be described and justified by the requesting party before submission.

7.3.2.2 Changes classification

Classify changes according to the provisions in 7.3.1.2 (class I change and class 2 change) before submission.

7.3.2.3 Initiation of change

For class I changes, the requesting party shall draft a change proposal (or change request) with necessary proof materials and submit it to the corresponding configuration control board for review. For class 2 changes, the supplier shall implement internal control in accordance with the provisions.

7.3.2.4 Change assessment

Change assessment shall be carried out by each corresponding configuration control board according to change classification, interfaces and phases. The assessment mainly includes:

a) necessity and feasibility of the change;

b) relevant items and documents affected by the change;

c) impact on interfaces, interchangeability, safety and reliability;

d) impact on production, testing and inspection;

e) impact on purchasing and storage;

f) impact on the operation, maintenance and replacement parts;

g) impact on the contract, logistical support and cost, etc.

7.3.2.5 Change disposition

All changes shall be disposed by each corresponding configuration control board as:

a) approved, defining the applicability of evolution and associated implementation modes;

b) rejected, with a supporting rationale, or

c) deferred until additional information is provided.

7.3.2.6 Change approval

The change proposal shall be approved by the appropriate personnel of each corresponding configuration control board members.

7.3.2.7 Implementation and verification

7.3.3 For the approved changes, the supplier shall prepare the change implementation documents (such as change notices) and release them to related parties for implementation, and shall verify the implementation. Change proposal/request.

For class I changes, a change proposal/request shall be submitted to the corresponding configuration control board for review, after the supplier has completed its review and approval process. A change proposal/request shall include:

a) change proposal/request number;

b) company name and submitting date of the change proposal/request;

c) title and number of changed configuration items and configuration documents;

d) change classification;

e) necessity and reasons for the change;

f) change contents;

g) impact of the change (affected items, documents, performance parameters, schedule, interfaces, etc.);

h) change implementation plan;

i) expense budget of the change, etc.

7.4 Deviation/waiver

7.4.1 Deviation/waiver requirements

To achieve expected objectives or specific purposes, deviations from configuration documents shall go through the application procedure, before product manufacturing; if finished products or products

during the manufacturing process have exceeded the allowable values specified in the configuration documents, an application for waiver shall be made.

Except for special circumstances, do not make deviation applications involving safety and fatal defects or impacts on the operation and maintenance. Waivers involving personnel health, function, reliability, maintainability, interchangeability and critical physical characteristics shall be approved by the customer.

The approved deviation/waiver applies only to specified context and time period, and does not change configuration documents.

The supplier shall implement internal control over the deviation/waiver. In order to avoid the repetition of waiver, the supplier shall analyse the causes, take corrective measures and incorporate the effective measures into corresponding documents.

7.4.2 Deviation/waiver classification

A deviation/waiver can be classified as a major and minor deviation/waiver. A major deviation/waiver involves:

a) functional characteristics and performance definitions;

b) critical physical characteristics (structure size, mass, moment of inertia);

c) interfaces;

d) product interchangeability, reliability, safety, security, electromagnetic compatibility and environmental adaptability;

e) personnel health and safety;

f) use and maintainability of product.

A minor deviation/waiver does not fulfil the criteria for the major deviation/waiver.

7.4.3 Deviation/waiver application

A deviation/waiver application generally includes:

a) application number;

b) company name and submitting date;

c) deviation/waiver classification;

d) necessity of the deviation or reason for the waiver;

e) deviation/waiver description;

f) numbers and titles of affected configuration items and documents;

g) impact on the function, performance parameters, schedule, interfaces (including improvement);

h) scope of the deviation (quantity and batches);

i) implementation plan;

j) expense budget, etc.

The supplier shall provide specific documents adopted for the deviation/waiver application.

7.4.4 Deviation and waiver control procedure

7.4.4.1 Deviation control procedure

a) Determine the necessity of the deviation

Any deviation to a configuration item shall be described and justified by the supplier before submission.

b) Deviation classification

The supplier shall determine the deviation category in accordance with 7.4.2.

c) Deviation application

For major deviations, submit a deviation application to the corresponding configuration control board for review; for minor deviations, the supplier shall implement internal control.

d) Deviation application review

A deviation review shall be performed by the corresponding configuration control board according to the product level and interface requirements. The review mainly includes:

1) necessity and feasibility of the deviation;

2) impact on the project, interfaces, interchangeability, safety and reliability;

3) impact on the production, testing and inspection equipment;

4) impact on the operation and maintenance equipment and replacement parts;

5) impact on the contract progress, logistical support and cost etc.;

6) determine the deviation category.

e) Deviation application approval

The configuration control board shall determine the deviation category and give suggestions on whether to approve the deviation application according to evaluation results. Provide a supporting rationale in case of rejection. In case of objections, resolve by consultation or submit the application to higher levels for adjudication.

f) Implementation and verification

For approved deviations, the supplier shall prepare the deviation implementation documents (such as technology notice) which shall be released to the related parties for implementation; prepare the corresponding process specification and adopt the corresponding process equipment and methods to ensure the correct implementation of the deviation; verify and record the conformity and the implementation of the deviation.

7.4.4.2 Waiver control procedure

The procedure of waivers shall be consistent with the nonconformance control system.

a) Determine the situation of the waiver

The manufacturer shall assess the waiver degree, waiver causes and influence caused by the waiver to properly judge the situation of the waiver.

b) Waiver classification

The supplier shall determine the waiver category in accordance with 7.4.2 and on the basis of the judgment results.

c) Waiver application

For the major waiver confirmed, the manufacturer shall present the waiver application which shall be submitted to the corresponding configuration control board for review after the level-by-level examination and approval are completed according to the provisions. For the minor waiver confirmed, the supplier shall implement internal control (rework, repair, degrade and scrap).

d) Review the waiver application

1) adequacy of reasons for the waiver application;

2) impact on the item interface, interchangeability, safety and reliability caused by the waiver;

3) feasibility of the implementation scheme;

4) impact on the contract, logistical support and cost, etc.

e) Approve the waiver application

According to the review results, make suggestions on whether to approve the waiver application submitted and put forward requirements to timely return the reply to the proposer. Provide a supporting rationale for rejection.

f) Acceptance for the waiver

The supplier shall implement the waiver acceptance for nonconforming products according to the review.

7.5 Interface control

7.5.1 An interface is a common boundary for two or more objects. Interface control is the controlling of interface changes in an appropriate and traceable way.

7.5.2 Interface control is a part of configuration control. Interface control shall make sure:

a) independently developed and manufactured items can interface with other items correctly and work properly;

b) functions of the corresponding interface and physical interface can change accordingly if an item changes.

7.5.3 Generally, the configuration interface management requirement shall be specified in the configuration management plan. If a project involves many interfaces, separate documents (such as agreement and contract) shall be prepared.

7.5.4 Generally configuration interfaces have the following types.

a) Functional and physical interfaces, according to interface characteristics:

1) functional interface: interconnected items work together to achieve the same functional objective;

2) physical interface: physical boundaries of the interconnected items are compatible with each other to achieve the overall structural integrity.

b) Internal and external interfaces according to the interface position:

1) internal interface: interface between parts of the same item;

2) external interface: interface between different items.

c) System and unit interfaces according to the interface level:

1) system interface: interface between the system-level items;

2) unit interface: interface between the items lower than the system level.

7.5.5 The supplier shall implement control over all types of interfaces to ensure the interface definition data are consistent with the product configuration.

8 Configuration status accounting

8.1 General

The configuration status accounting records and reports the approved documentation of the confirmed configuration items, configuration documents, proposals of change, deviation and waiver, and implementation of approved changes and deviations. The configuration status accounting provides visibility of the approved configuration, traceability of the configuration baselines evolution and comparison with the as-built configuration.

The configuration status accounting includes:

a) information of the development and related configuration documents of the approved configuration items;

b) status of the change, review and implementation;

c) status of the review and implementation of the deviation and waiver;

d) configuration audit information, including audit overview, audit results, handling of non-conforming items and tracking of results.

Discount of configuration state is carried out in accordance with programme (plan) of general management of configuration and requirements of customer, supplier/subsupplier.

8.2 Configuration status accounting requirements

8.2.1 The supplier shall collect all the information of configuration items to produce a formal record and report to relevant parties, therefore personnel involved can be provided with accurate and necessary information to ensure the project's development.

8.2.2 The configuration status accounting starts with the first configuration document, and runs through the whole process of product development. The configuration status accounting shall record related information accurately and comprehensively to ensure the traceability of the configuration evolution.

8.3 Configuration status accounting process

8.3.1 General

The configuration status accounting process includes the accumulation and handover of configuration documents, data collection, record and report of the configuration status, and configuration status accounting system analysis.

8.3.2 Configuration documents accumulation

The Configuration Manager preparing configuration documents shall accumulate all the documents from the establishment of the first configuration document, and register all documents in accordance with the generating time or document category to produce the configuration documents list.

8.3.3 Configuration documents handover

8.3.3.1 The Configuration Manager preparing configuration documents shall periodically hand over the accumulated configuration documents to the Configuration Management department. The documents shall be clean, complete and consistent with the configuration documents list.

8.3.3.2 The Configuration Manager shall verify the documents and finish the document handover procedure in accordance with the provisions.

8.3.4 Data collection

8.3.4.1 Data collection provides input for the record and report of the configuration item status. It shall comply with the provisions of data acquisition and meet the demands of the information/documentation management system.

8.3.4.2 Data collection shall consider document generating departments, document categories (such as text, graph and table) and document characteristics. The data collected shall be complete, true and unified.

8.3.4.3 The Configuration Manager is responsible for data collection. The collected data usually includes:

a) document title and number;

b) document release date and version number;

c) document generating department and responsible person;

d) approved change and validity date, etc.

8.3.5 Record of the configuration status

The record of the configuration status refers to the process of the Configuration Manager collating collected data according to different use ends and targets to form a formal record and report. The record and report shall be input into the configuration status accounting system. The record and report shall ensure:

a) the collected data is accurate, reliable and complete;

b) the collected data shall be updated timely and the original data shall be kept properly.

8.3.6 Report of the configuration status

The Configuration Manager shall periodically release/send configuration status accounting reports (see Annex C) to customers and suppliers/sub-suppliers according to their demands and management requirements. The reports usually include:

a) configuration item development status;

b) configuration baseline documents list;

c) status of major changes, deviation and waiver; its implementation and verification;

d) configuration audit status, major problems proposed, audit conclusion and problem handling results.

8.3.7 Configuration status accounting system analysis

The Configuration Manager shall analyse and improve the configuration status accounting to meet users' demands.

9 Configuration verification

9.1 General

Configuration verification is the process to verify the current configuration status of the analysed product and results in the establishment of configuration baselines. Configuration verification includes verification of the product configuration definition and verification of the product configuration.

9.2 Verification of the product configuration definition

9.2.1 At system requirements review (SRR), the functional configuration definition shall be verified against the mission objectives.

9.2.2 At preliminary design review (PDR), the development configuration definition shall be verified against the applicable technical specifications.

9.2.3 At critical design review (CDR), the design definition shall be verified against the relevant design documentation.

9.2.4 In case the verification fails, take corresponding improvement measures.

9.3 Verification of the product configuration

9.3.1 The supplier shall perform the configuration verification by systematically comparing the "as-built" configuration of a configuration item with its "as designed" configuration. For this comparison, the supplier shall prepare the "as-designed configuration list (ADCL)" and the "as-built configuration list (ABCL)" at the phase review meeting for review.

9.3.2 For prototypes, the configuration in terms of functional characteristics shall be verified at the qualification review (QR); for the configuration in terms of physical characteristics shall be verified at the acceptance review (AR).

9.3.3 For a serial production, the functional configuration verification (FCV) shall be performed from the test data acquisition of the first piece; the physical configuration verification (PCV) shall be performed along with the product qualification or simultaneously with the FCV.

10 Configuration audit

10.1 General

The configuration audit is a formal inspection to determine the consistency between configuration items and their configuration documents. The effectiveness of the configuration management system is measured by audits to verify the proper application of configuration management requirements during the life cycle of the product as specified by the customer. Configuration audits include functional configuration audits and physical configuration audits.

10.2 Configuration audit requirements

10.2.1 Establish the configuration audit team to perform functional and physical configuration audits for each configuration item.

10.2.2 Configuration audits are usually performed at the supplier's or sub-supplier's premises and in the form of meetings; the higher level shall perform audits on the lower level.

10.2.3 The configuration audit is to:

a) review the correctness and integrity of configuration documents;

b) review the consistency between configuration items and configuration documents;

c) review that the functional and physical characteristics of configuration items meet the contract, schedule and operation requirements;

d) review the correctness of the configuration identification and the effectiveness of the configuration control.

10.2.4 Generate the audit conclusion. For problems found, set a deadline for rectification.

10.3 Configuration audit team

10.3.1 The configuration audit team consists of representatives from both the customer and the supplier. Generally, a representative of the customer shall serve as the leader, and a representative of the supplier shall serve as the deputy leader.

10.3.2 Representatives of the configuration audit team shall have certain qualifications and be involved in the project's development.

10.4 Responsibilities of the supplier and the customer

10.4.1 In the configuration audit, the supplier shall be responsible for:

a) coordinating with the customer for the audit schedule, place and requirements;

b) preparing the audit plan;

c) designating the deputy leader of the configuration audit team and the supplier's personnel involved;

d) ensuring the participation of the sub-supplier in necessary audits;

e) preparing meeting documents required by the configuration audit plan;

f) providing the configuration audit team and personnel involved with a list of documents and equipment necessary for the audit;

g) providing necessary sources and equipment for the audit;

h) drafting meeting minutes.

10.4.2 In the configuration audit, the customer shall be responsible for:

a) designating the leader of the configuration audit team and the customer's personnel involved;

b) reviewing the meeting minutes to make sure it reflects all the important opinions proposed by the customer;

c) provide the audit conclusion: approval, conditional approval or disapproval.

10.5 Meeting minutes

10.5.1 The meeting minutes shall be drafted by the supplier and reflect the meeting accurately.

10.5.2 The meeting minutes shall generally include:

a) meeting date, place, host, participants and recorder;

b) agenda of the meeting;

c) problems, suggestions, solutions or requirements proposed;

d) conclusion and deadline for rectification.

10.5.3 Achieve the minutes after it is approved by the leader of the configuration audit team.

10.6 Functional configuration audit

10.6.1 The functional configuration audit is an inspection performed to verify whether functional characteristics (performance indexes, design constraints, operation assurance requirements) of a configuration item meet the requirements specified in the functional configuration documents and development configuration documents.

10.6.2 The data for the functional configuration audit shall be acquired from the test data of the prototype. If a prototype is not manufactured, the data shall be acquired from the test data of the first product.

10.6.3 The functional configuration audit shall be combined with the test of the prototype. It may also be gradually completed as the design requirements develop.

10.6.4 The functional configuration audit generally includes:

a) whether the supplier's test procedures and results meet the requirements specified in functional and (or) development configuration documents;

b) implementation of the development test plan and test specifications; integrity and accuracy of test results; whether test reports can reflect the tests accurately;

c) whether approved changes have been incorporated into corresponding configuration documents and have been implemented;

d) for requirements that cannot be completely verified by tests, confirm that analysis or simulation results can ensure that the functional configuration meets the requirements specified in configuration documents;

e) whether the cause analysis and corresponding correction measures have been performed for configuration items failing to meet the requirements;

f) whether technical problems for major deviations, waivers and others are processed properly;

g) for software, perform the necessary supplementary audit according to its own characteristics in addition to the audits mentioned above.

10.7 Physical configuration audit

10.7.1 The physical configuration audit is the final inspection performed to verify whether the completed configuration items can meet the requirements in functional, development and product configuration documents.

10.7.2 The data for the physical configuration audit shall be acquired from the test and (or) inspection data of the first product manufactured according to the formal process.

10.7.3 The physical configuration audit is generally performed after the functional configuration audit and along with the product qualification. Establish the product baseline after the physical configuration audit.

10.7.4 The physical configuration audit generally includes:

a) inspecting enough samples of product specifications, drawings, lists and related process specifications of each hardware configuration specified by the customer to verify the accuracy and integrity, including changes reflected on the configuration documents and physical product;

b) inspecting enough samples to ensure configuration items manufactured according to the production process meet the requirements in configuration documents;

c) reviewing whether acceptance procedures and the test data of configuration items meet the requirements specified in the product specifications. Configuration items failing to meet the requirements shall be re-tested by the supplier and re-audits shall be performed when necessary;

d) reviewing whether the product quality certificate documents and test records of the sub-suppliers are accurate;

e) reviewing whether problems left by the functional configuration audit have been processed properly;

f) for software, performing necessary supplementary audits according to its own characteristics in addition to the audits mentioned above.

10.8 Others

After the functional and physical configuration audit, the supplier shall:

a) publish the results of the functional or physical configuration audit;

b) input audit results into the configuration status accounting system;

c) designate the responsible personnel to complete any work left.

11 Configuration control board

11.1 The configuration control board is the authority consisting of technical and management experts and having the decision-making power on the product configuration status. Any organization having design responsibility and authority shall establish the configuration control board.

11.2 The organization shall establish the configuration control board at each project level according to the levels, interfaces, characteristics, and complexity of configuration items.

11.3 Considerations shall be given to the following aspects when specifying responsibilities and authorities:

a) complexity and characteristics of the project;

b) requirements of each project phase;

c) parties involved in the project development;

d) interfaces of activities during the configuration management;

e) structure of the management organization.

11.4 Main responsibilities of the configuration control board are:

a) reviewing the necessity of changes;

b) ensuring the correctness, coordination and validity of change proposals;

c) evaluating the effect brought by changes;

d) providing suggestions on whether to approve change proposals (change requests), deviations/ waivers;

e) supervising the implementation of the approved changes.