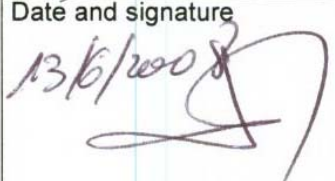
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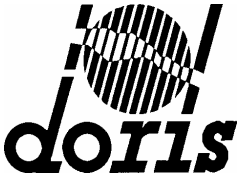
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PRODUCT ASSURANCE AND SAFETY REQUIREMENTS FOR DORIS DGXX INSTRUMENT

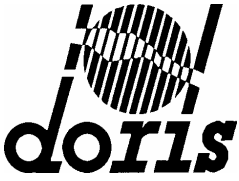
Prepared by :	C.MARTIN Project Product Assurance Responsable DCT/AQ/QP	Date and signature 06/06/08 P.B. 
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Approved by :	A.AURIOL Head of project DCT/PO/AL	Date and signature 13/6/2008 

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AUTHOR(S) : Bernard ZACCANTI, LOGIQUAL on behalf of CNES - DCT/AQ/QP in the frame of the contract N°06/CNES/60282/00 « Délégation de tâches Assurance et Contrôle Matériel et ingénierie embarqués ». + AQ Teams in support to DORIS project			
SUMMARY: This document defines the product assurance requirements for DORIS DGXX program.			
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DOCUMENT CHANGE RECORD

The modifications are listed in the Change Record section of the document and identified by change bars in affected sections.

Issue	Date	Modifications
0.0	15/12/04	<i>First issue</i>
1.0	29/06/05	<i>New issue taking into account internal CNES comments</i>
2.0	31/03/06	<i>Issue taking into account TAS comments (3 teleconferences : Ref. TASFR00431615 dated 13/10/2005 , Ref. TASFR00441629 dated 21/11/2005, Ref. TASFR00439117 dated 23/11/2005).</i>
2.1	30/08/06	<i>To avoid any misunderstanding, a new paragraph was added to prohibit pure tin</i>
2.2	23/11/06	<i>Update of the document format in compliance with DORIS documentation management. It has no impact on the requirements. There is no change in the paragraph numbers. (CO-DM-D1-419-CN rev.1)</i>
2.3	08/01/2007	<i>Update to take into account DORIS DGXX document configuration</i>
3.0	23/05/2008	<i>New edition issued from ECSS Tailoring according to the document "Groupe de travail AP Doris" N° 2007-0037707 v.1 du 17/012/2007.</i>

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ABBREVIATIONS

DEFINITION: In addition to the definitions given in RD1 GLOSSARY OF TERMS, some terms are defined within this document.

Abbr.	Definition
AIV	Assembly Integration Verification
AR	Acceptance Review
ASIC	Application Specific Integrated Circuit
CCD	Charge coupled device
CDR	Critical Design Review
CECC	electronic components committee
CENELEC	Comité européen de normalisation électrotechnique
CFRP <i>PRFC</i>	Carbon Fibre Reinforced Polymer / <i>Polymère Renforcé de Fibres de Carbone</i>
CI	Conformance inspection
CIDL	Configuration Item Data List
<i>LRDGC</i>	<i>Liste Récapitulative des Documents de Gestion de la Configuration</i>
CIL	Critical Item List <i>Liste des éléments critiques</i>
CN	Change Notice
CoC	Certificate of Conformity
CPU	Central Processing Unit
CPPA	Centralised Parts Procurement Agent
CR	Change Request
CSI	Customer Source Inspection
DCL	Declared Parts List / <i>Liste des composants EEE</i>
DDF	Design Definition File
DJF	Design Justification File
DJU	<i>Justification Document</i> / Dossier Justificatif d'Utilisation
DMMPL	Declared Materials and Mechanical Parts List
DPA	Destructive Physical Analysis / <i>Analyse Physique Destructive</i>
DPL	Declared Process List / <i>Liste des Procédés</i>
DRB <i>CRL</i>	Delivery Review Board / <i>Commission de Revue de livraison</i>
EAR	Export Administration Regulations
ECCN	Export Control Classification Number
ECSS	European Coordination for Space Standardisation
EEE	Electrical, Electronic, Electromechanical
EIDP <i>RCI</i>	END ITEM DATA PACKAGE / <i>Registre de Contrôle Individuel</i>
EPPL	European Preferred Parts List
ESCC	European Space Components Coordination
ESCIES	European space components information exchange system
FDIR	Failure Detection Isolation and Recovery
FMEA	Failure Modes /and Effects Analysis / Effects and Criticality Analysis
FMECA	<i>Analyse des Modes de Défaillances de leurs Effets et de leur Criticité</i>
FPGA	Field Programmable Gate Arrays
FTA	Fault Tree Analysis
GSE	Ground Support Equipment



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Abbr.	Definition
Hi-Rel	High-Reliability
ITAR	International Traffic in Arms Regulation
JAXA	Japanese aerospace exploration agency
KIP	Key Inspection Point / <i>Point clé interne Fournisseur</i>
LAT	Lot Acceptance Test
LED	Light emitting diode
LVT	Lot Validation Testing
MF	Maintenance File
MGT	Management file
MIP	Mandatory Inspection Point / <i>Point clé client</i>
MMIC	Microwave Monolithic Integrated Circuit
MMPP	Materials, Mechanical Parts, Processes
NCR	Non-Conformance Report
NPSL	NASA parts selection list
NRB	Nonconformance Review Board
ORR	Operational Readiness Review
PA	Product Assurance
PAD	Part Approval Document
PCB	Parts Control Board
PCN	Process Change Notice
PDR	Preliminary Design Review
PED	Plastic Encapsulated Devices
PRB	Part Review Board
PRD	Project requirements document
PSA	Part Stress Analysis / <i>Analyse des taux de charge</i>
PTR CRE	Post-Test Review / <i>Compte-Rendu des Essais</i>
QA	Quality Assurance
QCI	Quality Conformance Inspection
QML	Qualified Manufacturers List
QPL	Qualified Parts List
QR	Qualification Review
RAMS	Reliability, availability, maintainability, safety
REX	Lesson learned / <i>Retour EXpérience</i>
RFD	Request For Deviation
RFW	Request For Waiver
RNC	CNES STANDARDS REFERENCE / <i>Référentiel Normatif CNES</i>
RVT	Radiation Verification Testing
SCOPE	CNES preferential list of EEE parts <i>Sélection des Composants et Procédés d'assemblages Electroniques</i>
SEB	Single event burn-out
SEE	Single Event Effects / <i>Evènements singuliers</i>
SEFI	Single event functional interrupt
SEGR	Single event gate rupture
SEL	Single event latch-up
SET	Single event transient



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Abbr.	Definition
SEU	Single event upset
SRR	System Requirements Review
TCI	Technology conformance inspection
TRR <i>BT</i>	Test Readiness Review / <i>Bilan Technique</i>
TS	Technical Specification
WCA	Worst Case Analysis / <i>Analyse pire-cas</i>



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APPLICABLE AND REFERENCE DOCUMENTS

Published ECSS standards can be downloaded from the ECSS website <http://www.ecss.nl/>

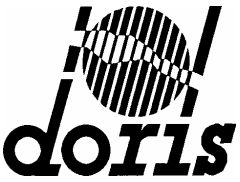
Reference	Document title
RNC-ISO-Q-40 = ISO 14620-1 (replace ECSS-Q-40B 17/05/2002 □)	AD1 Space Systems Safety Requirements
RNC-Q60-507 Draft.Document fourni	AD2 Radiation Harness Assurance Generic specification
CO-SP-D1-EA-15704-CN	AD3 Spécification technique de besoin DORIS DGXX
ECSS-P-001B VB 14/07/04 □ RNC-ECSS-P-001 V2 15/09/05 □	RD1 GLOSSARY OF TERMS GLOSSAIRE DES TERMES
ECSS-Q-00A 19/04/1996 □ RNC-CEN-Q-00 V1 12/02/03 =EN 13291-1 Ed1 02/2001 □	RD2 Product Assurance policy and principles AP des projets spatiaux - Exigences générales - Politique et principes
ECSS-Q-20B 08/03/2002 □ RNC-ECSS-Q-20 V3 17/07/02 □	RD3 Quality Assurance AP des projets spatiaux – Assurance Qualité
RNC-ECSS-Q-20-04 V1 30/01/06	RD4 Contrôle des éléments critiques
ECSS-Q-20-09B 08/03/2002 □ RNC-ECSS-Q-20-09 V3 22/09/03 □	RD5 Non conformance control system Instruction et Traitement des Anomalies
RNC-CNES-Q-20-505 V2 11/02/00 □	RD6 Traçabilité
RNC-CNES-Q-20-506 V2 15/02/00 □	RD7 Modalités de réalisation des points clés matériel
RNC-CNES-Q-20-507 V2 15/02/00 □	RD8 Bilan Technique
RNC-CNES-Q-20-508 V2 15/02/00 □	RD9 Commission de Revue d'Essais
ECSS-Q-30C draft1 06/07/2006	RD10 Dependability
ECSS-Q-30-02A 07/09/2001 RNC-ECSS-Q-30-02 V1 22/10/02 □	RD11 FMECA
ECSS-Q-30-01A 31/03/05 □ RNC-ECSS-Q-30-01 V1 23/03/06 □	RD12 Worst case circuit performance analysis Analyse des pires cas de fonctionnement
RNC-CNES-HB-504 V1 02/11/05 □	RD13 Manuel - ANALYSE PIRE CAS
ECSS-Q-30-11A 24/06/2006 RNC-ECSS-Q-30-11 V1 28/06/2006 □	RD14 Derating - EEE Components
ECSS-Q-60B 17/07/2007 □	RD15 EEE components
RNC-CNES-Q-61 V1 05/2004 □	RD16 COTS General requirements for the use of commercial EEE parts in space applications
EPPL	RD17 European preferred parts list (https://escies.org)
ESCC QPL http://bianca.cst.cnes.fr/http/IntranetBdd/DocPubInternet/PublicStandardCNESsurSiteInternet/Standard_CNES_public/eee-asf.htm	RD18 ESCC qualified part list (https://escies.org)
ECSS-Q-60-02A 17/07/07 □	RD19 ASIC and FPGA development
ECSS-Q-60-05A 07/04/06 RNC-ECSS-Q-60-05 V1 07/04/06 □	RD20 Hybrids microcircuits Generic procurement requirements
ECSS-Q60-12A 25/08/06 RNC-ECSS-Q-60-12 V1 15/12/06 □	RD21 MMIC Design, Selection, Procurement and use



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Reference	Document title
RNC - RNC-Q-60-502 18/02/00 □□	RD22 Stockage et destockage des composants EEE
ECSS-Q-70-B 14/12/2004 □ RNC-ECSS-Q-70 V2 25/04/05 □	RD23 Materials, Mechanical Parts and Processes <i>Matériaux, Composants mécaniques et Procédés</i>
RNC -ECSS-Q-70-01 VA 10/04/03	RD24 Cleanliness and contamination control
EN 14091 Ed1 11/2002 RNC -CEN-Q-70-02 V1 12/02/03 □ +□	RD25 Thermal vacuum outgassing test <i>Dégazage sous vide thermique</i>
EN 14098 Ed1 7/2002 RNC -CEN-Q-70-04 V1 12/02/03 □	RD26 Thermal cycling test <i>Essai de cyclage thermique</i>
ECSS-Q-70-06	RD27 Particle and UV radiation testing of space materials.
RNC -ECSS-Q-70-21 VA 10/12/02	RD28 Essai d'inflammabilité pour la sélection des matériaux d'un projet spatial
RNC -ECSS-Q-70-22 VA 10/12/02	RD29 Contrôle des équipements à durée de vie limitée sur étagère
RNC -CEN-Q-70-36 V1 12/02/03 □	RD30 Sélection des matériaux / corrosion sous contrainte
RNC -ECSS-Q-70-37 VA 4/6/02 □	RD31 Susceptibilité des métaux / corrosion sous contrainte
ECSS-Q-70-71A 27/02/04 RNC-ECSS-Q-70-71A V1 19/10/05 □	RD32 Data for selection of space materials and processes
ASTM-E595	RD33 NASA Outgassing Data
CEN-Q-70-29 V1 12/02/03	RD34 Détermination des produits de dégazage sous atmosphère pour les matériaux et éléments assemblés utilisés dans le poste d'équipage d'un satellite habité
ECSS-Q-80B 10/10/2005	RD35 Software Product Assurance
ECSS-M-30A	RD36 Logique de déroulement
ECSS-M-30-01	RD37 Organisation et conduite des revues
ECSS-M-40B 20/05/05 RNC-ECSS-M-40 V2 16/09/05 □	RD38 Configuration management
ECSS-M-50-B 11/05/07	RD39 Information/documentation management
ECSS-E-10-12	RD40 Methods for Calculation of Radiation Effects
ESCC 22800	RD41 ESA/SCC Non conformance Control System
ESCC 22900	RD42 basic specification. Tortal Doser Steady-State Irradiation Test Method
ESCC 24900	RD43 Minimum requirements for controlling environmental contamination of components
ESCC QML	RD44 ESCC qualified manufacturers list (https://escies.org)
ECSS-M-00-03	RD45 Risk management
ECSS-E-40B	RD46 Software Engeniering

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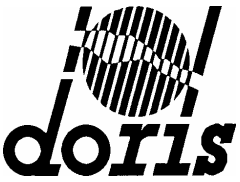
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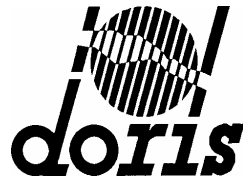
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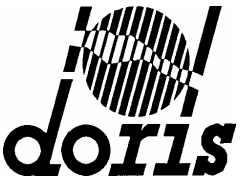
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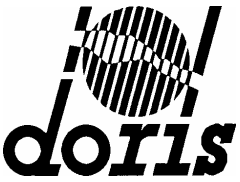
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0. PURPOSE

This document defines the PA and Safety requirements applicable to DORIS DGXX program.

These requirements are tailored from ECSS and CNES standards, and taking into account CNES lesson learned.

In the following, the CNES DORIS Project will be referred as “the Project”, the CNES as “the Customer” and the Supplier or the sub-suppliers of an instrument as “the Supplier” (most of the time a scientific laboratory that jointly develops the satellite project with “the Customer”).

In this document requirements are identified by

REQ(uirement)-PA-§-num [source]

1. APPLICABILITY

This document is applicable for development, design, production and verification of the Qualification Model, the Flight Model and the corresponding test facilities interfacing with flight hardware or impacting on the safety.

This document applies to the Supplier and to his sub-contractors participating in the Project.

2. POLICY PRINCIPLES

2.1 RESPONSIBILITY AND AUTHORITY

REQ-PA-2.1-10 [source: RD2 - §4.3.1.a]

The responsibility, the authority and the interrelation of personnel who manage, perform and verify work affecting quality shall be defined and documented (organization note, management plan, PA plan ...).

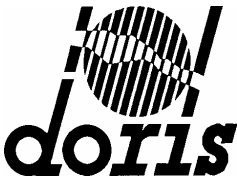
Conformity status & comments:

REQ-PA-2.1-20 [source: RD2 - §4.3.1.b]

The responsibilities and the interfaces of each organisation, either external or internal, involved in a project shall be defined and documented.

Conformity status & comments:

REQ-PA-2.1-30 [source: RD2 - §4.3.1.c]

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The delegation of product assurance tasks by a supplier to another lower tier supplier shall be done in a documented and controlled way. The supplier retains the responsibility towards the customer.

Conformity status & comments:

2.2 RESOURCES

REQ-PA-2.2-10 [source: RD2 - §4.3.2.b]

The Supplier shall provide adequate resources to perform the required PA tasks.

Conformity status & comments:

REQ-PA-2.2-20 [source: RD2 - §4.3.2.c]

Trained personnel shall be assigned to the various PA activities.

Conformity status & comments:

2.3 PA PROGRAMME MANAGEMENT

REQ-PA-2.3-10 [source: RD2 - §4.3.3.a]

The Supplier shall assign for the project a PA Manager from the PA line organisation - or at least a PA function - reporting functionally to the Supplier project Manager.

Conformity status & comments:

REQ-PA-2.3-20 [source: RD2 - §4.3.3.b]

The appointed Project PA Manager, irrespective of other responsibilities, shall have sufficient organisational authority and independence:

1. to propose and maintain a PA programme in accordance with the Project PA requirements.
2. to have unimpeded access to higher management as necessary to fulfil his duties.

Conformity status & comments :

REQ-PA-2.3-30 [source: RD2 - §4.3.3.c]

The Supplier shall establish a compliance matrix to the PA requirements with identification of the non-conformances and the associated potential risks. The compliance matrix shall be approved by the customer.

Conformity status & comments :

REQ-PA-2.3-40 [source: RD2 - §4.3.3.c]

The Supplier SHALL prepare and implement a project PA Plan.

This project PA Plan may refers to clauses of the Company Quality Manual and to in-house procedures.

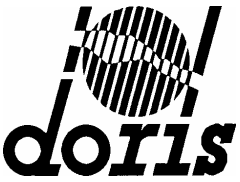
The supplier's project PA Plan shall be approved by the customer.

Conformity status & comments:

REQ-PA-2.3-50 [source: reformulated from RD2 - §3.3.3.d]

In case of changes in the Supplier compliance to PA requirements, the Supplier shall inform the Customer.

Conformity status & comments:

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REQ-PA-2.3-60 [source: RD2 - §4.3.3.f]

The supplier shall plan and perform quality audits using established and maintained procedures.

Conformity status & comments:

2.4 PA PROGRESS REPORTING

REQ-PA-2.4-10 [source: RD2-§4.3.3.e; RD3-§4.4; RD10-§4.11]

PA progress reporting shall be part of the overall project progress reporting and shall address:

- status of the PA activities since the last progress report
- potential problem areas
- critical items status and associated risk mitigation actions
- nonconformance and waiver status
- PA documentation.

Conformity status & comments:

REQ-PA-2.4-20 [source: new]

The Customer PA manager may organize specific meetings on quality action progress.

Conformity status & comments:

2.5 CONTRACTUAL ASPECTS

REQ-PA-2.5-10 [source: RD2 - §4.3.4]

All contracts shall include suitable PA provisions based upon the knowledge of the products and on purchaser's requirements.

Conformity status & comments:

REQ-PA-2.5-20 [source: RD2 - §4.3.4]

The PA function shall be involved in the preparation and negotiations of the PA provisions.

Conformity status & comments:

REQ-PA-2.5-30 [source: RD2 - §4.3.4]

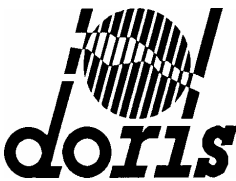
The PA function shall participate in the detailed review of the contract.

Conformity status & comments:

REQ-PA-2.5-40 [source: RD2 - §4.3.4]

The PA function shall be involved in the assessment and review of all changes to the contractual requirements.

Conformity status & comments:

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2.6 RISK ASSESSMENT AND CONTROL

REQ-PA-2.6-10 [source: RD2 - §4.3.5.a §4.3.5.b]

In the frame of the overall project risk management process, the Supplier shall perform a systematic risk assessment, reduction and control of risks with inputs from all PA disciplines.

Conformity status & comments:

REQ-PA-2.6-20 [source: RD2 - §4.3.5.c]

In identification of risk, the following aspects shall be systematically considered:

- Difficulties or uncertainties expected in demonstration of design performance, and with items having poor design margins.
- Risk identified by Dependability and Safety analyses.
- Difficulties or uncertainties expected in development of new products, components, parts, materials and processes.
- Difficulties or uncertainties expected in procurement, manufacturing, assembly, inspection, test, handling, storage and transportation, which may lead to unacceptable degradations in the quality of the product.
- Difficulties anticipated in product utilization or service implementation.
- Risk identified by Suppliers at lower levels.
- Risk of product quality degradation as the result of cost and schedule constraints imposed on the project.

Conformity status & comments:

REQ-PA-2.6-30 [source: modified from RD2 - §4.3.5.d]

Critical items shall be identified as a result from risk assessment.

The Supplier shall establish and maintain a Critical Items List (CIL) which shows the reason(s) for criticality, and the specific actions taken to reduce the criticality.

Conformity status & comments:

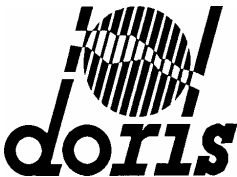
2.7 EXPERIENCE SUMMARY REPORT

REQ-PA-2.7-10 [source: modified from RD16- §8]

On completion of the programme, the Supplier shall establish an experience summary report featuring :

- Special requirements and conditions and policies applied for the particular programme
- Experience gained with EEE parts (both commercial and space level components) and MMPP during selection, evaluation, procurement, delivery, use
- Evaluation of the actual procurements including statistics on quantities, controls, schedule, performances
- Presentation of non-conformance and problem areas,
- Recommendations from lessons learned for future procurements and any related proposals to modify and adapt the PA requirements.

Conformity status & comments:

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3. QUALITY ASSURANCE

3.1 QA PROGRAMME

REQ-PA-3.1-10 [source: RD3 - §4.1.a+c]

The Supplier QA programme shall give assurance that adequate methods and procedures have been defined and are implemented in order to prove that

- all requirements are specified
- each applicable requirement is verified through one or more of the following methods: analysis, inspection, test, review of design, audits.

Conformity status & comments:

REQ-PA-3.1-20 [source: RD3 - §4.1.b+d+e]

The Supplier QA programme shall give assurance that

- a set of design rules and methods has been set up and is consistent with the project techniques and technologies;
- for each configuration item there is a defined and implemented qualification approach that makes it possible to demonstrate that the item is so designed that it performs satisfactorily in the intended environment;
- the approach adopted guarantees that the design is producible and repeatable and that the resulting product can be verified and operated within the required operating limits.

Conformity status & comments:

REQ-PA-3.1-30 [source: RD3 - §4.1.f]

The Supplier shall maintain a system of quality control that will include incoming inspection, materials control, shelf life control, manufacturing control and test surveillance.

Conformity status & comments:

3.2 QA ORGANIZATION - PROGRAMME PLAN - REPORTING

see §2.1 to §2.4

3.3 PERSONNEL TRAINING AND CERTIFICATION

See §2.2 for requirement about training program

REQ-PA-3.3-10 [source: RD3 - §4.5.2 and §4.5.3]

Operators performing or controlling critical processes (as defined in RD23) shall be trained and certified by internal or external training programs accepted by the Customer, or can demonstrate a regular and satisfactory use of the related skills.

Conformity status & comments:

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3.4 QA AUDITS

REQ-PA-3.4-10 [source: RD3 - §4.6.1]

The supplier shall perform systematic audits on his own performance to verify the implementation and effectiveness of the provisions defined in the QA programme plan.

Conformity status & comments:

REQ-PA-3.4-20 [source: RD3 - §4.6.2 and §4.6.4]

The Supplier shall establish and maintain an audit plan for procurement activities of CRITICAL ITEMS. No external audit shall be performed without the Customer being given due notice.

Conformity status & comments:

REQ-PA-3.4-30 [source: RD3 - §4.6.3]

Audits shall be performed when necessary to overcome failure, consistent poor quality, or other problems.

Conformity status & comments:

REQ-PA-3.4-40 [source: RD3 - §4.6.5]

The Customer shall have the right to audit any lower tier Supplier at any time; such audits shall be arranged by the Supplier and the next or higher level customers of the audited Supplier as relevant.

Conformity status & comments:

REQ-PA-3.4-50 [source: new]

No Supplier can use industrial secrets as a pretext for opposing action by Customer representatives, who are obliged to respect the confidentiality of information in their possession.

Conformity status & comments:

3.5 QA ROLE IN CONFIGURATION MANAGEMENT

REQ-PA-3.5-10 [source: RD3 - §4.7.1]

The Supplier shall establish, maintain and implement a configuration management plan which shall be in effect during the complete project life cycle.

Conformity status & comments:

REQ-PA-3.5-20 [source: RD3 - §4.7.2]

A Supplier PA representative shall attend all boards established to review the suitability for release of drawings, plans, specifications, procedures and changes.

Conformity status & comments:

REQ-PA-3.5-30 [source: RD3 - §4.7.3]

During the configuration verification process, the as-built configuration of hardware and software shall be certified against the latest approved manufacturing documentation.

Conformity status & comments:

REQ-PA-3.5-40 [source: RD3 - §4.7.4]

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The Supplier QA function shall ensure that:

- a. the as-designed status is defined prior to manufacturing,
- b. the as-built documentation is properly defined, identified and maintained in order to reflect approved modifications, and
- c. items to be delivered conform to the as-built documentation.

Conformity status & comments:

REQ-PA-3.5-50 [source: new]

Before being applied, any definition change shall be identified, documented, examined and approved in compliance with the configuration management plan.

Conformity status & comments:

3.6 CRITICAL ITEMS CONTROL

REQ-PA-3.6-10 [source: RD3 - §4.8.a]

The QA function shall contribute to the overall risk management activities by supporting the identification and risk evaluation of critical items for which major difficulties or uncertainties are expected in

- demonstration of design performances,
- development and qualification of new products, processes and technologies.
- procurement, manufacturing, assembly, inspection, test, handling, storage and transportation, which can lead to major degradation in the quality of the product
- product utilization or service implementation.

Conformity status & comments:

REQ-PA-3.6-20 [source: RD3 - §4.8.b]

The QA function shall contribute to the overall risk management activities by identifying the QA activities accompanying the individual risk reduction measures.

Conformity status & comments:

REQ-PA-3.6-30 [source: RD3 - §4.8.c]

The QA function shall contribute to the overall risk management activities by monitoring and documenting the achievement of the specified risk reduction implementation and the corresponding verification measures throughout all project phases.

Conformity status & comments:

3.7 DOCUMENTATION AND DATA CONTROL

REQ-PA-3.7-10 [source: RD3 - §5.1.1.a]

The QA function SHALL ensure that the pertinent issues of appropriate documents and data are available at all locations where operations essential to the effective functioning of the quality system are performed.

Conformity status & comments:

REQ-PA-3.7-20 [source: RD3 - §5.1.1.b+c]

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The QA function shall ensure that invalid or obsolete documents and data are assured against unintended use.

Conformity status & comments:

REQ-PA-3.7-30 [source: RD3 - §5.1.1.e]

The QA function SHALL ensure that the documents required by the business agreement are verified and signed by the designated people before release.

Conformity status & comments:

REQ-PA-3.7-40 [source: RD3 - §5.1.1.f]

The QA function SHALL ensure that documents are verified for incorporation of PA requirements.

Conformity status & comments:

REQ-PA-3.7-50 [source: RD3 - §5.1.1.g]

The QA function SHALL ensure that the need for document approval by product assurance is identified

Conformity status & comments:

REQ-PA-3.7-60 [source: RD3 - §5.1.1.h]

The QA function SHALL ensure that changes to documents and data are reviewed and approved by the same functions or organizations that performed the original review and approval unless specifically designated otherwise.

Conformity status & comments:

REQ-PA-3.7-70 [source: RD3 - §5.1.1.i]

The QA function SHALL ensure that a master list or equivalent document control procedure identifying the current revision of documents and data support is established and is readily available to preclude the use of invalid or obsolete documents and data.

Conformity status & comments:

REQ-PA-3.7-80 [source: RD3 - §5.1.2]

The supplier shall establish and maintain current PA data as defined by the business agreement.

Conformity status & comments:

3.8 QUALITY RECORDS

REQ-PA-3.8-10 [source: RD3 - §5.2.1]

The supplier shall maintain quality records to provide objective evidence of complete and effective performance of QA tasks and to demonstrate achievement of the required quality.

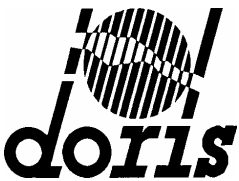
Conformity status & comments:

REQ-PA-3.8-20 [source: RD3 - §5.2.2]

Quality records shall be stored in safe conditions, which prevent alterations, loss or deterioration.

Conformity status & comments:

REQ-PA-3.8-30 [source: RD3 - §5.2.3]

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Quality records shall be retained for the period specified in the business agreement, unless release before that time is given by contractual authorization.

Conformity status & comments:

REQ-PA-3.8-40 [source: RD3 - §5.2.4]

The supplier shall ensure that quality records are readily accessible and retrievable whenever they are needed.

Conformity status & comments:

REQ-PA-3.8-50 [source: RD3 - §5.2.5]

Quality records shall be accessible to the customer upon request.

Conformity status & comments:

3.9 TRACEABILITY

REQ-PA-3.9-10 [source: RD3 - §5.4.1.a+b]

The Supplier shall implement a traceability system for CRITICAL ACTIVITY in order to establish unequivocal relationships between parts, materials or products and associated documentation or records.

Conformity status & comments:

REQ-PA-3.9-20 [source: : RD3 - §5.4.1.b]

The Supplier shall identify the level of traceability which he provides so as to retrieve the equipment data during procurement, manufacturing, inspection, testing, assembling and integration.

Conformity status & comments:

REQ-PA-3.9-30 [source: RD3 - §5.4.1.c]

The level of traceability to be applied to an item SHALL be specified in technical specifications and drawings.

Conformity status & comments:

3.10 IDENTIFICATION

REQ-PA-3.10-10 [source: RD3 - §5.4.2.a]

Each part, material or product shall be identified by a unique and permanent part or type number.

Conformity status & comments:

3.11 DATA RETRIEVAL SYSTEM

REQ-PA-3.11-10 [source: precision RD3 - §5.4.3.]

The Supplier shall define the available and accessible information for investigating all non-conformances during AIV and flight operation.

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Conformity status & comments:

REQ-PA-3.11-20 [source: RD3 - §5.4.3.a]

Documents and records shall be identified and linked to the respective items by means of their unique identification numbers.

Conformity status & comments:

REQ-PA-3.11-30 [source: RD3 - §5.4.3.b]

The data retrieval system shall allow traceability starting from any point of the interconnected network existing between records, documents and marking on parts.

Conformity status & comments:

REQ-PA-3.11-40 [source: RD3 - §5.4.3.c]

The Supplier SHALL ensure that identification numbers or methods and retrieval methodology used in different activities, such as design, configuration control, purchase, manufacturing and quality control, are consistent and interrelated.

Conformity status & comments:

3.12 METROLOGY AND CALIBRATION

REQ-PA-3.12-10 [source: RD3 - §5.5.1]

All measuring, inspection and test equipment used during verification activities shall be controlled and calibrated in order to demonstrate that the product complies with the technical specifications.

Conformity status & comments:

REQ-PA-3.12-20 [source: RD3 - §5.5.2]

Equipment shall be used in a manner which ensures that measurement uncertainty is known and is consistent with the required measurement capability.

Conformity status & comments:

REQ-PA-3.12-30 [source: RD3 - §5.5.3]

All measurements shall take into account the total error in the measurement process attributable to the cumulative error from the calibration chain, measuring equipment and, as appropriate, those contributed by personnel, procedures and the environment. The basis for the calculation of the cumulative error shall be recorded.

Conformity status & comments:

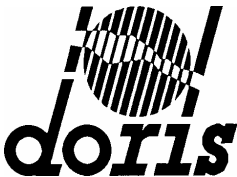
REQ-PA-3.12-40 [source: RD3 - §5.5.4]

Corrective action shall be taken when the total error is such as to compromise significantly the ability to make measurements within the required accuracy and precision.

Conformity status & comments:

REQ-PA-3.12-50 [source: RD3 - §5.5.5]

The supplier shall:

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- a. identify the measurements to be made and the accuracy required and select the appropriate inspection, measuring and test equipment;
- b. identify, calibrate and adjust all inspection, measuring and test equipment and devices that can affect product quality at prescribed intervals, or prior to use, against certified equipment having a known valid relationship to nationally recognized standards, where no such standards exist, the bases used for calibration shall be documented;
- c. establish, document and maintain calibration procedures, including details of equipment type, identification number, location, frequency of checks, checkmethod, acceptance criteria and the action to be taken when results are unsatisfactory;
- d. ensure that the inspection, measuring and test equipment is capable of the accuracy and precision necessary;
- e. identify inspection, measuring and test equipment with a suitable indicator or approved identification record to show the calibration status;
- f. maintain calibration records for inspection, measuring and test equipment ;
- g. assess and document the validity of previous inspection and test results when inspection, measuring or test equipment is found to be out of calibration;
- h. ensure that the environmental conditions are suitable for the calibrations, inspections, measurements and tests being carried out;
- i. ensure that the handling, preservation and storage of inspection, measuring and test equipment is such that the accuracy and fitness for use is maintained;
- j. safeguard inspection, measuring and test facilities, including both test hardware and test software, from adjustments that can invalidate the calibration setting.

Conformity status & comments:

REQ-PA-3.12-60 [source: RD3 - §5.5.6]

Where test hardware (e.g. jigs, fixtures, templates and patterns) or test software is used as suitable forms of inspection, it shall be checked to prove that it is capable of verifying the acceptability of the product prior to release for use during production and installation, and rechecked at prescribed intervals. The supplier shall establish the extent and frequency of such checks and shall maintain records as evidence of control.

Conformity status & comments:

REQ-PA-3.12-70 [source: RD3 - §5.5.7]

Test aids, such as test leads, break-out boxes, mains leads and similar items are not subject to the entire set of requirements defined in this clause, but shall be validated in a way appropriate to their usage.

Conformity status & comments:

REQ-PA-3.12-80 [source: RD3 - §5.5.8]

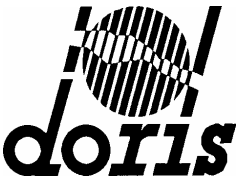
Measurement design data shall be made available, when required by the customer or his representative, for verification that it is functionally adequate.

3.13 NONCONFORMANCE AND ANOMALY CONTROL SYSTEM

DEFINITION [source: RD1]

Nonconformity or nonconformance: non-fulfilment of a requirement

Anomaly: any deviation from the expected situation

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DEFINITION [source: modified from RD5]

Classification of nonconformances:

Classification of nonconformances is not based on their consequences on cost and schedule but on the severity of their consequences. Major nonconformances are those which can have an impact on the customer's requirements in the following areas:

1. safety of people or equipment,
2. operational, functional or any technical requirements imposed by the business agreement,
3. reliability, maintainability, availability,
4. lifetime,
5. functional or dimensional interchangeability,
6. Hardware and/or software interfaces between different contractual levels
7. changes to or deviations from approved qualification or acceptance test procedures,
8. project specific items which are proposed to be scrapped
9. for EEE components, in case of:
 - (a) lot or batch rejection during manufacturing, screening or testing at the manufacturer's facilities, if the purchaser proposes:
 - . to use as-is the rejected lot or batch, or
 - . to continue processing, rework or testing, although the lot or batch does not conform to the specified requirements.
 - (b) nonconformances detected after delivery from the manufacturer, including
- (addition)** 10. nonconformances on flight products detected during AIV operations and tests.

All other non-conformances are considered to be minor.

REQ-PA-3.13-10 [source: RD3 - §5.6.1]

The Supplier SHALL establish and maintain a non-conformance control system in accordance with the general requirements in RD5.

Conformity status & comments:

REQ-PA-3.13-20 [source: RD3 - §5.6.2]

The system shall provide for a disciplined approach to the identification and segregation of nonconforming items, the recording, reporting, review, disposition and analysis of nonconformances, and the definition and implementation of corrective actions.

Conformity status & comments:

REQ-PA-3.13-30 [source: RD3 - §5.6.3]

Non-conformances shall be classified as major or minor on the basis of the severity of their consequences (see above definition).

Conformity status & comments:

REQ-PA-3.13-40 [source: addition to RD3 - §5.6]

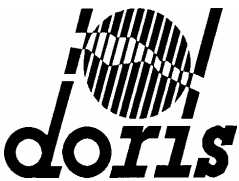
Anomaly as failure and accident shall be processed according to the non-conformance control system, and treated as a major non-conformance.

Conformity status & comments:

REQ-PA-3.13-50 [source: RD3 - §5.6.4]

The Supplier shall notify all major non-conformances to the Customer which specified the affected requirements by fax or by phone in 48 hours.

Conformity status & comments:

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REQ-PA-3.13-60 [source: RD3 - §5.6.5]

Decisions concerning investigations, corrective actions and closure of a major non-conformance shall be analysed during non-conformance review board including the Supplier's and Customer's technical and PA managers.

Conformity status & comments:

REQ-PA-3.13-70 [source: RD3 - §5.6.5]

The actions decided for processing and closure of major non-conformances shall be approved by the Customer.

Conformity status & comments:

REQ-PA-3.13-80 [source: RD3 - §5.6.6]

Processing for each major non-conformance shall be recorded on a non-conformance sheet containing at less:

- A description of the non-conformance (occurrence date, affected model, status of the non conformance),
- Investigations conducted and the results,
- Corrective actions,
- Validation tests,
- Corresponding documentation (references of memos, reports, etc.).

Conformity status & comments:

REQ-PA-3.13-90 [source: RD3 - §5.6.7. to §5.6.12]

Minor non-conformances shall be available for consultation by the Customer during key points, technical reviews and PTRB.

Conformity status & comments:

REQ-PA-3.13-100 [source: RD3 - §5.6.7. to §5.6.12]

The Customer reserves the right to change a minor non-conformance into a major one and the inverse.

Conformity status & comments:

REQ-PA-3.13-110 [source: RD3 - §5.6.7. to §5.6.12]

All non-conformances (minor and major) relative to a product shall be closed before it is delivered.

Conformity status & comments:

REQ-PA-3.13-120 [source: RD5 - §4.4]

A basic disposition for a nonconforming item can be one of the following:

a. Return to supplier:

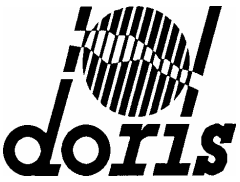
This disposition only applies to nonconforming procured items.

b. Use .as-is.:

The item is found to be usable without eliminating the nonconformance.

c. Rework:

The item is recoverable to conform completely to all specified requirements. By definition, rework is the re-application of the process as originally planned.

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Additional work shall be performed to prepare the item for the rework (e.g. removal of faulty work and cleaning). In no case should the result of earlier applied processes or the precondition for other processes to be applied later on, be affected.

d. Repair:

The item is recoverable such that it fulfils the intended usage requirements although it does not conform to the originally specified requirements.

The repair procedure shall be one of the following:

1. Qualified or standard repair procedure:

Those repair procedures which have been approved by the customer in advance for defined applications.

2. Specific repair procedure:

Those repair procedures which are prepared for the specific nonconformance and are approved by the NRB.

Any repair procedure shall include the verifications needed to check the repair result.

e. Scrap:

The item is not recoverable by rework or repair, for technical or economic reasons.

3.14 ALERT SYSTEM

DEFINITION [sources: RD1 plus RD3 - §5.7.3.b]

The alert system shall provide for formal notification to users, informing them of failures or nonconformity of items, which could also be present on other items already delivered [e.g. items with identical design concept, materials, components or processes], when all of the following criteria are met:

1. The item with the observed failure or problem has multiple applications, which can have implications for more than one project, thus requiring prompt action.
2. The failure or problem has occurred in the application of an item within the specified design and usage limitations. However, failures or problems due to usage within reasonably expected limits of performance, but where these limits were not specified precisely, should also cause the issuing of an alert.
3. A preliminary investigation has provided sufficient evidence of the root cause of the failure or problem.
4. The failures or problems are confirmed not to be of a random nature.

REQ-PA-3.14-10 [source: RD3 - §5.7.3.a]

The Supplier shall assess the impacts of internal alerts and shall inform the Customer of their consequences.

Conformity status & comments:

REQ-PA-3.14-20 [source: RD3 - §5.7.4]

The Supplier shall process alerts distributed by the Customer, by distribution of incoming relevant alerts to all possible affected users within the project organization.

Conformity status & comments:

REQ-PA-3.14-30 [source: RD3 - §5.7.4]

The Supplier shall process alerts distributed by the Customer, by assessment of incoming alerts to project work, and definition, implementation and follow-up of necessary corrective actions at any contractual level.

Conformity status & comments:

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3.15 HANDLING, STORAGE AND PRESERVATION

REQ-PA-3.15-10 [source: modified RD3 - §5.8]

The Supplier shall establish procedures and instructions for handling, storage / removal from storage, packaging / unpacking, preservation, marking, labelling, and transporting equipment, in order to ensure the integrity of the equipment for which they are responsible.

Conformity status & comments:

REQ-PA-3.15-20 [source: modified RD3 - §5.8]

These procedures for handling, storage and shipping shall be integrated in the user manual.

Conformity status & comments:

REQ-PA-3.15-30 [source: modified RD3 - §5.8]

The Supplier shall ensure that environment conditions are compatible with the specifications for the equipment (humidity, cleanliness, protection against shocks, temperature, pressure, etc.).

Conformity status & comments:

3.16 STATISTICAL QUALITY CONTROL AND ANALYSIS

REQ-PA-3.16-10 [source: RD3 - §5.9.1]

Statistical quality control and analysis methods, such as sample inspection plans, determination of quality levels, statistical process control and process capabilities studies, may be used whenever such methods are suitable to maintain or improve the required control of quality.

- When employing statistical quality control and analysis methods, the supplier shall ensure that all the conditions for proper use are enforced (e.g. sample significance, recording and elaboration of data, and formulation of clear decision rules).
- Statistical quality control applications, when used by the supplier for acceptance of materials, parts, processes and products, shall be approved by the customer.

Conformity status & comments:

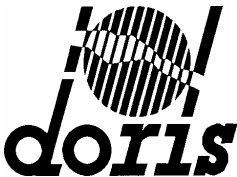
REQ-PA-3.16-20 [source: RD3 - §5.9.2]

- Sampling plans shall not be used when tests are non-destructive and the reduction in inspection or testing can jeopardize the fulfilment of the business agreement requirements.
- The supplier shall use existing international sampling plans to the maximum degree practicable.
- Sampling procedures shall be validated by the supplier's QA organization for the sample selection methods, and criteria for inspection severity, acceptance or rejection and screening of rejected lots.
- The supplier shall maintain complete records together with clear identification of the characteristics to which sampling is applied.

Conformity status & comments:

3.17 DESIGN AND VERIFICATION - GENERAL REQUIREMENTS

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3.18 DESIGN AND VERIFICATION - PLANNING

(intentionally left blank)

3.19 ORGANIZATIONAL AND TECHNICAL INTERFACES

REQ-PA-3.19-10 [source: RD3 - §6.3.b]

The supplier shall implement a QA programme to assure that incomplete, ambiguous or conflicting requirements shall be resolved with those responsible for imposing these requirements.

Conformity status & comments:

REQ-PA-3.19-20 [source: RD3 - §6.3.c]

The supplier shall implement a QA programme to assure that feedback information is maintained from production, test, product assurance, operations, towards design implementation.

Conformity status & comments:

REQ-PA-3.19-30 [source: RD3 - §6.3.d]

The supplier shall implement a QA programme to assure that methods and procedures are established to ensure that the experience gained in present and past activities is systematically incorporated into design construction.

Conformity status & comments:

3.20 DESIGN RULES – PRODUCEABILITY

REQ-PA-3.20-10 [source: RD3 - §6.4.2.a]

The product SHALL be so designed that it can be produced in an efficient manner with the required level of quality, according to capabilities and organization of the production.

Conformity status & comments:

3.21 DESIGN RULES – REPEATABILITY

REQ-PA-3.21-10 [source: RD3 - §6.4.3]

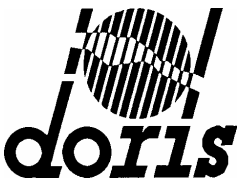
The product SHALL be so designed that its performances and characteristics can be reproduced over different models and serial production.

Conformity status & comments:

3.22 DESIGN RULES – INSPECTABILITY AND TESTABILITY

REQ-PA-3.22-10 [source: RD3 - §6.4.4]

The product SHALL be so designed that it can be easily and efficiently inspected and tested under

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representative conditions, for production, AIV and operational environment.

Conformity status & comments:

3.23 DESIGN RULES – OPERABILITY

REQ-PA-3.23-10 [source: RD3 - §6.4.5]

The product SHALL be so designed that it can be operated safely and easily in accordance with programme constraints and requirements, throughout its whole life cycle including handling, storage, transportation, integration and operations.

Conformity status & comments:

3.24 STANDARDS AND PROCEDURES

(intentionally left blank)

3.25 VERIFICATION PROCESS

REQ-PA-3.25-10 [source: RD3 - §6.6.1.c]

A system for tracking requirements and verification of results SHALL be established and maintained during the whole project life cycle.

Conformity status & comments:

REQ-PA-3.25-20 [source: RD3 - §6.6.2.a]

The supplier shall implement a QA programme to assure that the objectives of the analysis are clearly defined in relation with the development logic defined in the verification plan.

Conformity status & comments:

REQ-PA-3.25-30 [source: RD3 - §6.6.2.b]

The following items shall be identified:

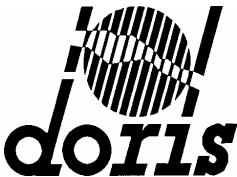
- reference of the configuration item definition under analysis;
- environmental constraints considered in the analysis;
- basic assumptions, analysis methods, mathematical models.

Conformity status & comments:

REQ-PA-3.25-40 [source: RD3 - §6.6.3]

The Supplier shall establish a verification matrix for technical specifications including for each requirement the following items: the type of justification and facilities implemented (modelling, tests, etc.), the references for corresponding technical reports, conformance status, possible comments.

Conformity status & comments:

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3.26 QUALIFICATION PROCESS

REQ-PA-3.26-10 [source: RD3 - §6.6.4.1]

The Supplier shall guarantee that all configuration items and their constituent items, either off-the-shelf or specifically designed, are properly qualified with margins commensurate with the application and use environment.

Conformity status & comments:

3.27 QUALIFICATION BY SIMILARITY

REQ-PA-3.27-10 [source: RD3 - §6.6.4.2.a+c]

Qualification by similarity with an identical or similar product (off-the-shelf equipment) shall be justified by providing evidence that the new application is within the limits of the previously qualified design :

- qualification test results meet the requirements
- any non-conformances during qualification test are available for evaluation
- qualification requirements and qualification ranges are compatible with project requirements (including operational conditions : environment, robustness, lifetime, etc.)
- Reliability data are compatible with project requirements (qualitative aspect: in flight experience),
- Differences in the as-built configuration of the flight model and of the qualification model are available
- a logbook of the selected model is available for review.

Conformity status & comments:

REQ-PA-3.27-20 [source: RD3 - §6.6.4.2.b]

Any difference in definition with respect to the reference product and any difference in the required qualification tests shall be identified.

Conformity status & comments:

REQ-PA-3.27-30 [source: RD3 - §6.6.4.2.b]

The need for complementary qualification tests (or analyses) shall be analysed and the decision justified and submitted to the Customer approval.

Conformity status & comments:

3.28 QUALIFICATION TESTING

REQ-PA-3.28-10 [source: RD3 - §6.6.4.3.a]

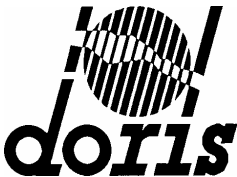
The product used for qualification testing shall be produced in accordance with a full and clearly identified manufacturing and inspection file.

Conformity status & comments:

REQ-PA-3.28-20 [source: RD3 - §6.6.4.3.b]

To obtain authorization to initiate qualification tests the Supplier shall demonstrate that:

1. The qualification model is fully representative of the flight model and any differences have been analysed to evaluate their effect on the qualification status.

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2. Inspection and test requirements are expressed in an unambiguous and quantified manner.

Conformity status & comments:

REQ-PA-3.28-30 [source: RD3 - §6.6.4.3.b3]

The qualification test procedures and facilities shall be defined before the qualification tests begin and shall be checked during the Test Readiness Reviews (TRR).

Conformity status & comments:

3.29 QUALIFICATION STATUS REPORTING

REQ-PA-3.29-10 [source: RD3 - §6.6.4.4.a]

The Supplier shall track, record and periodically report to the Customer, the qualification status of all deliverable items as well the progress of the qualification programme.

Conformity status & comments:

REQ-PA-3.29-20 [source: RD3 - §6.6.4.4.b]

Lists showing qualification status of items shall be made available at the various project reviews.

Conformity status & comments:

3.30 MAINTENANCE OF QUALIFICATION

REQ-PA-3.30-10 [source: RD3 - §6.6.4.5]

Once the design has been qualified, all subsequent changes, deviations and anomalies shall be reviewed for their impact on the qualification status and requalified as necessary (complementary qualification).

Conformity status & comments:

3.31 DESIGN CHANGES

REQ-PA-3.31-10 [source: RD3 - §6.7]

The supplier shall implement a QA programme to assure that all design changes and modifications are identified, documented, reviewed and approved before their implementation.

Conformity status & comments:

3.32 QA REQUIREMENTS FOR PROCUREMENT

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3.33 SELECTION OF PROCUREMENT SOURCES

REQ-PA-3.33-10 [source: RD3 - §7.2.1]

The supplier quality assurance organization shall participate in and approve the selection of procurement sources.

Conformity status & comments:

REQ-PA-3.33-20 [source: RD3 - §7.2.2]

The Supplier shall select its suppliers according to their competence in the space domain.
In case of uncertainty, an evaluation audit shall be set up.

Conformity status & comments:

3.34 RECORD AND LIST OF PROCUREMENT SOURCES

REQ-PA-3.34-10 [source: RD3 - §7.2.3.a]

The supplier shall establish and maintain records of all procurement sources involved in business agreement performance.

Conformity status & comments:

REQ-PA-3.34-20 [source: RD3 - §7.2.3.b]

The supplier shall submit to the customer, upon request, the list of procurement sources, including all the information in the records above, for information.

Conformity status & comments:

3.35 PROCUREMENT DOCUMENTS

REQ-PA-3.35-10 [source: RD3 - §7.3]

The Supplier shall ensure that for each procurement the following information is provided: technical specifications for the product or a data sheet, "customer" (of a product) acceptance conditions, Procurement deadlines, Certificate of conformance, Guarantee of perennality.

Conformity status & comments:

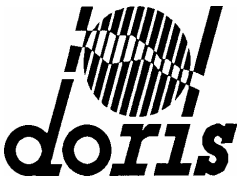
3.36 SURVEILLANCE OF PROCUREMENT SOURCES

REQ-PA-3.36-10 [source: RD3 - §7.4.2]

The surveillance programme – at least for critical procurement sources - shall include, to the extent appropriate, audits, reviews (e.g. manufacturing readiness review), mandatory inspection points and source inspection.

Conformity status & comments:

REQ-PA-3.36-20 [source: RD3 - §7.4.3]

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The Supplier shall define the most appropriate type and extent of surveillance, considering criteria such as

- quality cannot be verified by inspection or test at Supplier's facility,
- past performance or quality history of the lower level supplier is marginal,
- functional criticality and technical complexity of the supplies.

Conformity status & comments:

REQ-PA-3.36-30 [source: RD3 - §7.4.4]

The supplier shall ensure that each of his suppliers implements adequate surveillance on their lower level suppliers, in accordance with the same criteria.

Surveillance may be delegated by the customer to third parties.

Conformity status & comments:

3.37 RECEIVING INSPECTION

REQ-PA-3.37-10 [source: RD3 - §7.5.1.a]

The Supplier shall take appropriate actions to ensure that all incoming supplies, including documentation and packaging, conform to the requirements of the procurement documents.

Conformity status & comments:

REQ-PA-3.37-20 [source: RD3 - §7.5.2]

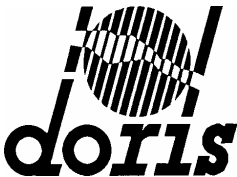
Receiving inspection activities shall include :

- verification of the packaging conditions and of the status of environmental sensors,
- visual inspection of the delivered items,
- verification of correct identification and, where appropriate, configuration identification for conformance to the ordering data,
- verification of the evidence of inspection and tests performed by the supplier and associated documentation,
- verification of the performance of supplier's source inspection, when required,
- performance of inspections and tests on selected characteristics of incoming supplies or test specimens submitted with the supplies,
- identification of the shelf life of limited-life items,
- identification of the inspection status and physical separation of the supplies in the receiving inspection area according to the following categories:
 - items for which the receiving inspection has not been completed;
 - conforming items;
 - nonconforming items.
- prevention of unauthorized use of uninspected items,
- identification of the items to be released for production (or to be stored according to §3.15) with conformance status and traceability data to be recorded in manufacturing documents,
- maintenance of receiving inspection records (see § 3.39).

Conformity status & comments:

3.38 CUSTOMER FURNISHED ITEMS

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3.39 RECEIVING INSPECTION RECORDS

REQ-PA-3.39-10 [source: RD3 - §7.5.4]

Receiving inspection records shall be maintained to ensure traceability and the availability of historical data to monitor supplier performance and quality trends.

Conformity status & comments:

3.40 QA REQUIREMENTS FOR MANUFACTURING, ASSEMBLY AND INTEGRATION

REQ-PA-3.40-10 [source: RD3 - §8.1]

The supplier shall ensure that the deliverables are built, assembled and integrated to the approved configuration baseline, in a planned, controlled and reproducible manner.

Conformity status & comments:

3.41 PLANNING OF MANUFACTURING, ASSEMBLY AND INTEGRATION ACTIVITIES AND ASSOCIATED DOCUMENTS

REQ-PA-3.41-10 [source: RD3 - §8.2.1]

The supplier, after a complete review of all requirements defined by the design and engineering documentation, shall plan manufacturing, assembly and integration operations in coordination with inspections and tests.

Conformity status & comments:

REQ-PA-3.41-20 [source: RD3 - §8.2.2]

The planning of manufacturing, assembly and integration operations and inspections shall be reflected in the manufacturing plan or flow chart for the product, which shall clearly depict the sequence of operations and associated inspections and tests. It shall include the identification of MIPs (see § 3.55), together with the reference to the procedures by which the various activities are performed and the required cleanliness levels and temperature and humidity requirements of the facilities.

Conformity status & comments:

REQ-PA-3.41-30 [source: RD3 - §8.2.3]

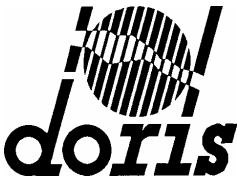
Adequate instructions, such as shop travellers, shall direct the actual performance of manufacturing, assembly and integration operations and inspections, to ensure that the activities proceed in an orderly manner and according to the planned sequence.

Conformity status & comments:

REQ-PA-3.41-40 [source: RD3 - §8.2.4]

Manufacturing, assembly and integration documents shall be issued and maintained in accordance with established and formal procedures.

Conformity status & comments:

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REQ-PA-3.41-50 [source: RD3 - §8.2.5.1]

The quality assurance function shall review and approve such documents, and any modifications thereof, to ensure that they include or refer to:

- identification of the item to be manufactured or equipment to be used,
- configuration data, including parts lists, drawings, changes and specifications,
- identification of the production and inspection equipment (e.g. tools, jigs and fixtures) to be used for the manufacturing, assembly and integration of the item,
- identification of critical characteristics as defined in ECSS-Q-30,
- detailed definition, by description or reference, of manufacturing, assembly, integration, inspections and test operations to be performed, and special conditions to be maintained,
- provisions for inspections and tests to be witnessed by customer representative,
- accept or reject criteria (with tolerances) and workmanship standards,
- details of sampling inspection procedures to be used, if any, and
- detailed procedures for the activities to be performed.

Conformity status & comments:

REQ-PA-3.41-60 [source: RD3 - §8.2.6]

The supplier shall also provide for detail support documents and instructions, such as drawings, procedure and instruction sheets, to enable operations to be correctly performed.

Conformity status & comments:

3.42 MANUFACTURING READINESS REVIEWS

See RD7

REQ-PA-3.42-10 [source: RD3 - §8.3.1]

The supplier shall perform an internal review of the readiness for manufacturing, prior to starting the manufacture of the first flight-standard product.

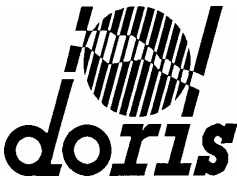
Conformity status & comments:

REQ-PA-3.42-20 [source: RD3 - §8.3.2]

The manufacturing readiness review shall evaluate systematically the following aspects:

- status of product definition and requirements, differences with the status of the qualification model, and impacts of these differences;
- status of manufacturing, assembly, inspection and test documentation, differences with the status of the qualification model, and impacts of these differences;
- validation status of manufacturing processes, with particular emphasis on critical processes;
- implementation of adequate dispositions for risk reduction, as defined by risk assessment, into the manufacturing, assembly, integration, inspection and test procedures;
- availability of required production, measuring and inspection equipment, and calibration status, when relevant;
- cleanliness of facilities, with respect to the required cleanliness levels;
- facility temperature and humidity with respect to requirements.

Conformity status & comments:

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3.43 CONTROL OF MANUFACTURING PROCESSES

REQ-PA-3.43-10 [source: RD3 - §8.4.1.a]

The Supplier shall monitor all processes used for manufacturing, assembly and integration, and shall enforce all applicable process requirements.

Conformity status & comments:

REQ-PA-3.43-20 [source: RD3 - §8.4.1.b]

All manufacturing processes shall be covered by documented process specifications or standards according to RD23.

Conformity status & comments:

REQ-PA-3.43-30 [source: RD3 - §8.4.1.c]

Process specifications shall include QA provisions, methods for inspection and test, number of samples, accept or reject criteria.

Conformity status & comments:

REQ-PA-3.43-40 [source: RD3 - §8.4.1.d]

Process witness samples shall be stored in proper conditions, as long as necessary.

Conformity status & comments:

3.44 CRITICAL MANUFACTURING PROCESSES

REQ-PA-3.44-10 [source: RD3 - §8.4.2]

The Supplier shall establish and implement procedures and controls for critical processes, to ensure that:

- critical processes are validated for the intended application in accordance with RD23,
- personnel who perform critical processes or evaluate the process performance are trained and certified or can demonstrate their proficiency through their regular activity,
- materials, equipment, computer systems and software, and procedures involved in the performance of the critical process are validated and monitored, and
- coordination is maintained with the cognizant engineering function to ensure proper selection of the non-destructive or destructive methods for the evaluation of process performance.

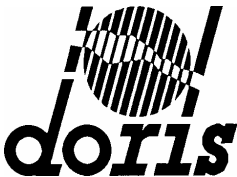
Conformity status & comments:

3.45 STATISTICAL PROCESS CONTROL

REQ-PA-3.45-10 [source: RD3 - §8.4.3]

When applicable, statistical methods for process control should be used for early detection of significant variations in manufacturing processes, in order to determine, analyse and eliminate the causes of undesirable variations.

Conformity status & comments:

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3.46 WORKMANSHIP STANDARDS

REQ-PA-3.46-10 [source: RD3 - §8.5.1]

The supplier shall employ workmanship standards throughout all phases of manufacturing, assembly and integration, to ensure acceptable and consistent workmanship quality levels.

Conformity status & comments:

REQ-PA-3.46-20 [source: RD3 - §8.5.2]

Workmanship standards shall identify acceptance or rejection criteria.

Conformity status & comments:

REQ-PA-3.46-30 [source: RD3 - §8.5.3]

Physical samples or visual aids shall be reviewed and agreed by the customer when they are used for the purpose of acceptance or rejection of items.

Conformity status & comments:

3.47 MATERIALS AND PARTS CONTROL

Requirements for the selection and control of materials and parts are defined in §7.

REQ-PA-3.47-10 [source: RD3 - §8.6.2]

The supplier shall ensure that only conforming items are released and used, and that those not required for the operation involved are removed from work operation areas.

Conformity status & comments:

REQ-PA-3.47-20 [source: RD3 - §8.6.3]

Items having limited-life or definite characteristics of quality degradation or drift with age or use shall be marked to indicate the dates, test times or cycles at which life was initiated and at which the useful life expires.

Conformity status & comments:

REQ-PA-3.47-30 [source: RD3 - §8.6.4]

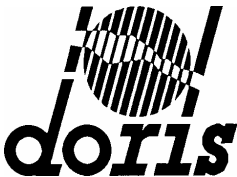
Sensitive items shall be processed or manufactured, inspected and tested in a controlled environment to prevent any degradation.

Conformity status & comments:

3.48 EQUIPMENT CONTROL - TOOLING

REQ-PA-3.48-10 [source: RD3 - §8.7.1]

- The supplier shall make provisions for accountability, identification and maintenance of manufacture, assembly and integration tooling.
- Manufacture, assembly and integration tooling shall be checked for its dimensional accuracy, regarding

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the product drawings, and correct function.

- c. Tooling shall be approved by the quality assurance organization prior to use. The approval shall be stamped on the equipment and recorded.
- d. Tools shall be checked for accuracy during the production life at adequate intervals.
- e. Tools shall be submitted to re-approval following modification.
- f. Tools shall be properly stored to prevent misuse, damage and deterioration.
- g. Unnecessary tools shall be removed from working areas.
- h. Records shall be kept of all manufacturing equipment.

Conformity status & comments:

3.49 EQUIPMENT FOR COMPUTER-AIDED MANUFACTURING

REQ-PA-3.49-10 [source: RD3 - §8.7.2]

- a. The supplier shall ensure that computer-aided techniques and data for processing and machining are validated prior to use and controlled during their use in manufacturing.
- b. In particular, provisions shall be made for the testing, approval and configuration control of the software involved and prevention of its being tampered with.
- c. Manufacturing, assembly and integration records shall be available for consultation by the Customer.

Conformity status & comments:

3.50 CLEANLINESS AND CONTAMINATION CONTROL PLAN

REQ-PA-3.50-10 [source: RD3 - §8.8.1.a]

The Supplier shall establish requirements and controls for molecular and particulate cleanliness of flight hardware and facilities and the limitation of sources of contamination.

Conformity status & comments:

REQ-PA-3.50-20 [source: RD3 - §8.8.1.b]

The controls to be applied shall be specified in a Cleanliness and Contamination Control plan.

Conformity status & comments:

3.51 CLEANLINESS LEVELS

REQ-PA-3.51-10 [source: new]

The Supplier shall guarantee that his equipment has been cleaned so as to be compatible with the cleanliness level during integration of the equipments into the micro-satellite (100000-class environment).

Conformity status & comments:

REQ-PA-3.51-20 [source: RD3 - §8.8.2.a]

Contamination-sensitive items shall be cleaned, controlled and maintained to the required cleanliness levels.

Conformity status & comments:

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REQ-PA-3.51-30 [source: RD3 - §8.8.2.b]

The required cleanliness levels for all levels of flight hardware shall be indicated on drawings, specifications, procedures, or other documents controlling the manufacture, assembly, integration and test of the items.

Conformity status & comments:

3.52 CLEANING MATERIALS AND METHODS

REQ-PA-3.52-10 [source: RD3 - §8.8.3]

The Supplier shall develop detailed methods for attaining the cleanliness levels required for the hardware. which shall be indicated in the user manual.

Conformity status & comments:

3.53 CONTAMINATION CONTROL

REQ-PA-3.53-10 [source: RD3 - §8.8.4.a]

Contamination shall be prevented to the maximum extent possible by operating in clean working areas and by proper handling, preservation, packaging and storage.

Conformity status & comments:

REQ-PA-3.53-20 [source: RD3 - §8.8.4.b]

Contamination-sensitive items fabricated or processed in contamination-controlled environments shall be inspected, tested, modified or repaired in identical or cleaner environments, unless specific precautions are taken to protect the items concerned from contamination.

Conformity status & comments:

REQ-PA-3.53-30 [source: RD3 - §8.8.4.c]

Specific protection measures, such as protective dust covers, shall be implemented to protect contamination-sensitive items when they are integrated in a higher level of assembly.

Conformity status & comments:

3.54 CLEANLINESS OF FACILITIES

REQ-PA-3.54-10 [source: RD3 - §8.8.5]

Fabrication, assembly and integration of contamination sensitive items shall be conducted in facilities that provide cleanliness levels compatible with the required product cleanliness.

Conformity status & comments:

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3.55 MANUFACTURING, ASSEMBLY AND INTEGRATION INSPECTION

REQ-PA-3.55-10 [source: RD3 - §8.9.1]

Inspection and tests shall be planned at the points of the manufacturing, assembly and integration flow where maximum assurance for correct processing and prevention of unrecoverable or costly nonconformances can be obtained.

Conformity status & comments:

REQ-PA-3.55-20 [source: RD3 - §8.9.2]

All critical characteristics identified in the critical item control programme shall be inspected, where feasible.

Conformity status & comments:

REQ-PA-3.55-30 [source: RD3 - §8.9.3]

Self-inspection by the operators performing the associated manufacturing, assembly and integration activities shall not be considered sufficient for critical characteristics.

Conformity status & comments:

REQ-PA-3.55-40 [source: RD3 - §8.9.4]

Among the inspections and tests as part of the manufacturing, assembly and integration flow, some selected inspections, called mandatory inspection points (MIPs) shall be performed with participation of representatives from the final or next contractual customer.

Conformity status & comments:

REQ-PA-3.55-50 [source: RD3 - §8.9.5]

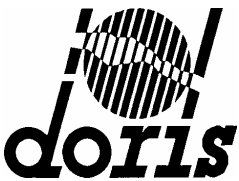
MIPs shall be agreed with the customer.

Conformity status & comments:

REQ-PA-3.55-60 [source: RD3 - §8.9.6]

MIPs shall be selected in accordance with the criteria as defined below, when one or more of the following conditions apply:

- a. When maximum visibility of quality is given.
- b. When critical processes are performed.
- c. Where the next step of the manufacturing sequence:
 - is irreversible, or
 - makes the item difficult and costly to disassemble for inspection, or
 - renders the location inaccessible for inspection.
- d. When the item, once installed in the next higher assembly damages by its failure the higher assembly.
- e. When previous failure history of the item indicates a need for inspection.
- f. When a potential adverse impact on the properties and integrity of the end product could result, owing to the criticality or complexity of the manufacturing step.
- g. When testing or critical inspections cannot be accomplished by the supplier (e.g. environments or test equipment not available at supplier's facility).
- h. When verification tests are destructive in nature and the quality cannot be verified solely by inspection or test at the supplier's facility.
- i. When manufacturing and AIV of complex equipment or subsystems (e.g. payloads) is planned.

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- j. When past performance or quality history of the lower level supplier is marginal.
k. When an item is going to final inspection.
Criteria g. to j. shall be considered together with the criticality and complexity of the supplies and the supplier's experience with the lower level supplier.

Conformity status & comments:

REQ-PA-3.55-70 [source: RD3 - §8.9.7]

A MIP shall require an invitation with the agreed notice before the event, and the participation of the customer, or their written agreement to proceed without their participation.

Conformity status & comments:

REQ-PA-3.55-80 [source: RD3 - §8.9.8]

The supplier shall make provisions for a positive identification of the inspection and test status of any items at any stage of the manufacturing, assembly and integration cycle, starting from the incoming inspection up to shipping of the end item.

Conformity status & comments:

3.56 AIV-CONTROL OF TEMPORARY INSTALLATIONS AND REMOVALS

REQ-PA-3.56-10 [source: RD3 - §8.10.1.a]

The supplier shall ensure the management and control of flight items which are temporarily removed or non-flight items which are temporarily installed to facilitate assembly, integration, testing, handling or preservation of the end item.

Conformity status & comments:

REQ-PA-3.56-20 [source: RD3 - §8.10.1.b]

The control shall be initiated upon installation or removal of the first temporarily installed or removed item and shall be maintained through delivery and use of the end item.

Conformity status & comments:

REQ-PA-3.56-30 [source: RD3 - §8.10.1.c]

Records of temporary installations and removals shall be established and maintained.

Conformity status & comments:

REQ-PA-3.56-40 [source: RD3 - §8.10.1.d]

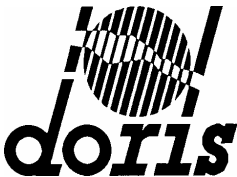
Temporarily installed items shall be accounted for to prevent their being incorporated in the final flight configuration.

Conformity status & comments:

3.57 LOGBOOKS

REQ-PA-3.57-10 [source: RD3 - §8.10.2.a]

The Supplier shall prepare and maintain logbooks in accordance with annex B of RD3 for all operations and

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tests performed on the item during the period to be covered by the logbook.

Conformity status & comments:

REQ-PA-3.57-20 [source: RD3 - §8.10.2.b]

Equipment logbooks shall start with the first qualification or acceptance test after assembly.

Conformity status & comments:

REQ-PA-3.57-30 [source: RD3 - §8.10.2.c]

Subsystem and system logbooks shall follow-on from the individual equipment logbooks to form a full record.

Conformity status & comments:

REQ-PA-3.57-40 [source: RD3 - §8.10.2.d]

The logbook shall accompany the hardware whenever it is placed in the custody of another organization and this organization shall update it.

Conformity status & comments:

REQ-PA-3.57-50 [source: RD3 - §8.10.2.e]

The logbooks shall contain historical and quality data and information which is significant for operation of the item, including non-conformances, deviations and open tasks, type of operations performed (unpacking, assembly, disassembly, connections, tests and tests conditions, inspection, cleaning, etc.), date of operations and the name of the operator.

Conformity status & comments:

NOTA : The logbook is supplied with the EIDP (end item data package cf. § 3.66) of the subassembly.

3.58 MANUFACTURING, ASSEMBLY AND INTEGRATION RECORDS

REQ-PA-3.58-10 [source: RD3 - §8.11]

Manufacturing, assembly and integration records shall be established and maintained, to provide all manufacturing, assembly, integration and inspection data required for traceability.

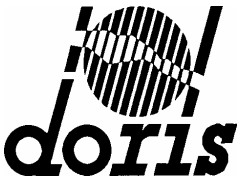
Conformity status & comments:

3.59 TEST FACILITIES

REQ-PA-3.59-10 [source: RD3 - §9.1]

The supplier shall ensure that test facilities, either internal or external, conform to the business agreement requirements.

Conformity status & comments:

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3.60 TEST EQUIPMENT

REQ-PA-3.60-10 [source: RD3 - §9.2.1]

The supplier shall ensure that computer-aided testing techniques and data are validated prior to use and controlled during their use in testing. In particular, provisions shall be made for testing, approval and configuration control of the software involved and prevention of its being tampered with.

Conformity status & comments:

REQ-PA-3.60-20 [source: RD3 - §9.2.2]

It shall be possible to verify the correct operation of all items of test equipment without having to apply them to the test item.

Conformity status & comments:

3.61 TEST PROCEDURES

REQ-PA-3.61-10 [source: RD3 - §9.3.1.a]

The supplier shall implement a QA programme to assure that tests are performed in accordance with documented procedures, which shall include, as a minimum:

1. scope of the test, including the identification of the requirement being verified,
2. identification of the test object,
3. applicable documents, with their revision status,
4. test flow,
5. test organization,
6. test conditions,
7. test equipment and set-up,
8. step-by-step procedure, including definition of specific steps to be witnessed by QA personnel,
9. recording of data,
10. pass or fail criteria and test data evaluation requirements, and
11. guidelines or criteria for deviation from test procedure and for retest.

Conformity status & comments:

REQ-PA-3.61-20 [source: RD3 - §9.3.1.b]

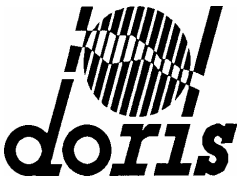
Test procedures and reports shall be reviewed and approved by the Supplier QA function.

Conformity status & comments:

REQ-PA-3.61-30 [source: safety]

If a test has a hazard potential with consequence severity critical or catastrophic, the test procedure shall highlight the nature of the hazard, and the hazard controls and safety devices shall be specified at the relevant operational steps.

Conformity status & comments:

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3.62 TEST REPORTS

REQ-PA-3.62-10 [source: RD3 - §9.3.2]

The supplier shall ensure that all tests are comprehensively documented in test reports, and that they include, as a minimum:

- reference to the applicable test procedure, and description of the deviations from it during the actual testing,
- test data records and evaluation, and
- summary of test results.

Conformity status & comments:

REQ-PA-3.62-20 [source: new]

Test reports shall include a conclusion stating the extent to which compliance with the relevant requirement(s) has been demonstrated, and what actions are recommended to overcome areas of non-compliance.

Conformity status & comments:

3.63 TEST PERFORMANCE MONITORING

REQ-PA-3.63-10 [source: RD3 - §9.4.1]

On the basis of an analysis of the test plan, the supplier's QA function shall define within the test plan the most appropriate way to monitor the performance of test activities, to ensure the adherence to the test procedures, and that any deviations are properly documented and treated.

Conformity status & comments:

REQ-PA-3.63-20 [source: RD3 - §9.4.2]

Test witnessing by supplier's QA personnel shall be considered when manual intervention is performed, at the setting-up, start and end of continuous fully automated test sequences, or when no automatic recording of test parameters or results is available.

Conformity status & comments:

REQ-PA-3.63-30 [source: RD3 - §9.4.3]

All testing activities related to critical characteristics as identified in the critical items control programme shall be certified.

Conformity status & comments:

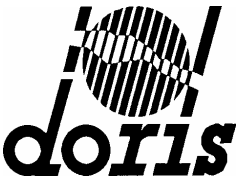
REQ-PA-3.63-40 [source: RD3 - §9.4.4]

Self-certification by the operators performing the test activities shall not be considered sufficient for critical characteristics.

Conformity status & comments:

REQ-PA-3.63-50 [source: RD3 - §9.4.5]

Testing activities or results to be subject to formal QA certification shall be identified as such in the relevant test procedure.

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Conformity status & comments:

REQ-PA-3.63-60 [source: RD3 - §9.4.6]

Testing shall be subject to the requirements for the control of hazardous operations defined in ECSS-Q-40.

Conformity status & comments:

REQ-PA-3.63-70 [source: RD3 - §9.4.7]

Where safety of personnel or damage to items or associated test equipment is possible, QA personnel shall be given direct authority to stop the test or shall give immediate access to anyone who holds such authority.

Conformity status & comments:

3.64 TEST REVIEWS

Definition

Purpose of the Test Readiness Review (TRR) - See RD8- :

- assess the as-built status of the items to be tested against the required configuration;
- review the status of non-conformances to verify that those still open have no impact on the validity of the test;
- review that approval status of the test procedure;
- assess the readiness of the test facility (including safety aspects).

Definition

Purpose of the Post-Test Review (PTR) - See RD9- :

- verify the completeness of the test data and their conformance to the requirements. If the test was successful, state that test results comply with the requirements and the test item can be processed/ tested further;
- verify that all deviations from the initial test procedure were authorized;
- verify that non-conformance and failures during the test were recorded and a disposition made.

REQ-PA-3.64-10 [source: RD3 - §9.5.1]

The supplier shall implement a QA programme to assure that formal reviews are performed before (TRR) and after (PTR) major portions of qualification or acceptance tests.

Conformity status & comments:

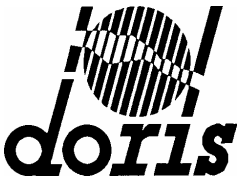
REQ-PA-3.64-20 [source: RD3 - §9.5.2]

The QA function shall be represented in the formal boards established for the review of readiness for testing and testing accomplishment.

TRR and PTR reviews shall be conducted by a Test Review Board (TRB) consisting of :

- the QA function (chairman);
- the engineering representative;
- the AIT representative;
- Customer representative if required.

Conformity status & comments:

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3.65 QA REQUIREMENTS FOR ACCEPTANCE AND DELIVERY

REQ-PA-3.65-10 [source: RD3 - §10.1.1]

The supplier shall establish a formal acceptance process for all deliverable items, at any contractual level, to ensure that conformance of the items to be delivered is fully assessed and documented.

Conformity status & comments:

REQ-PA-3.65-20 [source: RD3 - §10.1.2]

The supplier shall also ensure that the preparation of the items for delivery and the physical delivery itself are performed in such a way that quality degradation is prevented.

Conformity status & comments:

3.66 END ITEM DATA PACKAGE

REQ-PA-3.66-10 [source: RD3 - §10.2.1]

Every deliverable end item (flight and spare equipment) shall be delivered with their specific EIDP which shall contain:

- Certificate of conformance
- As-built configuration list including the reference and last issue of the documentation describing the equipment
- Logbook,
- Results of acceptance tests,
- Critical items list
- Limited life items list
- Temporary installation records
- Open/ deferred work, open tests
- Qualification status list
- Non-conformance list
- Deviations and waivers list
- Cleanliness certificate
- Safety assessment
- Verification control document
- Loose delivered items list
- Documents and records for further integration, testing and operation in higher-level assemblies
- Special packaging and shipping procedure

Conformity status & comments:

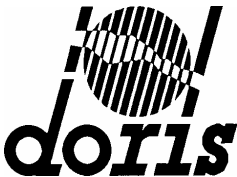
REQ-PA-3.66-20 [source: RD3 - §10.2.2]

The EIDP shall constitute the basis for formal acceptance reviews.

Conformity status & comments:

REQ-PA-3.66-30 [source: RD3 - §10.2.3]

The EIDP shall include the set of documents and records for further integration, testing and operation in higher level assemblies.

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Conformity status & comments:

REQ-PA-3.66-40 [source: RD3 - §10.2.4]

EIDPs shall be maintained and integrated into higher level EIDPs during subsystem or system integration and testing.

Conformity status & comments:

3.67 DELIVERY REVIEW BOARD (DRB)

REQ-PA-3.67-10 [source: RD3 - §10.3.1]

The supplier shall ensure that a DRB is convened prior to the delivery of equipments, separately assembled subsystems, test equipment or handling equipment for higher level activities.

Conformity status & comments:

REQ-PA-3.67-20 [source: RD3 - §10.3.2]

The DRB functions at system level shall be fulfilled by the final acceptance review defined in the business agreement and chaired by the customer.

Conformity status & comments:

REQ-PA-3.67-30 [source: RD3 - §10.3.3]

The DRB shall be composed, at least, of the following members:

- a. Representatives of the receiving organization:
 - Project manager, or authorized representative, as chairman;
 - PA manager, or authorized representative;
 - Engineering or design manager, or authorized representative.
- b. Submitting supplier's representatives:
 - Project manager, or authorized representative;
 - PA manager, or authorized representative;
 - Engineering or design manager, or authorized representative.
- c. Higher level customers' representative(s), as observers (not required for separate subsystems).

Conformity status & comments:

REQ-PA-3.67-40 [source: RD3 - §10.3.5]

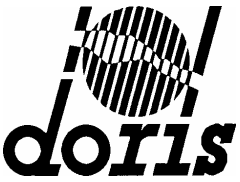
The DRB shall be responsible for authorising the shipment of the items under acceptance, and certifying in writing that:

- a. the items conform to the contractual requirements and to an approved design configuration;
- b. the items are free from material and workmanship deficiencies;
- c. all non-conformances are closed-out, or corresponding plans, compatible with the delivery, are accepted;
- d. the relevant EIDP is complete and accurate.

Conformity status & comments:

REQ-PA-3.67-50 [source: RD3 - §10.3.6]

Delivery shall only be authorized by the unanimous agreement of the DRB members and the certificate of

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conformity is available and signed by the Supplier responsible.

Conformity status & comments:

3.68 PREPARATION FOR DELIVERY

REQ-PA-3.68-10 [source: RD3 - §10.4.1]

The supplier shall ensure that packaging materials, methods, procedures and instructions provide for protection of items while at the supplier's plant, during transportation, and as far as is practicable after their arrival at destination.

Conformity status & comments:

REQ-PA-3.68-20 [source: RD3 - §10.4.2]

The supplier shall ensure that appropriate marking and labelling for packaging, storage, transportation and shipping of items are performed in accordance with the applicable specifications.

Conformity status & comments:

3.69 SHIPPING CONTROL AND TRANSPORTATION

REQ-PA-3.69-10 [source: RD3 - §10.5.1.a]

The supplier shall ensure that the items to be shipped from his plant are inspected before release and found to be complete, adequately preserved and packaged, correctly marked and accompanied by all the required documentation.

Conformity status & comments:

REQ-PA-3.69-20 [source: RD3 - §10.5.1.b]

Accompanying documentation shall include the EIDP and, attached to the outside of the shipping container, the handling and packing or unpacking procedure and any relevant safety procedures.

Conformity status & comments:

REQ-PA-3.69-30 [source: RD3 - §10.5.2]

The supplier shall make provisions for the prevention of damage to items during transportation.

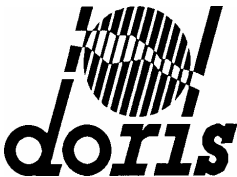
Conformity status & comments:

4. **DEPENDABILITY**

4.1 INTRODUCTION

[source: RD1] [EN 13701:2001]

Availability term definition :

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Ability of an item to be in a state to perform a required function under given conditions at a given instant of time or over a given time interval, assuming that the required external resources are provided.

- NOTE 1 This ability depends on the combined aspects of the reliability performance, the maintainability performance and the maintenance support performance.
- NOTE 2 Required external resources, other than maintenance resources do not affect the availability performance of the item.
- NOTE 3 When referring to the measure for availability, the preferred term is "instantaneous availability".
- NOTE 4 Adapted from IEC Multilingual Dictionary:2001 edition.

[source: RD1] [IEC Multilingual Dictionary:2001 edition]

Reliability term definition :

The ability of an item to perform a required function under given conditions for a given time interval.

- NOTE 1 It is generally assumed that the item is in a state to perform this required function at the beginning of the time interval.
- NOTE 2 Generally, reliability performance is quantified using appropriate measures. In some applications these measures include an expression of reliability performance as a probability, which is also called reliability.

4.2 ORGANISATION

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4.3 DEPENDABILITY PROGRAMME PLAN

REQ-PA-4.3-10 [source: RD10 - §4.3.d]

The establishment and implementation of the dependability programme plan – or compliance matrix to the PA requirements see § 2.3 - shall be considered in conjunction with the safety aspects of the programme. In particular the Contractor shall make sure that any potential conflict between dependability and safety requirements are adequately managed.

Conformity status & comments :

4.4 DEPENDABILITY RISK ASSESSMENT AND CONTROL

REQ-PA-4.4-10 [source: RD10 - §4.4.a+b]

As part of the risk management process, the Dependability engineer is responsible for identifying dependability associated risks that leads to the non-conformance to Dependability requirements. The identified risks and recommendations shall be reported to the (Supplier) project management.

Conformity status & comments :

REQ-PA-4.4-20 [source: RD10 - §4.4.c]

Dependability risk analysis reduction and control shall include the following steps:

- a. identification and classification of undesirable events according to the severity of their consequences;

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- b. analysis of failure scenarios, determination of related failure modes, failure origins or causes;
- c. classification of functions and associated products into criticality categories, allowing definition of appropriate tailoring of risk reduction efforts in relation with their criticality;
- d. definition of actions and recommendations for detailed risk assessment, risk elimination, or risk reduction and control to an acceptable level;
- e. implementation of risk reduction;
- f. decisions on risk reduction and risk acceptance;
- g. verification of risk reduction, assessment of residual risks.

Conformity status & comments :

REQ-PA-4.4-30 [source: RD10 - §4.4.d]

The process of risk identification and assessment implies both qualitative and quantitative approaches. All identified technical risks have to be assessed primarily for their consequence severity and categorized according to the appropriated project severity category and corresponding controls shall be recommended.

Conformity status & comments :

4.5 DEPENDABILITY CRITICAL ITEMS

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4.6 DESIGN REVIEWS

REQ-PA-4.6-10 [source: RD10 - §4.6.a]

The Supplier shall ensure that all dependability data for a design review are complete to a level of detail consistent with the objectives of the review and are presented to the Customer in accordance with the project review schedule.

Conformity status & comments :

REQ-PA-4.6-20 [source: RD10 - §5.4.2 Q30B]

The Supplier shall ensure that dependability aspects are duly considered in all design reviews.

Conformity status & comments :

REQ-PA-4.6-30 [source: RD10 - §4.6.b]

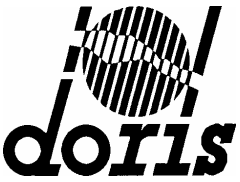
All dependability data submitted shall clearly indicate the design baseline upon which it is based and shall be coherent with all other supporting technical documentation.

Conformity status & comments :

REQ-PA-4.6-40 [source: RD10 - §4.6.c]

All design changes shall be assessed for their impact on dependability and a reassessment of the dependability shall be performed on the modified design where necessary.

Conformity status & comments :

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4.7 AUDITS

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4.8 USE OF PREVIOUSLY DESIGNED, MANUFACTURED, QUALIFIED OR FLOWN ITEMS

REQ-PA-4.8-10 [source: RD10 - §4.8.a]

Where the Supplier proposes to take advantage of previously designed, manufactured, qualified or flown elements in his system, he shall demonstrate that the proposed elements do conform to the dependability assurance requirements of the design specification.

Conformity status & comments :

4.9 DEPENDABILITY LESSONS LEARNT

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4.10 SUBCONTRACTOR CONTROL

REQ-PA-4.10-10 [source: RD10 - §4.10]

The Supplier shall be responsible for ensuring that products obtained from subcontractors meet the dependability requirements specified for the overall system.

Conformity status & comments :

4.11 PROGRESS REPORTING

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4.12 DOCUMENTATION

REQ-PA-4.12-10 [source: RD10 - §4.12.a]

The Supplier shall maintain all data used for the dependability programme. The file shall contain the following as a minimum:

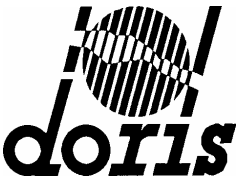
- dependability analyses, lists, reports and input data;
- dependability recommendation status log.

Conformity status & comments :

REQ-PA-4.12-20 [source: RD10 - §4.12.b]

Upon request the Customer shall have access to project dependability data.

Conformity status & comments :

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4.13 INTEGRATION OF DEPENDABILITY IN THE PROJECT

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4.14 DEPENDABILITY REQUIREMENTS IN TECHNICAL SPECIFICATION

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4.15 DEPENDABILITY DESIGN CRITERIA: GENERAL

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4.16 CONSEQUENCE SEVERITY CATEGORIES

Definition

Catastrophic consequence:

loss of life, injury to personnel
or loss or damage of launcher or launch site facilities
or long-term detrimental environmental effects

Critical consequence:

complete loss of mission or short-term detrimental environmental effects

Major consequence:

Major mission degradation

Minor or negligible consequence:

Minor mission degradation or any other effect

REQ-PA-4.16-10 [source: RD10 - §5.3.2.a]

The severity of a failure consequence shall be classified according to the following scale:

- 1 Catastrophic
- 2 Critical
- 3 Major
- 4 Minor or negligible.

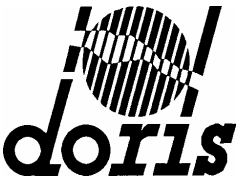
Conformity status & comments :

4.17 FAILURE TOLERANCE

REQ-PA-4.17-10 [source: RD10 - §5.3.3.a]

The Supplier shall verify the capability of the design to sustain single or multiple failures in accordance with failure tolerance requirements defined in the specifications.

Conformity status & comments :

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REQ-PA-4.17-20 [source: RD10 - §5.3.3.b]

This verification shall address all failure modes whose severity of consequence is classified as catastrophic, critical and major according to the project risk policy.

Conformity status & comments :

4.18 DESIGN APPROACH

REQ-PA-4.18-10 [source: RD10 - §5.3.4.c]

In implementation of availability and reliability into the design, the following methods shall preferably apply:

- functional design:
 - implementation of failure tolerance;
 - implementation of fault detection, isolation and recovery, allowing proper failure processing by dedicated flight and ground measures, and considering detection or reconfiguration times in relation with propagation times of events under worst case conditions;
 - implementation of monitoring of the parameters that are essential for mission performance, considering the failure modes of the system in relation to the actual capability of the detection devices, and considering the acceptable environmental conditions to be maintained on the product.
- physical design:
 - application of proven design rules;
 - preferred use of design that has performed successfully in the intended mission environment;
 - selection of parts having an appropriate quality level;
 - use of EEE parts derating and stress margins for mechanical parts;
 - optimum use of design techniques for redundancy (while keeping system design complexity as low as possible);
 - maximization of inspectability and testability of built-in equipment;
 - providing accessibility to equipment.

Conformity status & comments :

4.19 CRITICALITY CLASSIFICATION OF FUNCTIONS AND PRODUCTS

REQ-PA-4.19-10 [source: RD10 - §5.4.1.a]

During the preliminary design phase, the Supplier shall classify functions, and products into criticality categories.

Conformity status & comments :

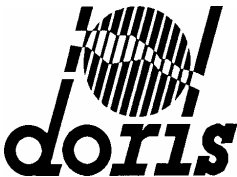
REQ-PA-4.19-20 [source: RD10 - §5.4.1.c]

The criticality category of functions (hardware and software) shall be directly related to the severity of the consequences resulting from failure of the function (e.g. a function whose failure induces a catastrophic consequence shall be classified with the highest criticality level).

Conformity status & comments :

4.20 INVOLVMENT IN DESIGN PROCESS

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4.21 INVOLVMENT IN OPERATIONAL ASPECTS

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4.22 DEPENDABILITY RECOMMENDATIONS

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4.23 IDENTIFICATION AND CLASSIFICATION OF UNDESIRABLE EVENTS

REQ-PA-4.23-10 [source: RD10 - §6.2.1]

The Supplier shall provide identification of undesirable events leading to the loss or degradation of product performances, together with their classification into categories related to the severity of their consequences.

Conformity status & comments :

4.24 ASSESSMENT OF FAILURE SCENARIOS

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4.25 DEPENDABILITY ANALYSIS AND THE PROJECT LIFE CYCLE

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4.26 DEPENDABILITY ANALYTICAL METHODS: GENERAL

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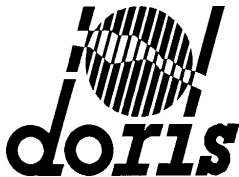
4.27 RELIABILITY PREDICTION

REQ-PA-4.27-10 [source: RD10 - §6.5.2.1]

Reliability prediction

1. Reliability prediction techniques shall be used to optimize the reliability of a design against competing constraints such as cost mass, to predict the in-service reliability of a product and to provide failure probability data for purposes such as risk assessment.
2. The reliability data sources and methods used in reliability predictions shall be as specified by the customer.
3. If the reliability data sources and methods are not specified by the customer, the supplier shall justify the selected data sources and methods used, for customer approval.
NOTE : ECSS-Q-30-08 is a guideline for the selection of reliability data sources and their use.
4. Reliability models shall be prepared to support predictions and FMEA/FMECA.

Conformity status & comments :

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4.28 FMEA/FMECA ANALYSES

See RD11

REQ-PA-4.28-10 [source: RD10 - §6.5.2.2]

The following analyses used for reliability analysis are also used for determining maintainability and availability requirements and tasks:

1. The analysis of failure mode effects FMEA/FMECA shall be performed at the functional level for the whole DORIS equipment and at component level for the interfaces in order to identify failure propagations.
2. All potential failure modes shall be identified and classified according to the severity (FMEA/FMECA) or criticality (FMECA) of their consequences. Measures shall be proposed in the analysis and introduced in the product design and in the control of processes to render all such consequences acceptable to the project.
3. When any design or process changes are made, the FMEA/FMECA shall be updated and the effects of new failure modes introduced by the changes shall be assessed.
4. Provisions for failure detection and recovery actions shall be identified as part of the FMEA/FMECA/FMECA.
5. The FMEA/FMECA shall be used to support the reliability modelling, the reliability and safety analyses, maintainability analysis, logistic support activity, test and maintenance planning, and the FDIR policy.
6. As part of the FMEA/FMECA, potential failure propagation shall be assessed.
7. Principles, requirements and procedures to apply FMEA/FMECA are described in RD11.
Preliminary FMEA/FMECA is required for PDR. Detailed FMEA/FMECA is required for CDR.

Output :

- ➡ Interfaces component FMECA
- ➡ Internal functional FMECA

|| for customer's agreement

Conformity status & comments :

4.29 HARDWARE-SOFTWARE INTERACTION ANALYSIS

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4.30 CONTINGENCY ANALYSIS

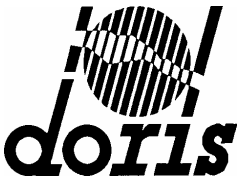
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4.31 FAULT-TREE ANALYSIS

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4.32 COMMON-CAUSE ANALYSES

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4.33 WORST CASE ANALYSIS

See RD12 and RD13

REQ-PA-4.33-10 [source: RD10 - §6.5.2.7]

WCA shall be performed on electronic/electrical equipment to demonstrate that it performs within specification despite particular variations in its constituent part parameters and the imposed environment. WCA shall be accomplished at equipment level.

The supplier shall identify the functions which are critical in term of performance maintain during the whole DORIS life, considering component ageing, radiation dose effects, temperature fluctuation, etc. For these functions a WCA analysis is requested.

WCA shall be realized according to ECSS-Q-30-01.

Conformity status & comments :

4.34 PART DERATING - PART STRESS ANALYSES

See RD14

REQ-PA-4.34-10 [source: RD10 - §6.5.2.8.a]

Part derating shall be implemented to assure that the stress levels applied to all EEE parts are within the limits specified by RD14.

Conformity status & comments :

REQ-PA-4.34-20 [source: RD10 - §6.5.2.8.b]

Part Stress Analyses (PSA) shall be performed at equipment level to verify that the derating rules have been implemented.

Conformity status & comments :

4.35 ZONAL ANALYSIS

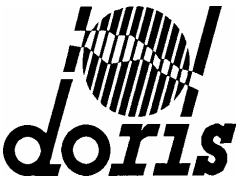
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4.36 INSTRUMENT INPUTS FOR FDIR

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4.37 MAINTENABILITY ANALYSES

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4.38 AVAILABILITY ANALYSES

REQ-PA-4.38-10 [source: RD10 - §6.5.4.a]

The Supplier shall perform availability analyses or simulations in order to assess the availability of the system.

The results are used to

- optimize the system concept with respect to design, operations and maintenance,
- verify conformance to availability requirements, and
- provide inputs to estimate the overall cost of operating the system.

Conformity status & comments :

4.39 OUTAGE ANALYSES

Definition

Outages regroupes :

- all Single Events Effects (SEU, SEL, MEU, SET, etc.) taking into account mean radiation fluxes and exceptional fluxes due to solar flares
- failures inducing a reconfiguration of the payload with delay (switch to redundancy, etc.)
- instrument's calibrations if any.

REQ-PA-4.39-10 [source: RD10 - §6.5.4.b+c+d]

The Supplier shall perform the outage analyses in order to supply input data for availability analyses.

The analysis output includes a list of all potential outages identified (as defined in the project), their causes, probabilities of occurrence and duration. Instead of outage probabilities, failure rates associated with outages can be provided.

Furthermore, the means of outage detection and the recovery methods shall be identified in the analysis.

Conformity status & comments :

4.40 DEPENDABILITY CRITICAL ITEMS LIST

REQ-PA-4.40-10 [source: RD10 - §6.6.a]

As a minimum failures with risk of propagation and single-point failures classified as catastrophic, critical or major, shall be listed as a critical item.

Conformity status & comments :

REQ-PA-4.40-20 [source: RD10 - §6.6.b]

Products that cannot be checked and tested after integration, limited-life products, products that do not meet - or cannot be verified as meeting - applicable maintainability requirements, shall be listed as critical items.

Conformity status & comments :

4.41 SOFTWARE DEPENDABILITY

REQ-PA-4.41-10 [source: RD10 - §5.4.2]

Software dependability shall be considered as part of the overall project dependability efforts and shall not

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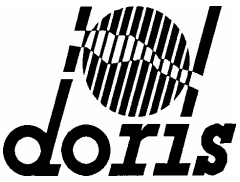
be conducted in isolation. It shall be the objective of the software dependability effort to ensure that dependability is considered throughout the software development.

Functions implemented by software shall be identified and analysed in the same manner as hardware functions, except that it is not possible to quantitatively assess these functions. Only a qualitative assessment can be made as the dependability of software is influenced by the software development process which is affected by the criticality of the software in relation to mission success.

Conformity status & comments :

4.42 DEPENDABILITY TESTING, DEMONSTRATION AND DATA COLLECTION

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5. SAFETY

5.1 SAFETY REQUIREMENTS

REQ-PA-5.1-10 [source: AD1]

The supplier shall apply all the requirements from AD1 outside a manned flight context.

Conformity status & comments :

REQ-PA-5.1-20 [source: AD1]

The Supplier shall establish a compliance matrix to the safety requirements for the Customer's approval.

Conformity status & comments :

5.2 SITE SAFETY REGULATIONS

REQ-PA-5.2-10 [source: AD1]

Risks related to the safety of people and properties during handling, integration, tests, etc., shall be identified, and corrective actions shall be implemented to comply with the legislation in force. In particular:

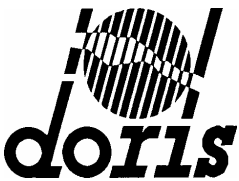
- on the launch site, the site safety regulations shall be applicable,
- during manufacturing, integration, tests, etc., the site safety regulations shall be applicable.

5.3 SAFETY ANALYSIS AT EQUIPMENT LEVEL

REQ-PA-5.3-10 [source: AD1]

Specific analyses, of the fault tree type, shall be used to demonstrate:

- that no single failure will lead to the risk of serious injury to individuals or significant damage to property,
- that no double failure will lead to the risk of human lives loss.

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6. EEE COMPONENTS

6.1 DEFINITION

The following terms and definitions are specific to this Standard in the sense that they are complementary or additional to those contained in ECSS-P-001B [RD1].

Note 1 The term “EEE component” is synonymous with the terms "EEE Part", "Component" or just "Part".

Note 2 For the purpose of clear understanding of this document, hereunder is a listing of component categories which are covered by the term EEE component, encapsulated or non-encapsulated, irrespective of the quality level: Capacitors, Connectors, Crystals, Discrete semiconductors (including diodes, transistors), Filters, Fuses, Magnetic components (e.g. Inductors, Transformers), Monolithic Microcircuits (including MMICs), Hybrid circuits, Relays, Resistors, heaters, Surface acoustic wave devices, Switches (including mechanical, thermal), Thermistors, Wires and Cables, Optoelectronic Devices (including opto-couplers, LED, CCDs, displays, sensors), Passive Microwave Devices (including, for instance, mixers, couplers, isolators and switches).

agent

Organization contracted to perform the procurement of EEE components including related engineering and quality assurance tasks.

characterization

Determination of the attributes of an EEE component, in sufficient detail to allow assessment of its suitability for a particular use or application.

commercial component

Part neither designed, nor manufactured with reference to military or space standards

Note 3 Commercial components are parts procured against a set of publicly available data put under configuration control by the supplier. They are a sub-set of non qualified parts which are approved through justification documents (including data collection, risk mitigation plan and its final results).

concurrent engineering

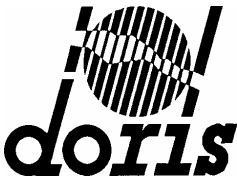
Engineering activity taking place in the context of simultaneous design of the product, the production process and all associated product usages, in an integrated, multifunctional team, with external organizational constraints minimized.

qualified parts

Parts belonging to QPLs or QMLs from the following normative systems: SCC, MIL, JAXA, CECC.

screening

Tests, inspections or combination thereof, imposed on 100% of parts, to remove unsatisfactory items or those likely to exhibit early failures.

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space qualified parts

Parts belonging to QPLs or QMLs from the following normative systems (ESCC, MIL, JAXA) according to quality levels listed in Table A-1 of the ECSS-Q-60-B.

6.2 COMPONENT PROGRAMME MANAGEMENT

6.2.1 GENERAL

REQ-PA-6.2.1-10 [source : RD15 §5.1.1]

The supplier shall establish and implement throughout the duration of the business agreement a component programme, which ensures that the requirements of the project as defined by the customer and the supplier in the related business agreement are in compliance with this specification.

EXPECTED OUTPUT : Compliance matrix.

6.2.2 COMPONENTS CONTROL PROGRAMME

REQ-PA-6.2.2-10 [source: RD15 §5.1.2.1]

Organization

The supplier shall identify the organization responsible for the management of the component programme, and describe the organization's approaches (including the procurement system and its rationale) and capability to efficiently implement, manage, and control the component requirements.

6.2.3 PARTS CONTROL BOARD

REQ-PA-6.2.3-10 [source: RD15 §5.1.3]

The approval of the selection and usage of EEE parts are implemented through Parts Control Boards (PCBs) held between the customer and the supplier

REQ-PA-6.2.3-20 [source: RD15 §5.1.3]

At supplier's level, the PCB is chaired by the supplier's parts engineer. The composition of the PCB shall as a minimum include the suppliers' parts engineer and a customer parts engineer.

REQ-PA-6.2.3-30 [source: RD15 §5.1.3]

Other pertinent experts from the customer or suppliers may also participate, on request.

REQ-PA-6.2.3-40 [source: RD15 §5.1.3]

Depending on the progress of the program, the main PCB activities shall be :

- Review and approval of the supplier's EEE parts management plan and any associated document
- Parts approval including evaluation activities,
- Problem assessment (e.g. non-conformances, RFD, RFW and alerts, delivery delays).

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6.2.4 RADIATION REVIEW

REQ-PA-6.2.4-10 [source : Engineering judgement]

A radiation review shall be held at PDR as defined in RNC-Q-60-507.

6.2.5 DECLARED COMPONENTS LIST

REQ-PA-6.2.5-10 [source: RD15 §5.1.4]

For each equipment, its supplier shall issue a DCL the electronic format EXCEL identifying all component types needed.

REQ-PA-6.2.5-20 [source: RD15 §5.1.4]

This list shall be kept under configuration control (issue and identification of changes).

REQ-PA-6.2.5-30 [source: RD15 §5.1.4]

The DCL shall be issued as a minimum at PDR and CDR (as designed) and at flight hardware delivery (as built).

REQ-PA-6.2.5-40 [source: RD15 §5.1.4]

After equipment CDR, all modifications affecting the PAD information shall be implemented, in the "as design" DCL, through the CN / CR process, submitted to the customer for approval.

REQ-PA-6.2.5-50 [source: RD15 §5.1.4]

The "as design" DCL shall be sent to the customer for approval.

EXPECTED OUTPUT : "as design" DCL

REQ-PA-6.2.5-60 [source: RD15 §5.1.4]

Any change of parts during equipment manufacturing (e.g. type and manufacturer) shall be handled through RFWs submitted to the customer for approval.

EXPECTED OUTPUT : RFW during equipment manufacturing

REQ-PA-6.2.5-70 [source: RD15 §5.1.4]

The "as built" DCL reflecting the actual EEE parts assembled into the flight hardware and their date code, shall be provided to the customer for review at the delivery of the flight hardware.

EXPECTED OUTPUT : "as built" DCL

REQ-PA-6.2.5-80 [source: RD15 §5.1.4]

The content of the DCL shall be as specified in its DRD in Annex D.

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6.3 COMPONENT SELECTION, EVALUATION AND APPROVAL

6.3.1 GENERAL

REQ-PA-6.3.1-10 [source: RD15 §5.2.1]

The supplier shall consider the following requirements during his selection process :

- Project requirements (e.g. quality levels, component policy, manufacturing and delivery schedules and budgets, quantities, export rules requirements),
- Design requirements (e.g. component type, case, dimensions, materials),
- Production requirements (e.g. packaging, thermal and storage constraints, component mounting process, ...),
- Operational requirements (e.g. electrical, mechanical, radiation, reliability, assembly, lifetime)

Note : The supplier of each product is responsible for the selection of components that do enable the performance, lifetime, environmental, material, safety, quality and reliability requirements of the product of which it forms a part, to be satisfied in all respects.

REQ-PA-6.3.1-10 [source: Engineering judgement]

During the selection process, the supplier shall first consider qualified parts (according the quality level of the Annex-A). If these parts are not available, upscreens Hi-Rel parts shall be secondly considered.

6.3.2 MANUFACTURER AND COMPONENT SELECTION

6.3.2.1 General rules

REQ-PA-6.3.2.1-10 [source: RD15 §5.2.2.1]

The supplier shall establish and maintain in his own facility, and ensure that his suppliers also establish and maintain, procedures for selecting and controlling all components intended for use in deliverable products.

REQ-PA-6.3.2.1-20 [source: RD15 §5.2.2.1]

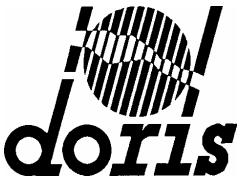
Components shall be selected on the basis of proven qualification, characterization, and previous space experience and data, relevant with regard to the requirements for the programme, from manufacturers or sources (preferably European) employing effective Product Assurance Programmes in manufacturing and test.

REQ-PA-6.3.2.1-30 [source: RD15 §5.2.2.1]

Preference shall be given to components which necessitate the least evaluation or qualification effort.

REQ-PA-6.3.2.1-40 [source: RD15 §5.2.2.1]

When selecting items, particular attention shall be paid to the current data, applicability of the basis of qualification, problem notifications and alerts, and adequacy of specifications.

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6.3.2.2 Parts and material restriction

REQ-PA-6.3.2.2-10 [source: RD15 §5.2.2.2]

The supplier shall ensure that non-hermetically sealed materials of components meet the requirements of ECSS-Q-70 regarding off-gassing, out-gassing, flammability, toxicity and/or other criteria specified for the intended use.

REQ-PA-6.3.2.2-20 [source: RD15 §5.2.2.2]

The supplier shall evaluate the robustness of selected EEE components to the stresses induced by its assembly techniques.

REQ-PA-6.3.2.2-30 [source: RD15 §5.2.2.2]

With respect to health and safety, beryllium oxide (except if identified in the procurement specification), cadmium, lithium, magnesium, mercury, zinc, radioactive material and all material which may cause safety hazard shall not be used.

REQ-PA-6.3.2.2-40 [source: RD15 §5.2.2.2]

For limited life, known instability, safety hazard or reliability risk reasons, the use of EEE parts listed below shall not be used:

- Pure tin (less than 3% Pb in case of SnPb alloy) used as finish on the leads, terminations and external surfaces of components and packages.
- Hollow core resistors,
- Potentiometers (except for mechanism position monitoring),
- Non-metallurgical bonded diodes,
- Semiconductor dice non passivated on active area,
- Wet slug tantalum capacitors other than capacitor construction using double seals and a tantalum case,
- Any component whose internal construction uses metallurgic bonding with a melting temperature not compatible with the end-application mounting conditions,
- Wire link fuses < 5A,
- TO5 relays without double welding or with integrated diodes,
- RNC90 > 100kohms (shall not be used for new designs),
- TO3 and DO4/DO5 packages (shall not be used for new designs).

REQ-PA-6.3.2.2-50 [source: RD15 §5.2.2.2]

The use of pure tin in internal cavities may be authorized, on a case-by-case basis, based on the demonstration there is no alternative product and there is no risk (supported by technical note).

EXPECTED OUTPUT : Technical note for parts having pure tin in internal cavities

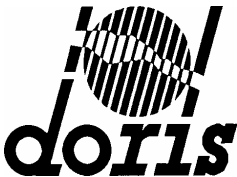
REQ-PA-6.3.2.2-60 [source: RD15 §5.2.2.2]

The justification of the use of pure tin shall be presented during PCB for the customer's approval.

6.3.2.3 Radiation hardness

REQ-PA-6.3.2.3-10 [source: RD15 §5.2.2.3]

The supplier who is responsible for the design of the piece of hardware shall demonstrate the compliance of its components selection with the radiation constraints of the project in accordance with the requirements of RNC-Q-60-507 [AD2].

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REQ-PA-6.3.2.3-20 [Engineering judgement]

The supplier shall apply the requirements defined in RNC-Q-60-507 to evaluate the radiation constraints of a given equipment (radiation environment and shielding).

REQ-PA-6.3.2.3-30 [source: RD15 §5.2.2.3]

The supplier shall apply the requirements defined in RNC-Q-60-507 to assess the actual radiation tolerance of the selected components for compliance with the radiation requirements in term of total dose, displacement damages and Single Events Effects (SEE).

EXPECTED OUTPUT : Equipment radiation analysis document

REQ-PA-6.3.2.3-40 [source: RD15 §5.2.2.3]

The supplier shall apply the requirements defined in RNC-Q-60-507 to identify components which are not compliant with the radiation requirements as critical radiation sensitive components.

REQ-PA-6.3.2.3-50 [source: RD15 §5.2.2.3]

The supplier shall implement a Radiation Hardness Assurance Programme, documented by a plan to be approved by the customer, for radiation sensitive components, covering the collection of all relevant information and specifying the necessary actions in terms of evaluation and procurement testing, planning and control.

EXPECTED OUTPUT : Radiation hardness assurance plan

REQ-PA-6.3.2.3-60 [source: RD15 §5.2.2.3]

The supplier shall issue an Equipment Radiation Analysis document identifying all sensitive components w.r.t. the relevant radiation effects, their impact and giving an adequate design solution (local shielding, design solution, specific test, RVT, ...) for the relevant equipment in accordance with the requirements of RNC-Q-60-507.

REQ-PA-6.3.2.3-70 [source: RD15 §5.2.2.3]

The Equipment Radiation Analysis document shall be submitted to the customer for approval.

Note : more detailed information about the above requirements is given in ECSS-E-10-12.

EXPECTED OUTPUT : Equipment radiation analysis document

6.3.2.4 Derating

REQ-PA-6.3.2.4-10 [source: RD15 §5.2.2.4].

The supplier shall implement derating rules for components used in his designs in accordance with the requirements of ECSS-Q-30-11.

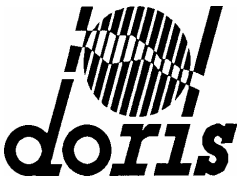
REQ-PA-6.3.2.4-20 [source: RD15 §5.2.2.4].

For wire link fuses (<5A), the current derating factor shall be 50% with an additional derating of 0,2%/°C for an increase in the temperature of fuse body above 25°C

6.3.2.5 Commercial parts.

REQ-PA-6.3.2.5-10 [Source : Engineering judgement]

Only monolithic integrated circuits are authorised in commercial grade.

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REQ-PA-6.3.2.5-20 [Source : Engineering judgment]

The supplier shall use commercial/industrial parts only for performance criteria.

REQ-PA-6.3.2.5-30 [Source : Engineering judgment]

The supplier shall demonstrate that no equivalent part, in term of performance, can be found in the High Reliability quality level. For this demonstration, a trade off shall be performed between the selected commercial component and the equivalent Hi-Rel component. For this trade off, the supplier shall consider :

- the need in terms of functionality, package, cost, schedule, risk level, assembly capability.
- the constraints in terms of environmental characteristics (e.g. thermal, mechanical, radiation, ON/OFF cycling, mission time, etc.).

This demonstration shall be detailed in the Justification Dossier.

REQ-PA-6.3.2.5-40 [Source : Engineering judgment]

The supplier shall manage a part types reduction/standardization programme for commercial parts.

REQ-PA-6.3.2.5-50 [Source : Engineering judgment]

Commercial component/manufacture parts shall be selected using the following criteria:

- Worldwide leading manufacturer : the manufacturer shall belong to the first three worldwide leading manufacturers of the component family (memory, ASIC, FPGA, microprocessor, analogical Monolithic Microcircuits).
- Main product of the manufacturer (runner product).
- High-volume product (>10000 parts) for Automotive or Medicine applications.
- Mature technology (>1 year).
- Single lot : Commercial parts shall be procured in a single lot, according to the standard manufacturer process.
- Wide temperature range: If the component is available in different temperature ranges, the component which has the widest temperature range shall be selected.
- Adapted performance grade: If the component is available in different performance grades, the component which has the grade adapted to the application shall be selected.

REQ-PA-6.3.2.5-60 [Source : Engineering judgment]

Active discrete parts and passive parts (and especially Capacitors, Connectors, Crystals, Filters, Fuses, Magnetic components, Relays, Resistors, heaters, Switches, Thermistors, Wires and Cables) shall not be used in commercial grade.

The supplier may submit a request for waiver to the precedent requirement, case by case, exceptionally, and only for performance reasons.

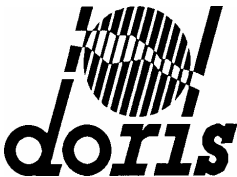
6.3.2.6 Export license limitations

REQ-PA-6.3.2.6-10 [Source : Engineering judgment]

Component selection shall take into account export license limitations.

REQ-PA-6.3.2.6-20 [Source : Engineering judgment]

The supplier shall take all measures that it deems fit to obtain all authorisations (licences approvals, etc.) required to manufacture, use, integrate, sell and/or export any element covered by the applicable laws and regulations in this respect.

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REQ-PA-6.3.2.6-30 [Source : Engineering judgment]

The supplier shall provide the customer with a copy of all authorisations obtained.

REQ-PA-6.3.2.6-40 [Source : Engineering judgment]

The authorisations obtained accordingly shall be reviewed during PCB.

EXPECTED OUTPUT : Export Authorisation

REQ-PA-6.3.2.6-50 [Source : Engineering judgment]

The supplier shall immediately inform the customer in writing regarding any refusal, suspension or withdrawal of an authorisation, including pursuant to a change in laws or regulations, which prevents the continuation or the performance of the equipment.

REQ-PA-6.3.2.6-60 [Source : Engineering judgment]

Parts subject to export restrictions or regulations shall not be preferred.

REQ-PA-6.3.2.6-70 [Source : Engineering judgment]

For US parts only : ITAR controlled components shall not be used.

REQ-PA-6.3.2.6-80 [Source : Engineering judgment]

For US parts only : EAR ECCN controlled components shall not be preferred.

6.3.3 COMPONENT EVALUATION

6.3.3.1 General

REQ-PA-6.3.3.1-10 [source: RD15 §5.2.3.1].

The supplier shall perform a component evaluation in absence of an approved demonstration that a component has the ability to conform to the requirements for functional performance, quality, dependability, and environmental resistance as required for the project.

REQ-PA-6.3.3.1-20 [source: RD15 §5.2.3.1].

The supplier shall plan and carry out the evaluation.

REQ-PA-6.3.3.1-30 [source: RD15 §5.2.3.1].

The planning of evaluation actions shall be derived from the results of an assessment of the design and application of the needed component.

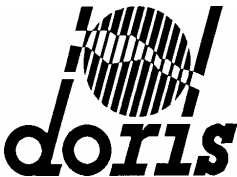
REQ-PA-6.3.3.1-40 [source: RD15 §5.2.3.1].

The evaluation actions shall be described in an evaluation plan, sent to the customer for approval, and include the following elements:

- Constructional Analysis.
- Evaluation Testing.
- Radiation Hardness.

EXPECTED OUTPUT : Evaluation plans

REQ-PA-6.3.3.1-50 [source: RD15 §5.2.3.1].

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In the definition of the evaluation programme any information including pertinent reliability, analysis and test data from the manufacturer of the component and previous use in comparable application shall be considered.

REQ-PA-6.3.3.1-60 [source: RD15 §5.2.3.1].

Omission of any of these elements, or alternative activities, shall be justified.

REQ-PA-6.3.3.1-70 [source: RD15 §5.2.3.1].

All tests and inspections shall be carried out on representative samples of the component type from the current production of the same manufacturer as intended to be used for the flight hardware.

REQ-PA-6.3.3.1-80 [source: RD15 §5.2.3.1].

The supplier shall summarize the result of all evaluation actions in the evaluation report, sent to the customer for approval.

EXPECTED OUTPUT : Evaluation reports

REQ-PA-6.3.3.1-90 [source: RD15 §5.2.3.1].

The evaluation report shall be reviewed to determine if they will have an impact on the content of the procurement specification.

6.3.3.2 Constructional analysis

REQ-PA-6.3.3.2-10 [source: RD15 §5.2.3.2].

Constructional analysis shall be carried out on representative components. The primary aim of constructional analysis is to provide an early indication of a component's probability of meeting the evaluation requirements and the operational goals of the concerned programme.

REQ-PA-6.3.3.2-20 [source: RD15 §5.2.3.2].

The Constructional Analysis shall comprise destructive and non-destructive inspections, analyses, and testing, to identify: Design and construction technology, Materials used, Inherent reliability aspects, Quality of workmanship, Potential hazards.

REQ-PA-6.3.3.2-30 [source: RD15 §5.2.3.2].

The findings of the analysis shall be contained within a Constructional Analysis Report and shall be included in the Evaluation Report.

6.3.3.3 Evaluation testing

REQ-PA-6.3.3.3-10 [source: RD15 §5.2.3.3].

The evaluation shall determine which inspections or tests are required to provide the confidence that the component type under evaluation, when assembled and tested in accordance with the procurement specification, successfully meets the mission requirements.

REQ-PA-6.3.3.3-20 [source: RD15 §5.2.3.3].

The supplier shall review the already existing data in order to adapt the content of the evaluation testing which can include: Endurance test (operating at elevated temperature and electrical stress), Mechanical stress (shock, vibration, constant acceleration), Environmental stress (thermal shock, temperature cycling,

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high and low temperature storage, humidity), Assembly capability testing, Radiation testing, for total dose and single event effects sensitivity.

Note: for guidance refer to ESCC basic specification no. 22600 and the ancillary specifications for dedicated component families.

6.3.4 PARTS APPROVAL

REQ-PA-6.3.4-10 [source: RD15 §5.2.4]

The supplier shall document the procedure for approval of each component type intended for use in flight products. The approval of components shall be based on consideration of all pertinent data including both the electrical and environmental performances as well as the quality and the dependability assurance requirements.

REQ-PA-6.3.4-20 [source: RD15 §5.2.4]

The supplier shall maintain a system of traceability of the acceptance and approval of each component used in flight products.

REQ-PA-6.3.4-30 [source: RD15 §5.2.4]

The approval process by the customer shall be organized as follows:

- 1 All parts belonging to EPPL, NPSL or qualified according to quality levels defined in annex A are approved by listing them in the DCL.
- 2 A PAD as specified in annex B is required for any other part. (including CECC parts).
- 3 A Justification document is required for any commercial part, instead of PAD.
- 4 A PAD as specified in annex B is also required for EPPL, NPSL or qualified parts when:
 - additional controls are required (e.g. precap, buy-off, LAT, RVT, DPA),
 - specific tests are required during procurement as per annex A.

REQ-PA-6.3.4-40 [source: Engineering judgement]

A Justification Document shall be supplied for any commercial part, instead of PAD. This document shall refer to the specific part type and manufacturer and shall include the following:

- A description of the trade off between the selected component and the equivalent High Reliability component. (see 6.3.2.5b))
- An action plan including lot acceptance tests and screening tests defined in 6.4.3 and 6.4.5.

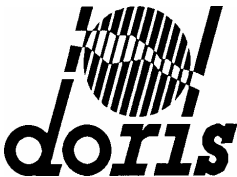
The supplier shall ensure that the elements of the Justification Document, including any action plan, are fully applicable at the time of the procurement of flight parts.

REQ-PA-6.3.4-50 [source: RD15 Engineering judgement]

When a PAD or a Justification Document is required, the customer's approval process shall include 2 steps :

- step 1: approval of the part type and attached action plan, through PAD or Justification Document for the PDR.
- step 2: approval of the results of the action plan defined during step 1 through PAD or Justification Document.

EXPECTED OUTPUTS : PADs, justification documents (for each commercial part).

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6.4 COMPONENT PROCUREMENT

6.4.1 GENERAL

REQ-PA-6.4.1-10 [source: RD15 §5.3.1]

The supplier shall ensure that all procured components meet the programme requirements with respect to inspection, screening and tests.

REQ-PA-6.4.1-20 [source: RD15 §5.3.1]

Components shall meet the quality levels and supplementary conditions specified in Annex A.

REQ-PA-6.4.1-30 [source: RD15 §5.3.1]

The supplier shall be responsible for manufacturer surveillance and control throughout the procurement programme.

REQ-PA-6.4.1-40 [source: RD15 §5.3.1]

For non qualified parts, the supplier shall put in place a configuration control system to ensure that any change of the product (e.g. mask, manufacturing and assembly process) affecting evaluation, performance, quality, reliability and interchangeability is communicated to him by the manufacturer (e.g. PCN).

REQ-PA-6.4.1-50 [source: RD15 §5.3.1]

The supplier shall ensure the compatibility of the change with its application.

REQ-PA-6.4.1-60 [source: RD15 §5.3.1]

The change shall be submitted to the customer for approval.

REQ-PA-6.4.1-70 [source: RD15 §5.3.1]

To reduce the risk of procuring counterfeit components, when parts are not directly procured from the manufacturer, the supplier shall procure parts only from distributors duly franchised by the parts manufacturer.

6.4.2 PROCUREMENT SPECIFICATION

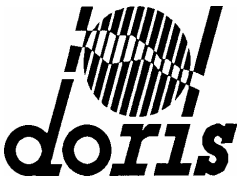
REQ-PA-6.4.2-10 [source: RD15 §5.3.2]

The supplier shall procure EEE components according to controlled specifications.

REQ-PA-6.4.2-20 [source: RD15 §5.3.2]

International specifications systems, new specifications or manufacturer's datasheets under configuration shall be used by the supplier.

REQ-PA-6.4.2-30 [source: RD15 §5.3.2]

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Any new specification shall be prepared and designed by the supplier as per existing international specification systems (ESCC, MIL). Preference shall be given to ESCC format when agreed by the manufacturer.

REQ-PA-6.4.2-40 [source: RD15 §5.3.2]

The content of any new specification shall be as specified in the Procurement Specification DRD in Annex D.

REQ-PA-6.4.2-50 [source: RD15 §5.3.2]

The use of any new specification or datasheet shall be submitted to the customer for approval through the approval process (see subclause 6.3.4)

REQ-PA-6.4.2-60 [source: RD15 §5.3.2]

Upon request, any new procurement specification prepared in the frame of the project, shall be delivered to the customer.

EXPECTED OUTPUT : Procurement specifications prepared in the frame of the project

REQ-PA-6.4.2-70 [source: RD15 §5.3.2]

The supplier shall keep each procurement specification or manufacturer's datasheet under configuration control.

6.4.3 SCREENING REQUIREMENTS

REQ-PA-6.4.3-10 [source: RD15 §5.3.3]

All components to be incorporated into flight standard hardware shall be subjected to screening testing.

REQ-PA-6.4.3-20 [source: RD15 §5.3.3]

The screening test requirements shall be so designed that accumulated stress does not jeopardise component reliability.

REQ-PA-6.4.3-30 [source: RD15 §5.3.3]

All screening tests shall be performed at the component manufacturer's premises or at a source approved by the customer for the performance of screening.

REQ-PA-6.4.3-40 [source: RD15 §5.3.3]

For high reliability parts : the applicable quality levels defined in Annex A shall apply.

REQ-PA-6.4.3-50 [source: Endgineering judgement]

For commercial parts : The screening tests shall include as a minimum :

- Thermal cycling (20 cycles, from -55°C to 125°C)
- Electrical testings.
- Burn-in (160h, 125°C)

According to information provided by the Justification Document, screening tests may be reduced for commercial parts.

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6.4.4 INITIAL CUSTOMER SOURCE INSPECTION (PRECAP)

REQ-PA-6.4.4-10 [source: RD15 §5.3.4]

The procurement entity shall carry out, at manufacturer's premises, a customer precap inspection for the following non-space qualified parts types: relays, crystals, oscillators and hybrids.

REQ-PA-6.4.4-20 [source: RD15 §5.3.4]

When not covered by MIL or ESCC specifications, methods and accept/reject criteria for customer's precap inspection shall be documented by a procedure to be presented to the customer, on request, for review.

EXPECTED OUTPUT : Procedure for customer precap on request when not covered by ESCC or MIL specification

6.4.5 LOT ACCEPTANCE

REQ-PA-6.4.5-10 [source: RD15 §5.3.5]

The supplier shall ensure that any lot or datecode of EEE parts is submitted to a lot acceptance procedure (in line with applied normative systems) according to the following rules :

REQ-PA-6.4.5-20 [source: RD15 §5.3.5]

1. Space qualified parts:

- ESCC: user's lot acceptance on the procured lot is not required due to periodic lot validation testing performed by the manufacturer.
- MIL: QCI or TCI performed by the manufacturer is in accordance with the quality level of the MIL specification.

REQ-PA-6.4.5-30 [source: RD15 §5.35]

2. Non space qualified parts:

- The content of the lot acceptance is defined according to the available data. The proposed lot acceptance is approved through the approval process (see subclause 6.3.4).
- The proposed lot acceptance shall be approved through the approval process (see subclause 6.3.4).

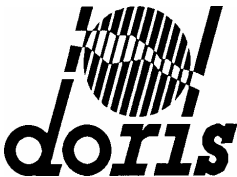
REQ-PA-6.4.5-40 [source: RD15 §5.3.5]

3. Commercial parts

- Lot acceptance tests for commercial parts shall comprise as minimum :
 - o Destructive Physical Analysis (DPA)
 - o Life test (1000h, 125°C)
 - o Temperature cycling test (500 cycles, from -55°C to 125°C)

According to information provided by the justification document, lot acceptance tests for commercial parts required may be reduced.

- The proposed lot acceptance shall be approved through the approval process (see subclause 6.3.4).
- The sample size for lot acceptance which may be reduced in some cases shall be submitted to the customer for approval through the approval process (see subclause 6.3.4)

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6.4.6 FINAL CUSTOMER SOURCE INSPECTION (BUY-OFF)

REQ-PA-6.4.6-10 [source: RD15 §5.3.6]

The procurement entity shall carry out, at manufacturer's premises, a final customer source inspection based on inspections for non-space qualified parts, tests and review activities to verify that the requirements of the purchase order are met prior to shipment of the flight parts.

REQ-PA-6.4.6-20 [source: RD15 §5.3.6]

The buy-off shall include:

- External visual inspection,
- Witnessing electrical measurements,
- Verifying mechanical dimensions,
- Review and verification of the data-package.

REQ-PA-6.4.6-30 [source: RD15 §5.3.6]

The buy-off may be replaced by an incoming inspection at procurement entity's facilities;

If the buy-off is replaced by an incoming inspection at procurement entity's facilities; it shall be reported in the PAD which is submitted to the customer for approval.

6.4.7 INCOMING INSPECTIONS

REQ-PA-6.4.7-10 [source: RD15 §5.3.7]

The procurement entity shall perform incoming inspection at his premises on all components to verify conformance with the purchase order requirements.

EXPECTED OUTPUT : Procedure for incoming

REQ-PA-6.4.7-20 [source: RD15 §5.3.7]

The incoming inspection shall include the following items: Marking control, Quantity verification, Packing checking, Review of the manufacturer delivered documentation, Additional tests based on the type of component, criticality and heritage with the manufacturer (e.g. solderability tests, electrical tests), export licence verification (when applicable).

REQ-PA-6.4.7-30 [source: RD15 §5.3.7]

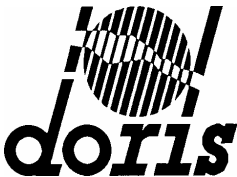
This process shall be documented by a procedure to be presented, on request, to the customer for review.

REQ-PA-6.4.7-40 [source: RD15 §5.3.7]

If the parts have passed successfully a final CSI (or buy-off), the incoming inspection may be reduced to: Packing checking, Quantity verification.

REQ-PA-6.4.7-50 [source: RD15 §5.3.7]

In case the incoming inspection has been performed by a procurement agent, the incoming inspection performed by the end-user, may be limited to the following items: Packing checking, Quantity verification, export licence verification (when applicable).

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6.4.8 RADIATION VERIFICATION TESTING.

REQ-PA-6.4.8-10 [source: RD15 §5.3.8]

When the component radiation sensitivity, as calculated either from radiation characterisation test or from existing radiation effects data, is suspected to be inadequate (in accordance with the requirements of RNC-Q-60-507) with respect to the component anticipated dose, RVT shall be implemented in line with the Radiation Hardness Assurance Programme defined in subclause 6.3.2.3.

REQ-PA-6.4.8-20 [source: RD15 §5.3.8]

RVT shall be performed in accordance with an internationally recognized standard, such as ESCC Basic Specification No. 22900, in accordance with the requirements of RNC-Q-60-507.

REQ-PA-6.4.8-30 [source: RD15 §5.3.8]

In such a case, a PAD as specified in Annex E or a Justification Document shall be issued and processed as per subclause 6.3.4.

REQ-PA-6.4.8-40 [source: RD15 §5.3.8]

The results of RVT shall be documented by a report.

When RVT is performed in the frame of the project, the supplier shall send the related report to the customer for information.

EXPECTED OUTPUT : RVT reports when RVT is performed in the frame of the project

6.4.9 DESTRUCTIVE PHYSICAL ANALYSIS

DPA comprises a series of inspections, tests and analyses performed on a sample of components to verify that the material, design and workmanship used for its construction, as well as the construction itself, meet the requirements of the relevant specification and are suitable for the intended application.

REQ-PA-6.4.9-10 [source: RD15 §5.3.9]

The DPA shall be performed on 3 samples per lot for the following non space qualified parts : as a minimum relays, oscillators and commercial parts.

EXPECTED OUTPUT : Procedure for DPA

REQ-PA-6.4.9-20 [source: RD15 §5.3.9]

DPA shall be carried out on representative samples of the components families.

REQ-PA-6.4.9-30 [source: RD15 §5.3.9]

The DPA sample size may be reduced in some cases which shall be submitted to the customer for approval through the PAD (or Justification document) process.

REQ-PA-6.4.9-40 [source: RD15 §5.3.9]

The DPA process shall be documented by a procedure to be sent, on request, to the customer for review.

REQ-PA-6.4.9-50 [source: RD15 §5.3.9]

The supplier shall ensure that the outcome of the DPA is satisfactory prior to the installation of the components into flight hardware.

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REQ-PA-6.4.9-60 [source: RD15 §5.3.9]

DPA may be performed by independent laboratories which shall be submitted to the customer for approval.

REQ-PA-6.4.9-70 [source: RD15 §5.3.9]

DPA may be performed by the manufacturer if witnessed by the supplier (or approved representative).

REQ-PA-6.4.9-80 [source: RD15 §5.3.9]

Methods and accept/reject criteria for inspection component (material, design, construction, workmanship) shall be documented by a procedure to be presented to the customer, on request, for review.

REQ-PA-6.4.9-90 [source: RD15 §5.3.9]

For health and safety reasons, any test producing beryllium oxide dust shall be omitted.

REQ-PA-6.4.9-100 [source: RD15 §5.3.9]

The results of DPA shall be documented by a report sent to the customer, on request, for information.

EXPECTED OUTPUT : DPA reports

6.4.10 RELIFING

REQ-PA-6.4.10-10 [source: RD15 §5.3.10]

Components from a supplier's or parts procurement agent's stock may be used provided the following criteria are met:

- The parts are stored according to the minimum conditions given in paragraph 6.5.
- The minimum overall requirements (including screening) are in accordance with the project requirements,
- The lot homogeneity and traceability can be demonstrated,
- The EEE parts documentation is available and the content is acceptable in accordance with the project requirements (including radiation data, if necessary),
- There are no open NCR's and no unresolved alerts with respect to their date code.

REQ-PA-6.4.10-20 [source: RD15 §5.3.10]

For components meeting the above criteria, and which have a lot / date code exceeding 7 years, a relifing shall be performed by the supplier according to RNC-CNES-Q-60-502.

REQ-PA-6.4.10-30 [source: RD15 §5.3.10]

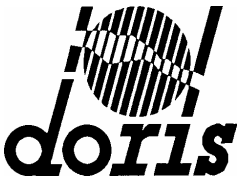
Parts older than 10 years shall not be installed on boards. It means that the duration between the date of the Date-Code of a component and the date of installation of this component on the board shall not exceed 10 years.

REQ-PA-6.4.10-40 [source: RD15 §5.3.10]

Commercial parts older than 5 years shall not be installed on boards.

6.4.11 MANUFACTURER'S DATA DOCUMENTATION DELIVERIES

REQ-PA-6.4.11-10 [source: RD15 §5.3.11]

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The manufacturer's CoC shall be delivered to the parts procurer.

REQ-PA-6.4.11-20 [source: RD15 §5.3.11]

Any other data (i.e. LAT/Lot Validation Testing, QCI/TCI), defined in the applicable procurement documents, shall be available at the manufacturer's facilities or delivered to the parts' procurer in line with the purchase order.

REQ-PA-6.4.11-30 [source: RD15 §5.3.11]

For non qualified parts, the documentation minimum storage period shall be 10 years after delivery of components by the manufacturer.

REQ-PA-6.4.11-40 [source: RD15 §5.3.11]

For qualified parts, the documentation storage period shall be under the responsibility of the manufacturer and the qualifying authority.

6.5 HANDLING AND STORAGE

REQ-PA-6.5-10 [source: RD15 §5.4]

The supplier shall establish and implement procedures for handling and storage of components in order to prevent possible degradation, as applicable for any facility dealing with components for flight application.

EXPECTED OUTPUT : Procedure for handling and storage of EEE parts

REQ-PA-6.5-20 [source: RD15 §5.4]

On request, these procedures shall be sent to the customer for review.

REQ-PA-6.5-30 [source: RD15 §5.4]

As a minimum, the following areas shall be covered:

- Control of the environment in accordance with ESCC Basic Specification No. 24900
- Measures and facilities to segregate and protect components during receiving inspection, storage, and delivery to manufacturing.
- Control measures to ensure that electrostatic discharge susceptible components are identified and handled only by trained personnel using anti static packaging and tools.

6.6 COMPONENT QUALITY ASSURANCE

6.6.1 GENERAL

REQ-PA-6.6.1-10 [source: RD15 §5.5.1]

The supplier shall establish and implement the requirements of this document including methods, organisations and documents used to control the selection and procurement of components in accordance with the requirements of ECSS-Q-20.

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6.6.2 NON CONFORMANCES OR FAILURES

REQ-PA-6.6.2-10 [source: RD15 §5.5.2]

The supplier shall establish and maintain a non-conformance control system in accordance with the general requirements in ECSS-Q-20-09.

REQ-PA-6.6.2-20 [source: RD15 §5.5.2]

Any observed deviation of EEE components from requirements as laid down in applicable specifications, procedures and drawings shall be controlled by the non-conformance control system (note : this includes failures, malfunctions, deficiencies and defects).

REQ-PA-6.6.2-30 [source: RD15 §5.5.2]

The non-conformance control system shall handle all non-conformances occurring on EEE components during:

- Manufacturer (if available), screening and acceptance tests,
- Incoming inspection,
- Integration and test of equipment,
- Storage and handling.

REQ-PA-6.6.2-40 [source: RD15 §5.5.2]

For ESCC qualified components the supplier shall apply the ESCC basic specification no 22800.

6.6.3 ALERTS

REQ-PA-6.6.3-10 [source: RD15 §5.5.3]

The supplier shall take into account all received alerts from international alert systems and shall validate that there are no alert on the proposed parts with respect to the batch information (including date-code).

EXPECTED OUTPUT : Action plan for alerts

REQ-PA-6.6.3-20 [source: RD15 §5.5.3]

If alerts become available at a later stage, the supplier shall analyse the alerts, analyse the project risk and propose an action plan for approval.

6.6.4 TRACEABILITY

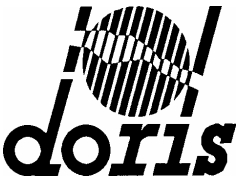
REQ-PA-6.6.4-10 [source: RD15 §5.5.4]

The traceability of individual components during components manufacturing and testing shall be maintained as required by the procurement specifications.

REQ-PA-6.6.4-20 [source: RD15 §5.5.4]

The traceability shall be maintained through incoming, storage, and installation at the procurer and supplier of the component in accordance with programme PA requirements.

REQ-PA-6.6.4-30 [source: RD15 §5.5.4]

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In any case, the traceability requirements imposed by the supplier on the EEE parts manufacturer or distributor shall allow managing the adequacy of the tests performed by the supplier (i.e. evaluation, lot validation, any additional test or inspection).

REQ-PA-6.6.4-40 [source: RD15 §5.5.4]

The traceability of EEE parts during installation in equipment shall be ensured by the supplier to allow the traceability of the manufacturer lot/datecode number of the EEE parts actually mounted.

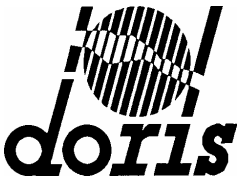
REQ-PA-6.6.4-50 [source: RD15 §5.5.4]

If as built DCL has yet not been delivered, the supplier shall be able to provide these information (part type actually installed with its relevant lot/datecode number) within one week.

6.6.5 LOT HOMOGENEITY FOR SAMPLING TEST

REQ-PA-6.6.5-10 [source: RD15 §5.5.5]

For radiation tests, the set of test samples used shall be a representative distribution for the wafer lot.

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6.7 SPECIFIC COMPONENTS

6.7.1 GENERAL

For the specific component types identified below, reference is made to applicable standards, in addition to the requirements of this standard.

6.7.2 ASICS

REQ-PA-6.7.2-10 [source: RD15 §5.6.2]

The specific requirements detailed in ECSS-Q-60-02 shall apply for the design development.

6.7.3 HYBRIDS

REQ-PA-6.7.3-10 [source: RD15 §5.6.3]

The specific requirements detailed in ECSS-Q-60-05 shall apply.

6.7.4 ONE TIME PROGRAMMABLE DEVICES

REQ-PA-6.7.4-10 [source: RD15 §5.6.4]

The specific requirements for FPGA, detailed in ECSS-Q-60-02, shall apply for the design development.

REQ-PA-6.7.4-20 [source: RD15 §5.6.4]

The PAD shall allow traceability to the information related to the procurement of blank parts, the programming and the acceptance of the programmed parts.

REQ-PA-6.7.4-30 [source: RD15 §5.6.4]

One time programmable components shall be submitted to a post-programming sequence.

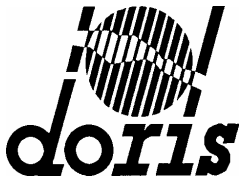
REQ-PA-6.7.4-40 [source: RD15 §5.6.4]

A dynamic post-programming burn-in shall be applied to FPGA's, according to test method 1015 of the MIL-STD-883.

REQ-PA-6.4.7-50 [source: RD15 §5.6.4]

The supplier shall prepare a post-programming procedure for the customer's approval, depending on part types (including when necessary electrical tests, programming conditions and equipment, burn-in conditions, additional screening tests and specific marking after programming).

EXPECTED OUTPUT : Procedure for post-programming sequence

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6.7.5 MICROWAVE MONOLITHIC INTEGRATED CIRCUITS

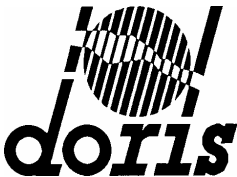
REQ-PA-6.7.5-10 [source: RD15 §5.6.5]

The specific requirements detailed in ECSS-Q-60-12 shall apply.

6.7.6 ELECTRICAL AND MECHANICAL GROUND SUPPORT EQUIPMENT

REQ-PA-6.7.6-10 [source: RD15 §5.1.5]

Flight hardware interfaces to GSE shall be protected by connector savers

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7. MATERIALS, MECHANICAL PARTS, PROCESSES

7.1 MMPP PROGRAMME MANAGEMENT

REQ-PA-7.1-10 [source: RD23 - §4.1.2]

Suppliers shall provide a MMPP plan in accordance with RD2 and this specification.

Conformity status & comments:

REQ-PA-7.1-20 [source: RD23 - §4.1.3.a]

The supplier shall appoint a MMPP manager who ensures that the requirements laid out in this Standard are satisfied.

Conformity status & comments:

REQ-PA-7.1-30 [source: RD23 - §4.1.3.b]

This manager shall be the customers contact as far as application of this Standard is concerned within the overall PA reporting system.

Conformity status & comments:

REQ-PA-7.1-40 [source: RD23 - §4.1.3.c]

The manager shall periodically inform the customer of the progress of tasks relating to its application.

Conformity status & comments:

REQ-PA-7.1-50 [source: RD23 - §4.1.3.d]

The manager shall ensure conformance to technical and scheduling aspects of the various actions undertaken (status of material validation, part qualification and process verification).

Conformity status & comments:

REQ-PA-7.1-60 [source: RD23 - §4.1.3.e]

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

Conformity status & comments:

7.2 CUSTOMER REVIEWS

REQ-PA-7.2-10 [source: RD23 - §4.1.4.a]

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

Conformity status & comments:

REQ-PA-7.2-20 [source: RD23 - §4.1.4.b]

The MMPP manager shall organize technical review meetings with his suppliers at all levels, as appropriate.

Conformity status & comments:

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7.3 ESTABLISHING AND PROCESSING OF LISTS

REQ-PA-7.3-10 [source: RD23 - §4.2.2.a]

Each Supplier and sub-Supplier shall establish, collect, review and deliver the declared MMPP lists including all the items intended for use in the flight equipment.

Conformity status & comments:

REQ-PA-7.3-20 [source: RD23 - §4.2.2.b]

The lists shall reflect the current design at the time of issue.

Conformity status & comments:

REQ-PA-7.3-30 [source: RD23 - §4.2.2.c]

These lists shall contain the MMPP used in the current design. The objectives are as follows:

1. compliance with all requirements of the programme;
2. to verify the results of equipment Supplier activities;
3. to control and monitor the status of MMPP in accordance with programme milestones, as shown in Annex A of RD23.

Conformity status & comments:

REQ-PA-7.3-40 [source: RD23 - §4.2.2.d]

The following constraints shall be taken into account:

1. requirements originating from the functional specifications;
2. requirements and conditions specific to the project;
3. maximum use of the materials and processes described in approved data sources, e.g. RD32, and items already approved on similar projects;
4. use of project related preferred lists, if available.

Conformity status & comments:

REQ-PA-7.3-50 [source: RD23 - §4.2.2.e]

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:

1. Critical items, subject to evaluation, validation, qualification, or verification programmes
2. Items that are not critical but which do not conform to one or more project requirements
3. Non-critical items.

Conformity status & comments:

7.4 MANAGEMENT OF THE LISTS

REQ-PA-7.4-10 [source: RD23 - §4.2.3.a]

The supplier shall document all the MMPP used in the project in accordance with the DRD

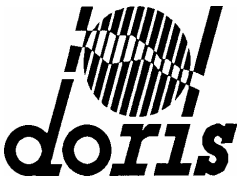
Conformity status & comments:

REQ-PA-7.4-20 [source: RD23 - §4.2.3.b]

The MMPP lists shall be provided in a form that is exchangeable, searchable, sortable and suitable for storage and retrieval.

Conformity status & comments:

REQ-PA-7.4-30 [source: RD23 - §4.2.3.c]

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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.

Conformity status & comments:

REQ-PA-7.4-40 [source: RD23 - §4.2.3.d]

These lists shall be updated during the course of the project.

Conformity status & comments:

REQ-PA-7.4-50 [source: RD23 - §4.2.3.e]

The preliminary lists shall include the items from suppliers' preliminary needs and are used to identify those that are critical (available for the PDR).

Conformity status & comments:

REQ-PA-7.4-60 [source: RD23 - §4.2.3.g]

Any change after CDR or QR shall be reflected in the list.

Conformity status & comments:

7.5 SUPPLIER ROLE AND RESPONSIBILITIES

REQ-PA-7.5-10 [source: RD23 - §4.2.4.a]

The Supplier shall be responsible for the following tasks:

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

Conformity status & comments:

REQ-PA-7.5-20 [source: RD23 - §4.2.4.b]

The lists established by the suppliers shall include all the information described in this document.

Conformity status & comments:

REQ-PA-7.5-30 [source: RD23 - §4.2.4.c]

Amendments to the lists shall be implemented through established change procedures.

Conformity status & comments:

REQ-PA-7.5-40 [source: RD23 - §4.2.4.d]

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

Conformity status & comments:

7.6 TECHNICAL CONSTRAINTS

REQ-PA-7.6-10 [source: RD23 - §4.3.a]

Parts and materials shall satisfy the mission's functional constraints.

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Conformity status & comments:

REQ-PA-7.6-20 [source: RD23 - §4.3.b]

They shall also satisfy both ground environment constraints (e.g. manufacture, tests, storage, maintenance, transport and integration) and flight constraints (launch and orbit).

Conformity status & comments:

REQ-PA-7.6-30 [source: RD23 - §4.3.c]

The technical criteria from §7.10 shall be taken into account, according to the mission.

Conformity status & comments:

REQ-PA-7.6-40 [source: RD23 - §4.3.d]

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).

Conformity status & comments:

7.7 CLEANLINESS AND CONTAMINATION CONTROL

REQ-PA-7.7-10 [source: RD23 - §4.4.a]

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

1. cleaning procedures, and
2. cleanliness monitoring procedures or methods.

Conformity status & comments:

REQ-PA-7.7-20 [source: RD23 - §4.4.b]

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).

Conformity status & comments:

REQ-PA-7.7-30 [source: RD23 - §4.4.c]

For cleanliness- or contamination-critical applications, a specific cleanliness control plan and requirement specification (chemical and particle) shall be established, see RD24

Conformity status & comments:

7.8 SAFETY HAZARDOUS PARTS AND MATERIALS

REQ-PA-7.8-10 [source: RD23 - §4.5]

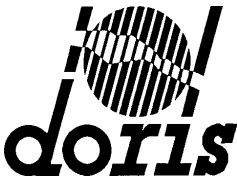
Parts and materials with hazardous characteristics shall be identified, managed and processed according to §5.

Conformity status & comments:

7.9 OPTICAL, MECHANICAL OR ELECTRICAL GSE HARDWARE

REQ-PA-7.9-10 [source: RD23 - §4.6]

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, electro-

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mechanical and chemical effects).

Conformity status & comments:

7.10 TECHNICAL CRITERIA FOR SELECTION OF MATERIALS

REQ-PA-7.10-10 [source: RD23 - §5.1.a]

The following requirements shall only be taken into account if the environmental conditions of the mission require their application. The specific requirements, test methods and accept or reject criteria are presented in the RD23 series of documents.

REQ-PA-7.10-20 [source: RD23 - §5.1.a]

Temperature

Material properties shall be compatible with the thermal environment to which they are exposed.

Conformity status & comments:

REQ-PA-7.10-30 [source: RD23 - §5.1.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, see RD26.

Conformity status & comments:

REQ-PA-7.10-40 [source: RD23 - §5.1.c]

Vacuum

1. Materials selection shall be made in accordance with approved data sources, see RD32.

2. Outgassing tests shall be carried out according to approved procedures, see RD25.

Conformity status & comments:

REQ-PA-7.10-50 [source: RD23 - §5.1.d]

Outgassing, 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, according to RD34 subclause 5.2.6.

Conformity status & comments:

REQ-PA-7.10-60 [source: RD23 - §5.1.e]

Flammability

The materials flammability resistance shall be evaluated for the most hazardous environment envisaged for their use, i.e. NASA STS payloads see NASA STD-6001 and RD28.

Conformity status & comments:

REQ-PA-7.10-70 [source: RD23 - §5.1.f]

Radiation

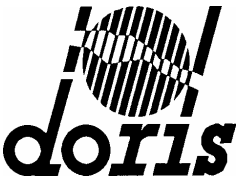
Materials used on the spacecraft external surfaces shall be assessed to determine their resistance to the radiation dosage expected during the mission, see RD27.

Conformity status & comments:

REQ-PA-7.10-80 [source: RD23 - §5.1.g]

Electrical charge and discharge

External surfaces of the spacecraft shall be sufficiently conductive, interconnected and grounded to the

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spacecraft structure to avoid the build-up of differential charges.

Conformity status & comments:

REQ-PA-7.10-90 [source: RD23 - §5.1.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.

Conformity status & comments:

REQ-PA-7.10-100 [source: RD23 - §5.1.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.

Conformity status & comments:

REQ-PA-7.10-110 [source: RD23 - §5.1.j]

Stress-corrosion

1. Materials used for structural and load-bearing applications (subject to tensile stress) shall be chosen in conformance with approved data sources, see Table 1 of RD30.

2. Any material not covered by standard RD30 shall be tested according to approved procedures, see RD31.

Conformity status & comments:

REQ-PA-7.10-120 [source: RD23 - §5.1.k]

Fluid compatibility

1. 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.

2. 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.

Conformity status & comments:

REQ-PA-7.10-130 [source: RD23 - §5.1.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.

Conformity status & comments:

REQ-PA-7.10-140 [source: RD23 - §5.1.m]

Atomic oxygen

1. 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).

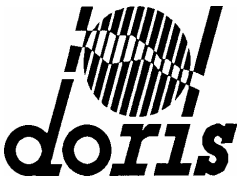
2. Test procedures shall be subject to the approval of the Customer.

Conformity status & comments:

REQ-PA-7.10-150 [source: RD23 - §5.1.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 that their use shall comply with safety evaluation and assessment results concerning design and application criteria or details.

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Conformity status & comments:

REQ-PA-7.10-160 [source: RD23 - §5.1.o]

Moisture absorption and desorption

Precautions shall be taken to avoid moisture absorption during manufacture and storage of CFRP-type materials, see RD24 and RD29.

Conformity status & comments:

REQ-PA-7.10-170 [source: RD23 - §5.1.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.

Conformity status & comments:

REQ-PA-7.10-180 [source: RD23 - §5.1.q]

Life

Materials shall be selected to ensure sufficient life with respect to the intended application.

Conformity status & comments:

REQ-PA-7.10-190 [source: new]

Pure tin

Pure tin use is prohibited either as building material or as constituent of mechanical part. Tin is considered pure if the alloy contains more than 97% of Sn.

Conformity status & comments:

7.11 SELECTION

REQ-PA-7.11-10 [source: RD23 - §5.2.a]

Materials shall be chosen giving preference to the following:

- those successfully used for an identical application in other space programmes similar with respect to environment constraints and lifetime to the proposed application;
- those for which satisfactory evaluation results are obtained on samples representative of the application with a sufficient margin as regards conditions of use;
- those included in approved data sources, for example RD32, ESA and NASA data banks.

Conformity status & comments:

REQ-PA-7.11-20 [source: RD23 - §5.2.b]

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.

Conformity status & comments:

7.12 DMMPL CONTENT

REQ-PA-7.12-10 [source: RD23 - §5.3.a]

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The DMMPL shall be broken down into distinct categories to enable each item in the documentation to be easily identified (an example of such a breakdown is given in the Annex B of RD23).

Conformity status & comments:

REQ-PA-7.12-20 [source: RD23 - §5.3.b]

The DMMPL shall include the following information:

- Issue status of the list.
- Unique item number that shall be the same throughout the duration of the project.
- Material/Part designation (commercial identification).
- Material keys, e.g. AISI; AA; CDA.
- Chemical nature and type of product. / type of parts.
- Manufacturers' name and procurement specifications or standards.
- Summary of functions and characteristics
- Summary of processing parameters (e.g. finish, temper condition, mix ratio and curing).
- Use and location.
- 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).

Conformity status & comments:

REQ-PA-7.12-30 [source: RD23 - §5.3.c]

Use of codes: any coding or acronyms used within the list shall be defined within the document.

Conformity status & comments:

7.13 CRITICALITY ANALYSIS

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

REQ-PA-7.13-10 [source: RD23 - §5.4.a]

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

Conformity status & comments:

REQ-PA-7.13-20 [source: RD23 - §5.4.b]

Any material not meeting the project requirements shall be the subject of a RFA to be submitted to the next customer.

Conformity status & comments:

REQ-PA-7.13-30 [source: RD23 - §5.4.c]

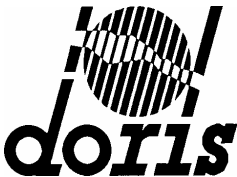
The RFA shall include the reason and details of the subsequent evaluation and validation to be performed; see RD23 Annex E and § 7.3 analysis of the criticality of preliminary lists.

Conformity status & comments:

7.14 EVALUATION AND VALIDATION PHASES

REQ-PA-7.14-10 [source: RD23 - §5.5.1.a]

Depending on the results of the criticality analysis, the Supplier shall perform either evaluation and

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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.

Conformity status & comments:

REQ-PA-7.14-20 [source: RD23 - §5.5.1.b]

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

Conformity status & comments:

7.15 EVALUATION PHASE

REQ-PA-7.15-10 [source: RD23 - §5.5.2.a]

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

- the limits of use;
- the materials 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.

Conformity status & comments:

REQ-PA-7.15-20 [source: RD23 - §5.5.2.b]

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

Conformity status & comments:

7.16 VALIDATION PHASE

REQ-PA-7.16-10 [source: RD23 - §5.5.3.a]

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.

Conformity status & comments:

REQ-PA-7.16-20 [source: RD23 - §5.5.3.b]

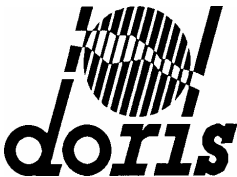
Validation status shall depend on the results obtained (validation report) and the review of corresponding documentation (available at CDR).

Conformity status & comments:

7.17 APPROVAL PHASE

REQ-PA-7.17-10 [source: RD23 - §5.5.4]

Provided that the requirements 7.17, 7.15-10, 7.15-20, 7.16-10 and 7.16-20 are satisfied, the material then receives an approval identification in the declared material list for the project.

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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.

Conformity status & comments:

7.18 DEVIATION REQUEST

REQ-PA-7.18-10 [source: RD23 - §5.5.5]

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 RD3.

Conformity status & comments:

7.19 PROCUREMENT SPECIFICATIONS

REQ-PA-7.19-10 [source: RD23 - §5.6.1.a]

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

Conformity status & comments:

REQ-PA-7.19-20 [source: RD23 - §5.6.1.b]

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

Conformity status & comments:

REQ-PA-7.19-30 [source: RD23 - §5.6.1.c]

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.

Conformity status & comments:

REQ-PA-7.19-40 [source: RD23 - §5.6.1.d]

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

Conformity status & comments:

7.20 INCOMING INSPECTION PROCEDURE

REQ-PA-7.20-10 [source: RD23 - §5.6.2.a]

All materials shall be submitted to an incoming inspection.

Conformity status & comments:

REQ-PA-7.20-20 [source: RD23 - §5.6.2.b]

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

Conformity status & comments:

7.21 VALIDATION STATUS OF MATERIALS

REQ-PA-7.21-10 [source: RD23 - §5.7.1]

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.

Conformity status & comments:

7.22 TRACEABILITY OF MATERIALS

REQ-PA-7.22-10 [source: RD23 - §5.7.2.a]

The Supplier shall apply the traceability rules defined in § 3.9 to all materials.

Conformity status & comments:

REQ-PA-7.22-20 [source: RD23 - §5.7.2.b]

Materials shall be identified by a unique reference number, code or a lot number to provide traceability shall there be an incident or nonconformance, or a need for a technical investigation following failure or damage, to reconstruct the materials history, either individually (individual traceability) or by the manufacturing lot of which it was a part (lot traceability).

Conformity status & comments:

7.23 PACKAGING, STORAGE, REMOVAL FROM STORAGE

REQ-PA-7.23-10 [source: RD23 - §5.7.3.a]

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

Conformity status & comments:

REQ-PA-7.23-20 [source: RD23 - §5.7.3.b]

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

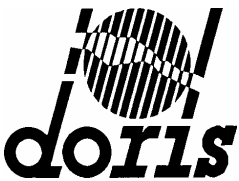
Conformity status & comments:

7.24 LIMITED-LIFE MATERIALS BEFORE IMPLEMENTATION

REQ-PA-7.24-10 [source: RD23 - §5.7.4.a]

The Supplier shall ensure that all materials which 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.

Conformity status & comments:

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REQ-PA-7.24-20 [source: RD23 - §5.7.4.b]

Materials which have exceeded their shelf-life expiry date may be re-certified 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 such as given in RD29.

Conformity status & comments:

7.25 LIMITED-LIFE MATERIALS AFTER IMPLEMENTATION

REQ-PA-7.25-10 [source: RD23 - §5.7.5]

Materials with limited-life after implementation (such as propellant) 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, see RD3.

Conformity status & comments:

7.26 MATERIALS NONCONFORMANCES AND ALERTS

REQ-PA-7.26-10 [source: RD23 - §5.7.6]

See § 3.13 for requirements about nonconformance and anomaly.

See §3.14 for requirements about alerts.

7.27 HEALTH AND SAFETY

REQ-PA-7.27-10 [source: RD23 - §5.7.7]

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

Conformity status & comments:

7.28 SELECTION OF MECHANICAL PARTS

REQ-PA-7.28-10 [source: RD23 - §6.1]

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

Conformity status & comments:

7.29 SELECTION

REQ-PA-7.29-10 [source: RD23 - §6.2.a]

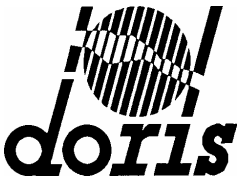
Parts shall be chosen from those successfully used for an identical application in other space programmes similar with respect to environment constraints and lifetime whenever those parts exist.

Conformity status & comments:

REQ-PA-7.29-20 [source: RD23 - §6.2.b]

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

Conformity status & comments:

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REQ-PA-7.29-30 [source: RD23 - §6.2.c]

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.

Conformity status & comments:

7.30 DECLARED MECHANICAL PARTS LIST (DMPL) CONTENT

REQ-PA-7.30-10 [source: RD23 - §6.3.a]

The DMPL shall be broken down into distinct categories to enable each item in the documentation to be easily identified (a breakdown is given in the DMPL DRD, see RD23 Annex C).

Conformity status & comments:

REQ-PA-7.30-20 [source: RD23 - §6.3.b]

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 parts;
- 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).

Conformity status & comments:

REQ-PA-7.30-30 [source: RD23 - §6.3.c]

Use of codes: any coding or acronyms used within the list shall be defined within the document.

Conformity status & comments:

REQ-PA-7.30-40 [source: RD23 - §6.3.d]

Only those mechanical parts procured to a specification as a finished product shall be entered on the DMPL.

Conformity status & comments:

An example of a suitable DMPL format is given in the DMPL DRD, see RD23 Annex C.

7.31 CRITICALITY ANALYSIS

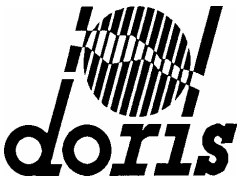
To conform to mission requirements, the objective of the analysis is to identify whether further data are required.

REQ-PA-7.31-10 [source: RD23 - §6.4.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 (see RD4).

Conformity status & comments:

REQ-PA-7.31-20 [source: RD23 - §6.4.b]

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

Conformity status & comments:

REQ-PA-7.31-30 [source: RD23 - §6.4.c]

Any critical part shall be the subject of a RFA.

Conformity status & comments:

REQ-PA-7.31-40 [source: RD23 - §6.4.d]

The RFA shall include the reason and the details of the subsequent evaluations and validations to be performed, see RD23 Annex E and § 7.3 analysis of the criticality of preliminary lists.

Conformity status & comments:

7.32 EVALUATION AND QUALIFICATION PHASES : GENERAL

REQ-PA-7.32-10 [source: RD23 - §6.5.1.a]

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.

Conformity status & comments:

REQ-PA-7.32-20 [source: RD23 - §6.5.1.b]

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.

Conformity status & comments:

7.33 EVALUATION PHASE

REQ-PA-7.33-10 [source: RD23 - §6.5.2.a]

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,
- behavioural tendencies and degradation processes depending on environment parameters (including sensitivity to pollution), and
- acceptance criteria.

Conformity status & comments:

REQ-PA-7.33-20 [source: RD23 - §6.5.2.b]

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

Conformity status & comments:

REQ-PA-7.33-30 [source: RD23 - §6.5.2.c]

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

Conformity status & comments:

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7.34 QUALIFICATION PHASE

REQ-PA-7.34-10 [source: RD23 - §6.5.3.a]

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.

Conformity status & comments:

REQ-PA-7.34-20 [source: RD23 - §6.5.3.b]

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

Conformity status & comments:

7.35 APPROVAL PHASE

REQ-PA-7.35-10 [source: RD23 - §6.5.4]

Provided that the requirements **7.33-10, 7.33-20, 7.33-30, 7.34-10 and 7.34-20** 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 either:

- select another mechanical part,
- propose a modified evaluation programme and resubmit for approval, or
- initiate a deviation procedure if the above actions fail to achieve positive results.

Conformity status & comments:

7.36 DEVIATION REQUEST

REQ-PA-7.36-10 [source: RD23 - §6.5.5]

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, according to RD3.

Conformity status & comments:

7.37 PROCUREMENT OF MECHANICAL PARTS : GENERAL

REQ-PA-7.37-10 [source: RD23 - §6.6.1.a]

Mechanical parts with long lead times or procurement delays (versus the project schedule) shall be identified before the formal subsystem PDR.

Conformity status & comments:

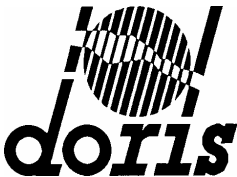
REQ-PA-7.37-20 [source: RD23 - §6.6.1.b]

Procurement shall be thoroughly planned, documented and implemented in a timely manner to obtain reliable product assurance provision at CDR.

Conformity status & comments:

REQ-PA-7.37-30 [source: RD23 - §6.6.1.c]

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

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Conformity status & comments:

7.38 PROCUREMENT SPECIFICATION

REQ-PA-7.38-10 [source: RD23 - §6.6.2.a]

Each part shall be covered by a procurement specification or a standard.

Conformity status & comments:

REQ-PA-7.38-20 [source: RD23 - §6.6.2.b]

These specifications shall define the part characteristics, requirements, tests methods, acceptance criteria, lot acceptance testing, source inspection, receiving inspection tests.

Conformity status & comments:

REQ-PA-7.38-30 [source: RD23 - §6.6.2.c]

The procurement specifications shall be explicitly accepted by the part manufacturer.

Conformity status & comments:

7.39 SOURCE INSPECTION

REQ-PA-7.39-10 [source: RD23 - §6.6.3.a]

For complex parts related to a specific project development, each supplier shall define the nature and frequency of their own source inspection points.

Conformity status & comments:

REQ-PA-7.39-20 [source: RD23 - §6.6.3.b]

Source inspection shall be carried out by the supplier on the premises of the part manufacturer according to RD3.

Conformity status & comments:

7.40 INCOMING INSPECTION PROCEDURE

REQ-PA-7.40-10 [source: RD23 - §6.6.4.a]

Each part or batch of parts shall be submitted to an incoming inspection.

Conformity status & comments:

REQ-PA-7.40-20 [source: RD23 - §6.6.4.b]

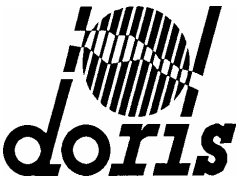
An incoming inspection procedure shall define the inspections and tests to be carried out.

Conformity status & comments:

7.41 QUALIFICATION STATUS OF PARTS

REQ-PA-7.41-10 [source: RD23 - §6.7.1.a]

The supplier shall ensure that all critical parts are qualified before being used in the manufacture of qualification or flight products.

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Conformity status & comments:

REQ-PA-7.41-20 [source: RD23 - §6.7.1.b]

Any modification, change in condition or configuration of application shall invalidate the use of the part and require additional qualification testing.

Conformity status & comments:

7.42 TRACEABILITY OF PARTS

REQ-PA-7.42-10 [source: RD23 - §6.7.2.a]

The supplier shall apply the traceability rules defined in § 3.9 to his parts.

Conformity status & comments:

REQ-PA-7.42-20 [source: RD23 - §6.7.2.b]

Parts should be identified by a unique reference number or code and a lot number to provide traceability - where there is an incident or nonconformance, or for the purposes of technical investigations following failure or damage - to reconstruct the parts history, either individually (individual traceability) or by the manufacturing lot it was part of (lot traceability).

Conformity status & comments:

7.43 PACKAGING, STORAGE, REMOVAL FROM STORAGE

REQ-PA-7.43-10 [source: RD23 - §6.7.3.a]

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

Conformity status & comments:

REQ-PA-7.43-20 [source: RD23 - §6.7.3.b]

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

Conformity status & comments:

7.44 LIMITED-LIFE PARTS OR PARTS SUBJECT TO WEAROUT

REQ-PA-7.44-10 [source: RD23 - §6.7.4.a]

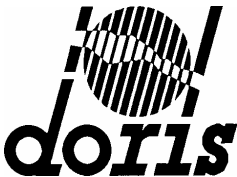
Limited-life parts after implementation or subject to wear out, e.g. mechanisms, pyro initiators and O-rings; shall be identified and controlled, storage and mission life being taken into account.

Conformity status & comments:

REQ-PA-7.44-20 [source: RD23 - §6.7.4.b]

These parts shall be assessed as candidates to the critical items list, see RD3.

Conformity status & comments:

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7.45 PARTS NONCONFORMANCE AND ALERTS

REQ-PA-7.45-10 [source: RD23 - §5.7.6]

See § 3.13 for requirements about nonconformance and anomaly.

See §3.14 for requirements about alerts.

7.46 PROCESS CONTROL - SPECIFICATIONS OR PROCEDURES

REQ-PA-7.46-10 [source: RD23 - §7.1.a]

Each process to be used in the manufacturing or assembly of a product shall be identified by a specification or procedure.

Conformity status & comments:

REQ-PA-7.46-20 [source: RD23 - §7.1.b]

Reference shall be made to accept and reject criteria.

Conformity status & comments:

7.47 ASSOCIATED MATERIALS AND MECHANICAL PARTS

REQ-PA-7.47-10 [source: RD23 - §7.2]

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

Conformity status & comments:

7.48 SELECTION

REQ-PA-7.48-10 [source: RD23 - §7.3.a]

Processes shall be chosen from those already verified according to the order of preference and priority given below, i.e.:

- those covered by space agencies or other governmental organization certification for identical conditions of use;
- those for which satisfactory evaluation and verification results are 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.

Conformity status & comments:

REQ-PA-7.48-20 [source: RD23 - §7.3.b]

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

- reliability;
- inspectability;
- re-workability of the process item;
- reproducibility.

Conformity status & comments:

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7.49 DECLARED PROCESSES LIST (DPL) CONTENT

REQ-PA-7.49-10 [source: RD23 - §7.4.a]

DPL shall be broken down into clear categories to facilitate locating each item in the documentation (a breakdown is given in the DPL DRD, see RD23 Annex D).

Conformity status & comments:

REQ-PA-7.49-20 [source: RD23 - §7.4.b]

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).

Conformity status & comments:

REQ-PA-7.49-30 [source: RD23 - §7.4.c]

Use of codes: any coding or acronyms used within the list shall be defined within the document.

Conformity status & comments:

An example of a suitable DPL format is given in the DPL DRD, see RD23 Annex D.

7.50 CRITICALITY ANALYSIS

To conform to mission requirements, the objective of the analysis is to identify whether further data is required.

REQ-PA-7.50-10 [source: RD23 - §7.5.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.

Conformity status & comments:

REQ-PA-7.50-20 [source: RD23 - §7.5.b]

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

Conformity status & comments:

REQ-PA-7.50-30 [source: RD23 - §7.5.c]

Any critical process shall be the subject of an RFA.

Conformity status & comments:

REQ-PA-7.50-40 [source: RD23 - §7.5.d]

The RFA shall include the reason and the details of the subsequent evaluation and validation to be performed, see RD23 Annex E and § 7.3 analysis of the criticality of preliminary lists.

Conformity status & comments:

REQ-PA-7.50-50 [source: RD23 - §7.5.e]

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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.

Conformity status & comments:

7.51 EVALUATION AND VERIFICATION PHASE : GENERAL

REQ-PA-7.51-10 [source: RD23 - §7.6.1.a]

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.

Conformity status & comments:

REQ-PA-7.51-20 [source: RD23 - §7.6.1.b]

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.

Conformity status & comments:

7.52 EVALUATION PHASE

REQ-PA-7.52-10 [source: RD23 - §7.6.2.a]

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.

Conformity status & comments:

REQ-PA-7.52-20 [source: RD23 - §7.6.2.b]

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

Conformity status & comments:

7.53 VERIFICATION PHASE

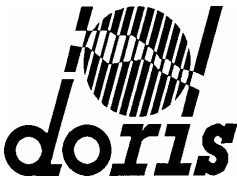
REQ-PA-7.53-10 [source: RD23 - §7.6.3.a]

For each critical process, a verification programme shall be drawn up by the contractor and then implemented.

Conformity status & comments:

REQ-PA-7.53-20 [source: RD23 - §7.6.3.b]

The verification programme shall be defined in conformance with existing ECSS or national agency standards of verification.

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Conformity status & comments:

REQ-PA-7.53-30 [source: RD23 - §7.6.3.c]

This programme shall check or confirm that the processes satisfy the mission requirements with appropriate margins and that the parameters needed for the product design are defined so as to obtain verification status.

Conformity status & comments:

REQ-PA-7.53-40 [source: RD23 - §7.6.3.d]

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

Conformity status & comments:

7.54 APPROVAL PHASE

REQ-PA-7.54-10 [source: RD23 - §7.6.4]

Provided that the requirements 7.52-10, 7.52-20, 7.53-10, 7.53-20, 7.53-30 and 7.53-40 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 either

- select other processes,
- propose a modified evaluation programme and resubmit for approval, or
- initiate a deviation procedure if the above actions fail to achieve positive results.

Conformity status & comments:

7.55 DEVIATION REQUEST

REQ-PA-7.55-10 [source: RD23 - §7.6.5]

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, according to RD3.

Conformity status & comments:

7.56 VERIFICATION STATUS OF A PROCESS

REQ-PA-7.56-10 [source: RD23 - §7.7.1]

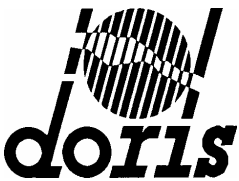
The supplier shall confirm that all critical processes have been verified before being used in the manufacture of qualification or flight products. Any modification, change in condition or configuration of application can invalidate the use of the process and require additional verification testing.

Conformity status & comments:

7.57 RE-VERIFICATION 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.

REQ-PA-7.57-10 [source: RD23 - §7.7.2.a]

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When a process needs to be re-verified, a request for approval shall be established and a re-verification 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.

Conformity status & comments:

7.58 IMPLEMENTATION OF A PROCESS

REQ-PA-7.58-10 [source: RD23 - §7.7.3.a]

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

Conformity status & comments:

REQ-PA-7.58-20 [source: RD23 - §7.7.3.b]

This verification shall ensure that:

- manufacturing and quality control tools associated with the process are adequate, calibrated and properly maintained are used under appropriate environmental and cleanliness conditions, see subclause § 7.7.
- personnel are properly trained and certified when applicable, and
- the processes specifications, manufacturing and inspection procedures and workmanship standards including clear definition of manufacturing operations and clear acceptance criteria exist.

Conformity status & comments:

7.59 TRACEABILITY OF PROCESSES

REQ-PA-7.59-10 [source: RD23 - §7.7.4]

Traceability of processes shall be in accordance with § 3.9 requirements.

Conformity status & comments:

7.60 PROCESS NONCONFORMANCES AND ALERTS

REQ-PA-7.60-10 [source: RD23 - §7.7.5]

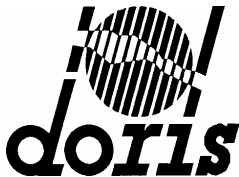
See § 3.13 for requirements about nonconformance and anomaly.

See § 3.14 for requirements about alerts.

7.61 MANDATORY INSPECTION POINTS (MIP)

REQ-PA-7.61-10 [source: RD23 - §7.7.6]

See § 3.55 for requirements about MIP.

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7.62 PACKAGING, STORAGE, REMOVAL FROM STORAGE

REQ-PA-7.62-10 [source: RD23 - §7.7.7]

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

Conformity status & comments:

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8. SOFTWARE

8.1 DEFINITIONS

This specification contains references to the terms, definitions and abbreviated terms given in the chapter 3 of the ECSS-Q80B.

In addition, to improve the understanding of the requirements, the following definitions are added:

Existing software

Existing software is any software developed outside the contract to which this Standard is applicable, and includes:

- software from previous developments provided by the supplier;
- software from previous developments provided by the customer;
- Commercial-Off-The-Shelf, Off-The-Shelf and Modified-Off-The-Shelf software;
- freeware and open source software.

Reused software

Reused software is any existing software or part of existing software to be used for or integrated into the operational system.

8.2 SOFTWARE PRODUCT ASSURANCE PROGRAMME IMPLEMENTATION

8.2.1 ORGANIZATION, RESPONSIBILITY AND AUTHORITY

REQ-PA-8.2.1-10 [Source : ECSS-Q80B § 5.2.1]

organization

The supplier shall ensure that an organizational structure is defined for software development, and that individuals have defined tasks and responsibilities.

REQ-PA-8.2.1-20 [Source : ECSS-Q80B § 5.2.2]

Responsibility and authority

ECSS-Q-00A subclause 4.3.1 is applicable.

EXPECTED OUTPUT:

- a. Responsibility, authority and interrelation of personnel managing, performing and verifying work affecting quality [PAF; SRR];
- b. External and internal interfaces and responsibilities of each organization [PAF; SRR];
- c. Lower level supplier performing delegated product assurance tasks [PAF; SRR].

REQ-PA-8.2.1-30 [Source : ECSS-Q80B § 5.2.3]

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Resources

ECSS-Q-00A subclause 4.3.2 is applicable.

EXPECTED OUTPUT: Software product assurance resource requirements [PAF; SRR].

8.2.1.1 Software product assurance manager

REQ-PA-8.2.1.1-10 [Source : ECSS-Q80B § 5.2.4.1]

One person shall be appointed as software product assurance manager for the project.

EXPECTED OUTPUT: Identification of the software product assurance manager [PAF; SRR].

REQ-PA-8.2.1.1-20 [Source : ECSS-Q80B § 5.2.4.2]

ECSS-Q-00A subclause 4.3.3 is applicable with “product assurance manager” being replaced by “software product assurance manager”.

8.2.1.2 Training

REQ-PA-8.2.1.2-10 [Source : ECSS-Q80B § 5.2.5.1]

A review of the project requirements shall be conducted to establish and make timely provision for acquiring or developing the resources and skills for the management and technical staff.

EXPECTED OUTPUT: Training plan [MGT; SRR].

REQ-PA-8.2.1.2-20 [Source : ECSS-Q80B § 5.2.5.2]

Training records shall be maintained.

EXPECTED OUTPUT: Records of training and experience [PAF].

REQ-PA-8.2.1.2-30 [Source : ECSS-Q80B § 5.2.5.3]

It shall be ensured that the right composition and categories of appropriately trained personnel are available for the planned activities and tasks in a timely manner.

REQ-PA-8.2.1.2-40 [Source : ECSS-Q80B § 5.2.5.4]

The training subjects shall be determined by the specific tools, techniques, methodologies and computer resources to be used in the development and management of the software product. Personnel can undergo training to acquire skills and knowledge relevant to the specific field with which the software is to deal.

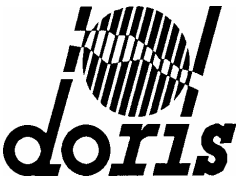
8.2.2 CONTRACTUAL ASPECTS

ECSS-Q-00A subclause 4.3.4 is applicable.

8.2.3 SOFTWARE PRODUCT ASSURANCE PROGRAMME MANAGEMENT

8.2.3.1 Software product assurance planning and control

REQ-PA-8.2.3.1-10 [Source : ECSS-Q80B § 5.4.1.1]

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The supplier shall develop a software product assurance plan in response to the software product assurance requirements.

EXPECTED OUTPUT: Software product assurance plan [PAF; SRR, PDR].

REQ-PA-8.2.3.1-20 [Source : ECSS-Q80B § 5.4.1.2]

The software product assurance plan shall meet the requirements of a product assurance plan as set out in ECSS-Q-00A subclause 3.3.3.

- NOTE : If the software product assurance plan refers to supplier internal manuals, standards or procedures, then these documents become an integral part of the supplier's product assurance plan.

EXPECTED OUTPUT: Software product assurance plan [PAF; SRR, PDR].

REQ-PA-8.2.3.1-30 [Source : ECSS-Q80B § 5.4.1.3]

The software product assurance plan shall be updated at each milestone in such away that the activities to be undertaken in the following phase are fully defined.

EXPECTED OUTPUT: Software product assurance plan [PAF; CDR, QR, AR, ORR].

REQ-PA-8.2.3.1-40 [Source : ECSS-Q80B § 5.4.1.4]

The software product assurance plan shall specify or reference the following items:

- quality objectives, expressed in measurable terms whenever possible;
- the software development life cycle, the related milestones and the input and output criteria for each development phase;
- types of verification and validation activities (including tests) to be carried out;
- detailed planning of verification and validation activities (including tests) to be carried out, including schedules, resources and approval authorities;
- specific responsibilities for quality activities such as reviews and tests configuration management and change control, nonconformance control and corrective action;
- methods, tools and rules to be applied;
- the procedures for determining the criticality category of software processes, functions, objects (according to the design methodology adopted), packages, units, files;
- specific actions and measures for supplier control.

EXPECTED OUTPUT: Software product assurance plan [PAF; SRR, PDR].

REQ-PA-8.2.3.1-50 [Source : ECSS-Q80B § 5.4.1.5]

Before acceptance review, the software product assurance plan shall be supplemented to specify the quality measures related to the operations and maintenance processes (alternatively a specific software product assurance plan shall be issued).

EXPECTED OUTPUT: Quality measures for the operations and maintenance processes in the software product assurance plan [PAF; AR].

REQ-PA-8.2.3.1-60 [Source : ECSS-Q80B § 5.4.1.6]

The supplier shall provide with the software product assurance plan a compliance matrix documenting conformance to the software product assurance requirements applicable for the project or contract.

EXPECTED OUTPUT: Compliance matrix [PAF; SRR, PDR].

8.2.3.2 Software product assurance reporting

REQ-PA-8.2.3.2-10 [Source : ECSS-Q80B § 5.4.2.1]

ECSS-Q-20B subclause 4.4 is applicable.

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NOTE : The software product assurance reporting can be included in the system product assurance reporting.

REQ-PA-8.2.3.2-20 [Source : ECSS-Q80B § 5.4.2.2]

The software product assurance report shall include an assessment of the current quality of the software development process (see subclause “process metrics”).

EXPECTED OUTPUT: Assessment of the quality of the software development process in the software product assurance report [PAF; SRR, PDR, CDR, QR, AR, ORR].

REQ-PA-8.2.3.2-30 [Source : ECSS-Q80B § 5.4.2.3]

The software product assurance report shall include an assessment of the current quality of the product, based on measured properties, verifications undertaken, problems detected and problems resolved.

EXPECTED OUTPUT: Assessment of the quality of the software product in the software product assurance report [PAF; SRR, PDR, CDR, QR, AR, ORR].

REQ-PA-8.2.3.2-40 [Source : ECSS-Q80B § 5.4.2.4]

The assessment shall be made with reference to the metrication as defined in the software product assurance plan.

EXPECTED OUTPUT: Software product assurance report [PAF; SRR, PDR, CDR, QR, AR, ORR].

8.2.3.3 Audits

REQ-PA-8.2.3.3-10 [Source : ECSS-Q80B § 5.4.3]

ECSS-Q-20B subclause 4.6 is applicable.

EXPECTED OUTPUT: Audit plan and schedule [PAF; SRR].

8.2.3.4 Alerts

REQ-PA-8.2.3.4-10 [Source : ECSS-Q80B § 5.4.4]

ECSS-Q-20B subclause 5.7 is applicable.

EXPECTED OUTPUT:

- Preliminary alert information [PAF];
- Alert information [PAF].

8.2.3.5 Nonconformances

REQ-PA-8.2.3.5-10 [Source : ECSS-Q80B § 5.4.5.1]

ECSS-Q-20B subclause 5.6 is applicable with “Nonconformance review board” being replaced by “Software review board”.

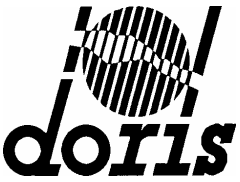
EXPECTED OUTPUT:

- Description of nonconformance control system [PAF; SRR];
- Nonconformance [DJF];
- Nonconformance record [DJF].

REQ-PA-8.2.3.5-20 [Source : ECSS-Q80B § 5.4.5.2]

The Software review board shall be established at all contractual levels and include, at least, a representative from the software product assurance and the software engineering organizations.

EXPECTED OUTPUT: Identification of SRB and members [MGT; SRR]

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REQ-PA-8.2.3.5-30 [Source : ECSS-Q80B § 5.4.5.3]

The software product assurance plan shall specify the point in the software life cycle from which the nonconformance procedures apply.

EXPECTED OUTPUT: Identification of the point in the software life cycle from which the non-conformance procedures apply - software product assurance plan [PAF; SRR, PDR].

8.2.3.6 Software problems

REQ-PA-8.2.3.6-10 [Source : ECSS-Q80B § 5.4.6.1]

The supplier shall define and implement procedures for the logging, analysis and correction of all software problems encountered during software development.

EXPECTED OUTPUT: Software problem reporting procedures [PAF; PDR].

REQ-PA-8.2.3.6-20 [Source : ECSS-Q80B § 5.4.6.2]

The procedures for software problems shall define the interface with the non-conformance system (i.e. the circumstances under which a problem qualifies as a non-conformance).

EXPECTED OUTPUT: Software problem reporting procedures [PAF; PDR].

REQ-PA-8.2.3.6-30 [Source : ECSS-Q80B § 5.4.6.3]

The supplier shall ensure the correct application of problem reporting procedures

8.2.4 RISK MANAGEMENT AND CRITICAL ITEM CONTROL

REQ-PA-8.2.4-10 [Source : ECSS-Q80B § 5.5.1]

Risk management

Risk management for software shall be performed by cross-reference to the project risk policy, as specified by ECSS-M-00-03

REQ-PA-8.2.4-20 [Source : ECSS-Q80B § 5.5.2]

Critical item control

For critical item control ECSS-Q-00A sub clause 3.3.5 is applicable.

8.2.5 SUPPLIER SELECTION AND CONTROL

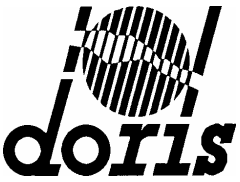
8.2.5.1 Supplier selection

REQ-PA-8.2.5.1-10 [Source : ECSS-Q80B § 5.6.1]

For supplier selection ECSS-Q-20B sub clause 7.2 is applicable.

EXPECTED OUTPUT:

- Results of pre-award audits [PAF];
- Records of procurement sources [PAF].

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8.2.5.2 Supplier requirements

REQ-PA-8.2.5.2-10 [Source : ECSS-Q80B § 5.6.2.1]

The supplier shall establish software product assurance requirements for the next level suppliers, tailored to their role in the project, including a requirement to produce a product assurance plan.

EXPECTED OUTPUT: Software product assurance requirements for suppliers [PAF; SRR].

REQ-PA-8.2.5.2-20 [Source : ECSS-Q80B § 5.6.2.2]

The supplier shall provide the software product assurance requirements applicable to the next level suppliers for the customer's acceptance.

EXPECTED OUTPUT: Software product assurance requirements for suppliers [PAF; SRR].

8.2.5.3 Supplier monitoring

REQ-PA-8.2.5.3-10 [Source : ECSS-Q80B § 5.6.3.1]

The supplier shall monitor the next lower level suppliers' conformance to the product assurance requirements.

REQ-PA-8.2.5.3-20 [Source : ECSS-Q80B § 5.6.3.2]

The monitoring process shall include the review and approval of the next lower level suppliers' product assurance plans, the continuing verification of processes and products, and the monitoring of the final validation of the product.

REQ-PA-8.2.5.3-30 [Source : ECSS-Q80B § 5.6.3.3]

The supplier shall ensure that a software development process is defined and applied by the next lower level suppliers in compliance with the software product assurance requirements for suppliers.

EXPECTED OUTPUT: Next level suppliers' software product assurance plan [PAF; PDR].

REQ-PA-8.2.5.3-40 [Source : ECSS-Q80B § 5.6.3.4]

The supplier shall provide the next lower level suppliers' software product assurance plan for customer's acceptance.

EXPECTED OUTPUT: Next level suppliers' software product assurance plan [PAF; PDR].

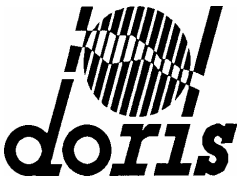
8.2.5.4 Criticality classification

REQ-PA-8.2.5.4-10 [Source : modified ECSS-Q80B § 5.6.4]

The supplier shall provide the lower level suppliers with the results of the safety and dependability analyses performed at system level, including:

- the criticality classification of the software products to be developed;
- information about the system-level failures that might be caused by the software products to be developed.

EXPECTED OUTPUT: Safety and dependability analyses results for lower level suppliers [RB; SRR].

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8.2.6 PROCUREMENT

8.2.6.1 Procurement review

REQ-PA-8.2.6.1-10 [Source : modified ECSS-Q80B § 5.7.3]

The choice of procured software shall be described and submitted for customer review.

EXPECTED OUTPUT: Procured software component list in the software development plan [MGT; SRR, PDR].

8.2.6.2 Procurement details

REQ-PA-8.2.6.2-10 [Source : ECSS-Q80B § 5.7.4]

For each of the software items the following data shall be provided:

- ordering criteria (e.g. versions, options and extensions);
- receiving inspection criteria;
- arrangements for maintenance and upgrades to new releases;
- back-up solutions if the product becomes unavailable;
- contractual arrangements for the development and maintenance phases.

EXPECTED OUTPUT: Procurement data [MGT; SRR, PDR].

8.2.6.3 Procured software Identification

REQ-PA-8.2.6.3-10 [Source : ECSS-Q80B § 5.7.5]

All the procured software shall be identified and registered by configuration management.

8.2.6.4 Receiving Inspection

REQ-PA-8.2.6.4-10 [Source : ECSS-Q80B § 5.7.6]

The supplier shall subject the procured software to a planned receiving inspection against pre-defined criteria before its acceptance.

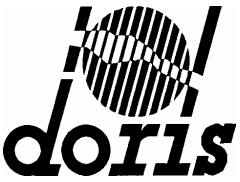
NOTE : Supplementary specific tests associated with the operational environment can be specified.

EXPECTED OUTPUT: Receiving inspection report [PAF; PDR, CDR, QR].

8.2.6.5 Exportability

REQ-PA-8.2.6.5-10 [Source : ECSS-Q80B § 5.7.7]

Any constraints regarding exportability shall be taken into account.

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8.2.7 TOOLS AND SUPPORTING ENVIRONMENT

8.2.7.1 Development computer selection

REQ-PA-8.2.7.1-10 [Source : ECSS-Q80B § 5.8.1]

The development computer equipment shall be selected according to the following criteria:

- availability;
- compatibility
- performance;
- maintenance;
- durability and technical consistency with the operational equipment;
- the assessment of the product with respect to requirements, including the criticality category;
- the available support documentation;
- the acceptance and warranty conditions;
- the conditions of installation, preparation, training and use;
- the maintenance conditions, including the possibilities of evolutions;
- copyright constraints.

8.2.7.2 Choice description

REQ-PA-8.2.7.2-10 [Source : ECSS-Q80B § 5.8.2]

The choices of development computer equipment shall be described.

EXPECTED OUTPUT: Descriptions of choices of development equipment in the software development plan [MGT; SRR, PDR].

8.2.7.3 Methods and tools

REQ-PA-8.2.7.3-10 [Source : ECSS-Q80B § 5.8.3.1]

Mature methods and tools shall be used for all activities of the development cycle, including requirements analysis, software specification, design, coding, validation, testing, configuration management, verification and product assurance.

EXPECTED OUTPUT: Justification included or referenced in the product assurance file [PAF; PDR].

REQ-PA-8.2.7.3-20 [Source : ECSS-Q80B § 5.8.3.2]

The choice of development methods and tools shall be justified by demonstrating that:

- the development team has appropriate experience or training to apply them,
- the tools and methods are appropriate for the functional and operational characteristics of the product, and
- the tools are available (in an appropriate hardware environment) throughout the development and maintenance lifetime of the product.

NOTE : This can be demonstrated through testing or documented assessment.

EXPECTED OUTPUT: Justification included or referenced in the product assurance file [PAF; PDR].

REQ-PA-8.2.7.3-30 [Source : ECSS-Q80B § 5.8.3.3]

Suitability of the software development environment shall be justified.

EXPECTED OUTPUT: Evidence of suitability of the software development environment [DJF; SRR, PDR].

REQ-PA-8.2.7.3-40 [Source : ECSS-Q80B § 5.8.3.4]

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The availability of the software development environment to developers and other users shall be verified before the start of each development phase.

REQ-PA-8.2.7.3-50 [Source : ECSS-Q80B § 5.8.3.5]

The correct use of methods and tools shall be verified and reported.

EXPECTED OUTPUT: Software product assurance report [PAF; SRR, PDR, CDR, QR, AR, ORR].

8.2.8 ASSESSMENT AND IMPROVEMENT PROCESS

REQ-PA-8.2.8-10 [Source : ECSS-Q80B § 5.9.1]

Assessment process

The supplier shall monitor and control the effectiveness of the processes used during the development of the software, including the relevant processes corresponding to the services called from other organizational entities outside the project team.

EXPECTED OUTPUT: Software process assessment plan [PAF].

REQ-PA-8.2.8-20 [Source : ECSS-Q80B § 5.9.2]

Assessment procedure

A process assessment procedure shall be developed, documented and applied.

EXPECTED OUTPUT: Software process assessment procedure [PAF].

REQ-PA-8.2.8-30 [Source : ECSS-Q80B § 5.9.3]

Assessment records

Assessment records shall be kept and maintained.

EXPECTED OUTPUT: Software process assessment records [PAF].

REQ-PA-8.2.8-40 [Source : ECSS-Q80B § 5.9.4]

Assessment data

Data shall be collected and analysed to gain an understanding of the strengths and weaknesses of the employed processes.

EXPECTED OUTPUT: Software process assessment records: strengths and weaknesses [PAF].

REQ-PA-8.2.8-50 [Source : ECSS-Q80B § 5.9.5]

Quality data

Quality data shall be collected, maintained, and used to support the process assessments.

EXPECTED OUTPUT: Software process assessment records : quality data [PAF].

REQ-PA-8.2.8-60 [Source : ECSS-Q80B § 5.9.6]

Process improvement

The results of the analyses shall be used as feedback to improve the employed processes, to recommend changes in the direction of the project, and to determine technology advancement needs.

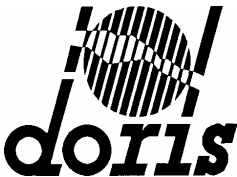
EXPECTED OUTPUT: Software process assessment records: improvement plan [PAF].

REQ-PA-8.2.8-70 [Source : ECSS-Q80B § 5.9.7]

Process or project documentation

Process or project documentation shall be updated to reflect the improvements.

EXPECTED OUTPUT: Software process assessment record: updates to process or project documentation [PAF].

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8.3 SOFTWARE PROCESS ASSURANCE

8.3.1 SOFTWARE DEVELOPMENT LIFE CYCLE

REQ-PA-8.3.1-10 [Source : ECSS-Q80B § 6.1.1]

Life cycle definition

The software development life cycle shall be defined or referenced in the software product assurance plan. If the software development plan does not contain the definition of the software life cycle, then it shall be included in the software product assurance plan

EXPECTED OUTPUT: Reference to software development life cycle definition [PAF; SRR, PDR].

REQ-PA-8.3.1-20 [Source : ECSS-Q80B § 6.1.2]

Life cycle definition review

The software life cycle shall be reviewed against the contractual software engineering and product assurance requirements.

REQ-PA-8.3.1-30 [Source : ECSS-Q80B § 6.1.3]

Life cycle resources

The software life cycle shall be reviewed for suitability and for the availability of resources to implement it by all functions involved in its application.

NOTE : The life cycle is associated with choices of techniques used during the development of the software product (e.g. database management system, extensive product reuse, and man-machine interface generators) and with the risks inherent in the project (e.g. highly changeable product specifications, stringent schedule constraints and project size).

REQ-PA-8.3.1-40 [Source : ECSS-Q80B § 6.1.4]

Quality objectives

In the definition of the life cycle and associated milestones and documents, the quality objectives shall be taken into account (see ECSS-E-40B sub clause 5.3.2 and ECSS-Q-80B sub clause 7.1).

REQ-PA-8.3.1-50 [Source : ECSS-Q80B § 6.1.5]

Phase outputs

The state of completion of phase outputs shall be specified when the life cycle is defined.

EXPECTED OUTPUT: Reference to the software development life cycle definition [PAF; SRR, PDR].

REQ-PA-8.3.1-60 [Source : ECSS-Q80B § 6.1.7]

Milestones

The milestones shall be specified when the software life cycle is defined.

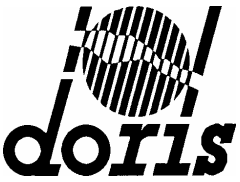
NOTE : If the need for additional milestones is identified (e.g. Detailed Design Review, see ECSS-E-40B, sub clause 5.3.2.9), the product assurance documentation presented during previous reviews can be updated accordingly.

EXPECTED OUTPUT: Reference to the software development life cycle definition [PAF; SRR, PDR].

REQ-PA-8.3.1-70 [Source : ECSS-Q80B § 6.1.8]

Role of customer

The role of the customer at these milestones shall be defined in accordance with ECSS-M-30A sub clause

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4.5 and clause 7 and also with ECSS-M-30-01.

EXPECTED OUTPUT: Reference to the software development life cycle definition [PAF; SRR, PDR].

REQ-PA-8.3.1-80 [Source : ECSS-Q80B § 6.1.9]

Validation process schedule

A milestone shall be scheduled immediately before the software validation process starts, to check that the software status is compatible with the commencement of validation activities and that the necessary resources, software product assurance plans, test and validation documentation, simulators or other technical means are available.

EXPECTED OUTPUT: Reference to the software development life cycle definition [PAF; SRR, PDR].

8.3.2 REQUIREMENTS APPLICABLE TO ALL SOFTWARE ENGINEERING PROCESSES

8.3.2.1 Documentation of processes

REQ-PA-8.3.2.1-10 [Source : ECSS-Q80B § 6.2.1.1]

The following activities shall be covered in project plans:

- development;
- specification, design and customer documents to be produced;
- configuration and documentation management;
- verification and validation activities (including testing);
- maintenance.

NOTE: In case software-specific plans are not produced, these activities may be addressed either in software-specific plans or in project general plans.

EXPECTED OUTPUT: Software project plans [MGT, MF, DJF]

REQ-PA-8.3.2.1-20 [Source : ECSS-Q80B § 6.2.1.2]

All plans shall be finalized before the start of the activities.

EXPECTED OUTPUT: Software project plans [MGT, MF, DJF].

REQ-PA-8.3.2.1-30 [Source : ECSS-Q80B § 6.2.1.3]

All plans shall be updated for each milestone to reflect any changes during development.

EXPECTED OUTPUT: Software project plans [MGT, MF, DJF].

REQ-PA-8.3.2.1-40 [Source : ECSS-Q80B § 6.2.1.4]

The software product assurance plan shall identify all plans to be produced and used, the relationship between them and the time-scales for their preparation and update.

EXPECTED OUTPUT: Identification of software plans, their interrelations and schedule for preparation [PAF; SRR, PDR].

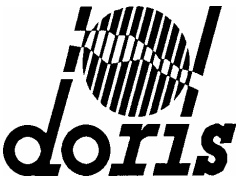
REQ-PA-8.3.2.1-50 [Source : ECSS-Q80B § 6.2.1.5]

Each plan shall be reviewed against the relevant contractual requirements.

REQ-PA-8.3.2.1-60 [Source : ECSS-Q80B § 6.2.1.6]

The following activities shall be covered by development procedures and project standards:

- recording of development metrics;

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- classification of software product according to its functional criticality;
- use of program design language, if it is used in the detailed design;
- use of coding languages.

EXPECTED OUTPUT: Procedures and standards [PAF; PDR].

REQ-PA-8.3.2.1-70 [Source : ECSS-Q80B § 6.2.1.7]

Procedures and project standards shall include provision for all classes of software included in the project.

EXPECTED OUTPUT: Procedures and standards [PAF; PDR].

REQ-PA-8.3.2.1-80 [Source : ECSS-Q80B § 6.2.1.8]

All procedures and project standards shall be finalized before starting the activities.

EXPECTED OUTPUT: Procedures and standards [PAF; PDR].

REQ-PA-8.3.2.1-90 [Source : ECSS-Q80B § 6.2.1.9]

Each procedure or standard shall be reviewed against the relevant plans and contractual requirements.

REQ-PA-8.3.2.1-100 [Source : ECSS-Q80B § 6.2.1.10]

Before any activity is started, each procedure or standard for that activity shall be reviewed by all functions involved in its application, for suitability and for the availability of resources to implement it.

8.3.2.2 Software dependability and safety analysis

REQ-PA-8.3.2.2-10 [Source : modified ECSS-Q80B § 6.2.2]

The supplier shall perform a software dependability and safety analysis of the software items, in accordance with the requirements of ECSS-Q-30B and ECSS-Q-40B and using the results of system-level safety and dependability analyses, in order to determine the criticality of individual software components.

EXPECTED OUTPUT: Software dependability and safety analysis report [PAF; PDR].

REQ-PA-8.3.2.2-20 [Source : modified ECSS-Q80B § 6.2.2]

The software dependability and safety analysis shall be based on a combination of well-established methods and techniques, to be performed at technical specification and design level, such as:

- software failure modes, effects and criticality analysis;
- software fault tree analysis;
- software common cause failure analysis.

EXPECTED OUTPUT: Criticality classification of software components [PAF; SRR, PDR].

REQ-PA-8.3.2.2-30 [Source : modified ECSS-Q80B § 6.2.2]

Based on the results of the software criticality analysis, the supplier shall apply suitable engineering measures to reduce the number of software critical components and mitigate the risks associated with the critical software (ref. subclause « handling of critical software »).

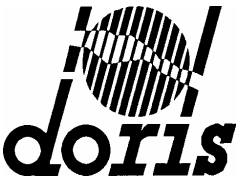
REQ-PA-8.3.2.2-40 [Source : modified ECSS-Q80B § 6.2.2]

The supplier shall update the software dependability and safety analysis at each software development milestone, to confirm the criticality category of software components.

EXPECTED OUTPUT: Software dependability and safety analysis report [PAF; CDR, QR, AR].

REQ-PA-8.3.2.2-50 [Source : modified ECSS-Q80B § 6.2.2]

The supplier shall provide the results of the software dependability and safety analysis for integration into the system-level dependability and safety analyses, addressing in particular:

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- additional failure modes identified at software design level;
- recommendations for system-level activities, (e.g. introduction of hardware inhibits, modifications of the system architecture, etc.).

REQ-PA-8.3.2.2-60 [Source : modified ECSS-Q80B § 6.2.2]

As part of the software requirements analysis activities (ref. subclause “software requirements analysis”), the supplier shall contribute to the Hardware-Software Interaction Analysis by identifying, for each hardware failure included in the HSIA, the requirements that specify the software behaviour in the event of that hardware failure.

8.3.2.3 Handling of critical software

REQ-PA-8.3.2.3-10 [Source : ECSS-Q80B § 6.2.3.1]

The supplier shall define and apply measures to assure the reliability of critical software.

These measures can include:

- use of software design or methods that have performed successfully in a similar application;
- failure mode analysis of the software, with the insertion of appropriate features for failure isolation and handling;
- defensive programming techniques, such as input verification and consistency checks;
- prohibiting the use of language commands and features that are unpredictable use of formal design language for formal proof;
- 100 % code branch coverage at unit testing level;
- full inspection of source code;
- witnessed or independent testing;
- gathering and analysis of failure statistics;
- removing deactivated code or showing through a combination of analysis and testing that the means by which such code could be inadvertently executed are prevented, isolated, or eliminated.

EXPECTED OUTPUT: Definition of measures and verification activities in software product assurance plan [PAF; PDR, CDR].

REQ-PA-8.3.2.3-20 [Source : ECSS-Q80B § 6.2.3.2]

The application of the chosen measures to handle the critical software shall be verified.

EXPECTED OUTPUT: Verification and validation documentation [DJF; PDR, CDR, QR, AR].

REQ-PA-8.3.2.3-30 [Source : ECSS-Q80B § 6.2.3.3]

Critical software shall be subject to regression testing after:

- any change of functionality (e.g. instruction set of a processor) of the underlying platform hardware, and
 - any change of the tools that affect directly or indirectly the generation of the executable code.
- NOTE : In case of minor changes in tools that affect the generation of the executable code, a binary comparison of the executable code generated by the different tools can be used to verify that no modifications are introduced.

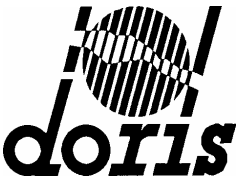
EXPECTED OUTPUT: Definition of measures and verification activities in software product assurance plan [PAF; PDR, CDR].

REQ-PA-8.3.2.3-40 [Source : ECSS-Q80B § 6.2.3.4]

The need for additional verification of critical software shall be analysed after:

- any change of functionality or performance of the underlying platform hardware, and
- any change in the environment in which the software or the platform hardware operate.

EXPECTED OUTPUT: Definition of measures and verification activities in software product assurance plan [PAF; PDR, CDR].

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REQ-PA-8.3.2.3-50 [Source : modified ECSS-Q80B § 6.2.3.5]

The measures used to handle critical software and their justification shall be described in the design documentation.

EXPECTED OUTPUT:

- Definition of measures for critical software in the design documentation [DDF; PDR, CDR];
- Verification and validation documentation [DJF; PDR, CDR].

REQ-PA-8.3.2.3-60 [Source : ECSS-Q80B § 6.2.3.6]

Unreachable code shall be removed and the need for re-verification and re-validation shall be analysed.

REQ-PA-8.3.2.3-70 [Source : ECSS-Q80B § 6.2.3.7]

Testing on instrumented code shall be re-run on the non-instrumented code.

REQ-PA-8.3.2.3-80 [Source : ECSS-Q80B § 6.2.3.8]

Integration and validation testing shall be executed on the non-instrumented code.

REQ-PA-8.3.2.3-90 [Source : modified ECSS-Q80B § 6.2.9]

- The supplier shall define and implement measures to avoid propagation of failures between software components of different criticality.

NOTE: This can be achieved by design measures such as separate hardware platforms, isolation of software processes or prohibition of shared memory (segregation and partitioning).

- Software components whose malfunction may cause failures of higher criticality components shall be classified in accordance with the consequences of those failures.

EXPECTED OUTPUT: Definition of handling measures for critical software and verification activities in the software product assurance plan [PAF; PDR, CDR].

8.3.2.4 Software configuration management

REQ-PA-8.3.2.4-10 [Source : ECSS-Q80B § 6.2.4.1]

ECSS-M-40 shall be applied for software configuration management complemented by the following requirements.

NOTE : Sub clause “software configuration management” contains requirements on product assurance of software configuration management which are complementary to the ECSS-M-40A (sub clause 5.3.2) requirements.

REQ-PA-8.3.2.4-20 [Source : ECSS-Q80B § 6.2.4.2]

The software configuration management system shall allow any reference version to be re-generated from backups.

EXPECTED OUTPUT: Software configuration management [MGT; SRR, PDR].

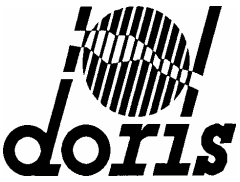
REQ-PA-8.3.2.4-30 [Source : modified ECSS-Q80B § 6.2.4.3]

The software configuration file and the software release note shall be provided with each software delivery.

EXPECTED OUTPUT:

- Software configuration file [DDF];
- Software release note [DDF].

REQ-PA-8.3.2.4-40 [Source : ECSS-Q80B § 6.2.4.4]

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The software configuration file shall be available and up to date for each project milestone.
EXPECTED OUTPUT: Software configuration file [DDF; PDR, CDR,QR, AR,ORR].

REQ-PA-8.3.2.4-50 [Source : ECSS-Q80B § 6.2.4.5]

Any components of the code generation tool that are customizable by the user shall be put under configuration control and the change control procedures defined for the project shall take into account the specific aspects of these components.
EXPECTED OUTPUT: Software configuration file [DDF; PDR, CDR,QR, AR,ORR].

REQ-PA-8.3.2.4-60 [Source : ECSS-Q80B § 6.2.4.6]

The supplier shall ensure that all authorized changes are implemented in accordance with the software configuration management plan.
EXPECTED OUTPUT: Authorized changes - Software configuration file [DDF; PDR, CDR, QR, AR, ORR].

REQ-PA-8.3.2.4-70 [Source : ECSS-Q80B § 6.2.4.7]

The following documents shall be controlled (see ECSS-Q-20B sub clause 5.1):

- procedural documents describing the quality system to be applied during the software life cycle;
- planning documents describing the planning and progress of the contract activities;
- documents describing a particular software product, including:
 - . development phase inputs,
 - . development phase outputs,
 - . verification and validation plans and results,
 - . test case specifications, test procedures and test reports,
 - . traceability matrices,
 - . documentation for the software and system operators and users, and
 - . maintenance documentation.

REQ-PA-8.3.2.4-80 [Source : ECSS-Q80B § 6.2.4.8]

The supplier shall establish a mechanism to protect all supplied software (e.g. source, executable or data) against corruption.
EXPECTED OUTPUT:
a. Identification and protection method or tool [PAF; SRR,PDR];
b. Identification and protection method in the software configuration file [DDF; CDR, QR, AR, ORR].

REQ-PA-8.3.2.4-90 [Source : modified ECSS-Q80B § 6.2.4.9]

The supplier shall define a checksum-type key calculation for the delivered operational software (e.g. executable binary, database).
EXPECTED OUTPUT: Identification and protection method and tool [PAF; SRR, PDR].

REQ-PA-8.3.2.4-100 [Source : ECSS-Q80B § 6.2.4.10]

The checksum value shall be specified in the software configuration file.

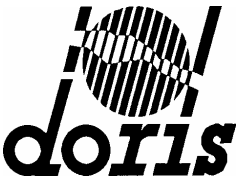
NOTE : The checksum value is calculated:

- prior to each delivery;
- at reception to check identification.

EXPECTED OUTPUT: Checksum value in the software configuration file [DDF; CDR, QR, AR, ORR].

REQ-PA-8.3.2.4-110 [Source : ECSS-Q80B § 6.2.4.11]

If the protection mechanism used is based on a tool, this tool shall be agreed between the customer and the supplier in advance.
EXPECTED OUTPUT: Identification and protection method or tool [PAF; SRR, PDR].

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REQ-PA-8.3.2.4-120 [Source : ECSS-Q80B § 6.2.4.12]

The software media deliverable to the customer shall be marked by the supplier during the preparation of each delivery, indicating the following minimum information:

- the software name;
- the version number;
- the reference to the software configuration file.

EXPECTED OUTPUT:

- a. Labelling method [PAF; SRR, PDR];
- b. Labels [DDF; CDR, QR, AR].

8.3.2.5 Process metrics

REQ-PA-8.3.2.5-10 [Source : ECSS-Q80B § 6.2.5.1]

Process metrics shall be collected, stored, analysed, and reported on a regular basis by applying quality models and procedures.

NOTE : Sub clause “process metrics” deals with process metrics only. Note that sub clause “product quality objectives and metrication” deals with product metrics.

EXPECTED OUTPUT: Details of metrics in software product assurance plan [PAF; SRR, PDR].

REQ-PA-8.3.2.5-20 [Source : ECSS-Q80B § 6.2.5.2]

Metrics shall be used to manage the development and to assess the quality of the development process.

EXPECTED OUTPUT: Details of metrics in software product assurance plan [PAF; SRR, PDR].

REQ-PA-8.3.2.5-30 [Source : ECSS-Q80B § 6.2.5.3]

The collection, storage, analysis and reporting of metrics shall be defined in the software product assurance plan.

EXPECTED OUTPUT: Details of metrics in software product assurance plan [PAF; SRR, PDR].

REQ-PA-8.3.2.5-40 [Source : ECSS-Q80B § 6.2.5.4]

The following basic process metrics shall be used within the supplier’s organization:

- duration: how phases and tasks are being completed versus the planned schedule;
- effort: how much effort is consumed by the various phases and tasks compared to the plan.

EXPECTED OUTPUT: Metrics reports in software product assurance reports [PAF; PDR, CDR, QR, AR, ORR].

REQ-PA-8.3.2.5-50 [Source : ECSS-Q80B § 6.2.5.5]

The following basic process metrics shall be used within the supplier’s organization, and reported to the customer:

- number of problems detected during inspection;
- number of problems detected during integration and validation testing and use.

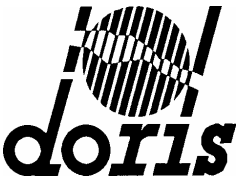
NOTE : See also software problem reporting described in sub clause “software problems”.

EXPECTED OUTPUT: Metrics reports in software product assurance reports [PAF; PDR, CDR, QR, AR, ORR].

REQ-PA-8.3.2.5-60 [Source : ECSS-Q80B § 6.2.5.6]

Metrics reports shall be included in the software product assurance reports.

EXPECTED OUTPUT: Metrics reports in software product assurance reports [PAF; PDR, CDR, QR, AR, ORR].

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8.3.2.6 Verification

REQ-PA-8.3.2.6-10 [Source : ECSS-Q80B § 6.2.6.1]

Activities for the verification of the quality requirements shall be specified in the definition of the verification plan (see ECSS-E-40B sub clause 5.8.2).

NOTE : Verification includes various techniques such as review, inspection, testing, walk-through, cross-reading, desk-checking, and many types of analysis such as traceability analysis, formal proof or fault tree analysis. The term “review” includes both joint reviews with the customer and internal reviews.

EXPECTED OUTPUT: Software verification plan - verification of quality requirements [DJF; PDR].

REQ-PA-8.3.2.6-20 [Source : modified ECSS-Q80B § 6.2.6.2]

- The outputs of each development activity shall be verified for conformance against pre-defined criteria.
- Only outputs which have been subjected to planned verifications shall be used as inputs for subsequent activities.

EXPECTED OUTPUT: Software product assurance reports [DJF; SRR, PDR, CDR, QR, AR, ORR].

REQ-PA-8.3.2.6-30 [Source : ECSS-Q80B § 6.2.6.3]

A summary of the assurance activities concerning the verification process and their findings shall be included in software product assurance reports.

EXPECTED OUTPUT: Software problem reports [DJF; SRR, PDR, CDR, QR, AR, ORR].

REQ-PA-8.3.2.6-40 [Source : modified ECSS-Q80B § 6.2.6.4]

The completion of actions related to software problem reports shall be verified and recorded.

EXPECTED OUTPUT: Software problem reports [DJF; SRR, PDR, CDR, QR, AR, ORR].

REQ-PA-8.3.2.6-50 [Source : new]

The completion of actions related to software problem reports shall be verified and recorded.

EXPECTED OUTPUT: Software problem reports [DJF; SRR, PDR, CDR, QR, AR, ORR]

REQ-PA-8.3.2.6-60 [Source : ECSS-Q80B § 6.2.6.5]

Software containing deactivated code shall be verified specifically to ensure that the deactivated code cannot be activated or that its accidental activation cannot harm the operation of the system.

EXPECTED OUTPUT:

- SPA reports [PAF; CDR, QR, AR, ORR];
- Software problem reports [DJF; CDR, QR, AR, ORR].

REQ-PA-8.3.2.6-70 [Source : modified ECSS-Q80B § 6.2.6.6]

Software containing configurable code shall be verified specifically to ensure that unintended configuration cannot be activated at run time or included during code generation.

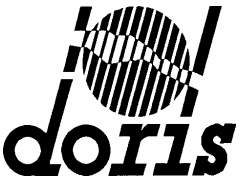
EXPECTED OUTPUT: Software verification reports [DJF; CDR, QR, AR].

REQ-PA-8.3.2.6-80 [Source : ECSS-Q80B § 6.2.6.7]

The supplier shall:

- ensure that the planned verification activities are adequate to ensure that the products of each phase are in conformity,
- ensure that verification activities are performed according to the plan, and
- ensure that the planned verification activities include full verification of critical software (see sub clause “software dependability and safety analysis”) at each stage of its development.

EXPECTED OUTPUT: Software problem reports [DJF; SRR, PDR, CDR, QR, AR, ORR].

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REQ-PA-8.3.2.6-90 [Source : ECSS-Q80B § 6.2.6.8]

Each review and inspection shall be based on a written procedure.

EXPECTED OUTPUT: Review and inspection procedures [PAF; SRR, PDR, CDR, QR, AR, ORR].

REQ-PA-8.3.2.6-100 [Source : ECSS-Q80B § 6.2.6.9]

The review or inspection procedures shall specify:

- the inspected items,
- the person in charge,
- participants,
- the means of inspection (e.g. tools or check list), and
- the nature of the report.

EXPECTED OUTPUT: Review and inspection procedures [PAF; SRR, PDR, CDR, QR, AR, ORR].

REQ-PA-8.3.2.6-110 [Source : ECSS-Q80B § 6.2.6.10]

Reviews and inspections shall be carried out according to defined criteria, and according to the defined level of independence of the reviewer from the author of the reviewed item.

REQ-PA-8.3.2.6-120 [Source : ECSS-Q80B § 6.2.6.11]

Review and inspection records shall be kept. These records shall identify the reviewed item, the author, the reviewer, the review criteria and the finding of the review.

EXPECTED OUTPUT: Review and inspection records [PAF; SRR, PDR, CDR, QR, AR, ORR].

REQ-PA-8.3.2.6-130 [Source : ECSS-Q80B § 6.2.6.12]

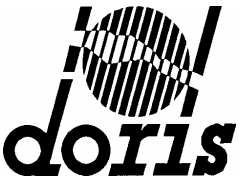
Traceability matrices shall be verified at each milestone.

EXPECTED OUTPUT: Review and inspection records [PAF; SRR, PDR, CDR, QR, AR, ORR].

8.3.2.7 Reuse of existing software

REQ-PA-8.3.2.7-10 [Source : modified ECSS-Q80B § 6.2.7]

- 1) Analyses of the advantages to be obtained with the selection of existing software w.r.t. new development shall be carried out.
- 2) The existing software shall be assessed with regards to the applicable functional, performance and quality requirements.
- 3) The quality level of the existing software shall be analysed with respect to the project requirements, according to the criticality of the system function implemented. The following aspects shall be considered:
 - a) software requirements documentation;
 - b) software architectural and detailed design documentation;
 - c) forward and backward traceability between system requirements, software requirements, design and code;
 - d) unit tests documentation and coverage;
 - e) integration tests documentation and coverage;
 - f) validation documentation and coverage;
 - g) verification reports;
 - h) performance (e.g, memory occupation, CPU load);
 - i) operational performances;
 - j) residual nonconformances and waivers;
 - k) user operational documentation (e.g. user manual);

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- l) code quality (adherence to coding standards, metrics).
- 4) The results of the reused software analysis (e.g. detailed reference to requirement and design documents, test reports and coverage results) shall be recorded in the software reuse file, together with an assessment of the possible level of reuse and a description of the assumptions and the methods applied when calculating the level of reuse.

EXPECTED OUTPUT : Results of the reused software analysis in the software reuse file [DJF; SRR, PDR].

REQ-PA-8.3.2.7-20 [Source : modified ECSS-Q80B § 6.2.7]

The analysis of the suitability of existing software for reuse shall be complemented by an assessment of the following aspects:

- the acceptance and warranty conditions;
- the available support documentation;
- the conditions of installation, preparation, training and use;
- the identification and registration by configuration management;
- maintenance responsibility and conditions, including the possibilities of changes;
- the durability and validity of methods and tools used in the initial development, that are envisaged to be used again;
- the copyright constraints (modification rights);
- the licensing conditions;
- exportability constraints.

EXPECTED OUTPUT: Results of the reused software analysis in the software reuse file [DJF; SRR, PDR].

REQ-PA-8.3.2.7-30 [Source : modified ECSS-Q80B § 6.2.7]

- a) Corrective actions shall be identified, documented in the reuse file and applied to the reused software not meeting the applicable requirements for the aspects listed in subclauses 6.2.7.1 and 6.2.7.2.
- b) Reverse engineering techniques shall be applied to generate missing documentation and to reach the required verification and validation coverage.
- c) For software products whose life cycle data from previous development are not available and reverse engineering techniques are not fully applicable, the following methods shall be applied:
- generation of validation and verification documents based on the available user documentation (e.g. user manual) and execution of tests in order to achieve the required level of test coverage;
 - use of the product service history to provide evidence of the product's suitability for the current application, including information about:
 - relevance of the product service history for the new operational environment,
 - configuration management and change control of the software product,
 - effectiveness of problem reporting,
 - actual error rates and maintenance records,
 - impact of modifications

EXPECTED OUTPUT: Corrective actions for reused software in the software reuse file [DJF; SRR, PDR].

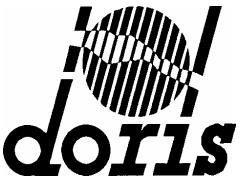
REQ-PA-8.3.2.7-40 [Source : modified ECSS-Q80B § 6.2.7]

The software reuse file shall be updated at project milestones to reflect the results of the identified corrective actions for reused software not meeting the project requirements.

EXPECTED OUTPUT: Results of Corrective actions for reused software in the software reuse file [DJF; CDR, QR, AR].

REQ-PA-8.3.2.7-50 [Source : modified ECSS-Q80B § 6.2.7]

All the reused software shall be identified and registered by configuration management.

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REQ-PA-8.3.2.7-60 [Source : modified ECSS-Q80B § 6.2.7]

The detailed configuration status of the reused software baseline shall be provided in the reuse file and shall be submitted to the customer for approval.

EXPECTED OUTPUT: Configuration status of reused software in the software reuse file [DJF; SRR, PDR, CDR, QR, AR].

8.3.2.8 Automatic code generation

REQ-PA-8.3.2.8-10 [Source : new]

For the selection of tools for automatic code generation, the supplier shall evaluate the following aspects: evolution of the tools in relation to the tools that use the generated code as an input (e.g. compilers or code management systems);

- customization of the tools to comply with project standards;
- portability requirements for the generated code;
- collection of the required design and code metrics;
- verification of software components containing generated code;
- configuration control of the tools including the parameters for customisation.

REQ-PA-8.3.2.8-20 [Source : new]

The requirements on testing applicable to the automatically generated code shall ensure the achievement of the same objectives as those for manually generated code.

EXPECTED OUTPUT: Verification and validation documentation [DJF; PDR, CDR, QR, AR, ORR].

REQ-PA-8.3.2.8-30 [Source : new]

The required level of verification and validation of the automatic generation tool shall be at least the same as the one required for the generated code, if the tool is used to skip verification and validation activities on the target code.

REQ-PA-8.3.2.8-40 [Source : new]

Modelling standards for automatic code generation tools shall be defined and applied.

EXPECTED OUTPUT: Modelling standards [PAF; SRR, PDR.]

REQ-PA-8.3.2.8-50 [Source : new]

Adherence to modelling standards shall be verified.

EXPECTED OUTPUT: Software product assurance reports [PAF; PDR, CDR].

REQ-PA-8.3.2.8-60 [Source : new]

Subclause « coding » shall be applicable to automatically generated code, unless the supplier demonstrates that the automatically generated code will not need to be manually modified.

REQ-PA-8.3.2.8-70 [Source : new]

The verification and validation documentation shall address separately the activities to be performed for manually and automatically generated code.

EXPECTED OUTPUT: Verification and validation documentation [DJF; PDR, CDR, QR, AR, ORR].

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8.3.3 REQUIREMENTS APPLICABLE TO INDIVIDUAL SOFTWARE ENGINEERING PROCESSES OR ACTIVITIES

8.3.3.1 Software requirements analysis

REQ-PA-8.3.3.1-10 [Source : ECSS-Q80B § 6.3.1.1]

The software development shall start with analysis to fully and unambiguously define the software requirements in the technical specification on the basis of these inputs.

NOTE 1 : The requirements baseline on the software can be presented to the supplier in various forms, e.g. a customer requirements specification, a system requirements specification or a general description of the project objectives.

NOTE 2 : The supplier may develop these requirements in close cooperation with the customer and the supplier may obtain the customer's approval before entering the development stage. In some cases, the technical specification is provided by the customer.

REQ-PA-8.3.3.1-20 [Source : ECSS-Q80B § 6.3.1.2]

The technical specification shall be subject to documentation control and configuration management as part of the development documentation

REQ-PA-8.3.3.1-30 [Source : ECSS-Q80B § 6.3.1.3]

In the definition of the technical specification all results from the dependability analysis (including results from the HSIA (ECSS-Q-30B sub clause 8.2.2)) shall be taken into account.

REQ-PA-8.3.3.1-40 [Source : ECSS-Q80B § 6.3.1.4]

The technical specification shall include all non-functional requirements necessary to satisfy the requirements baseline in addition to the functional requirements, including, as a minimum, the following: performance, safety, reliability, robustness, quality, maintainability, configuration management, security, privacy, metrication, verification and validation.

NOTE : Performance requirements include requirements on numerical accuracy.

EXPECTED OUTPUT: Software requirements specification - Non-functional requirements [TS; PDR]

REQ-PA-8.3.3.1-50 [Source : ECSS-Q80B § 6.3.1.5]

Prior to the technical specification elaboration, customer and supplier shall agree on the following principles and rules as a minimum:

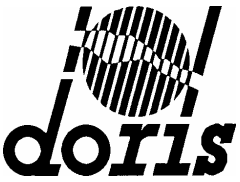
- assignment of persons (on both sides) responsible for establishing the technical specification;
- methods for agreeing on requirements and approving changes;
- efforts to prevent misunderstandings such as definition of terms, explanations of background of requirements;
- recording and reviewing discussion results on both sides

8.3.3.2 Software architectural design and design of software items

REQ-PA-8.3.3.2-10 [Source : ECSS-Q80B § 6.3.2.1]

A design methodology appropriate to the type of software product being developed and suitable tools shall be used, and identified in the software development plan.

The design method(s) and tools documentation shall be made available to the customer for acceptance.

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EXPECTED OUTPUT: Definition of methodology and tools in the software development plan [MGT; SRR, PDR].

REQ-PA-8.3.3.2-20 [Source : ECSS-Q80B § 6.3.2.2]

The design definition file shall be subject to documentation control and configuration management

REQ-PA-8.3.3.2-30 [Source : ECSS-Q80B § 6.3.2.3]

Mandatory and advisory design standards shall be defined and applied.

EXPECTED OUTPUT: Design standards [PAF; SRR, PDR]

REQ-PA-8.3.3.2-40 [Source : ECSS-Q80B § 6.3.2.4]

For software in which numerical accuracy is relevant to mission success (e.g. for an attitude and orbit control subsystem, scientific data generation components) specific rules on design and code shall be defined to ensure that the specified level of accuracy is obtained.

EXPECTED OUTPUT: Design and coding rules for numerical accuracy [PAF; PDR].

REQ-PA-8.3.3.2-50 [Source : ECSS-Q80B § 6.3.2.5]

Adherence to design standards shall be verified.

EXPECTED OUTPUT: Results in software product assurance reports [PAF; PDR, CDR].

REQ-PA-8.3.3.2-60 [Source : ECSS-Q80B § 6.3.2.6]

The complexity and modularity of the design shall be checked to ensure achievement of quality requirements.

NOTE : These checks can be implemented in parallel with the design process so as to ensure that they are taken into account by the designers.

EXPECTED OUTPUT: Results in software product assurance reports [PAF; PDR, CDR]

REQ-PA-8.3.3.2-70 [Source : ECSS-Q80B § 6.3.2.7]

The nature of the checks, the criteria, the tools used and the feedback process to the design team shall be described in the software product assurance plan.

EXPECTED OUTPUT: Description of checks in the software product assurance plan [PAF; PDR].

REQ-PA-8.3.3.2-80 [Source : ECSS-Q80B § 6.3.2.8]

Synthesis of results obtained and corrective actions implemented shall be described in quality assessment reports.

EXPECTED OUTPUT: Results in software product assurance reports [PAF; PDR, CDR].

REQ-PA-8.3.3.2-90 [Source : ECSS-Q80B § 6.3.2.9]

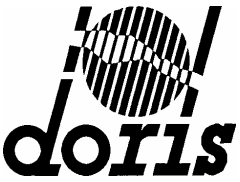
The supplier shall review the design documentation to ensure that it contains the appropriate level of information for maintenance activities.

EXPECTED OUTPUT:

- Description of checks in the software product assurance plan [PAF; SRR, PDR];
- Results in software product assurance reports [PAF; PDR, CDR, QR, AR, ORR].

8.3.3.3 Coding

REQ-PA-8.3.3.3-10 [Source : ECSS-Q80B § 6.3.3.1]

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Coding standards (including consistent naming conventions and adequate commentary rules) shall be specified and observed.

EXPECTED OUTPUT: Coding standards [PAF; PDR].

REQ-PA-8.3.3.3-20 [Source : ECSS-Q80B § 6.3.3.2]

The standards shall be designed to ensure consistency with the product quality requirements.

NOTE : Coding standards depend on the software quality objectives (see sub clause “product quality objectives and metrication”).

EXPECTED OUTPUT: Coding standards and description of tools [PAF; PDR].

REQ-PA-8.3.3.3-30 [Source : ECSS-Q80B § 6.3.3.3]

The tools to be used in implementing and checking conformance with coding standards shall be identified in the product assurance plan before coding activities start.

EXPECTED OUTPUT: Coding standards and description of tools [PAF; PDR].

REQ-PA-8.3.3.3-40 [Source : ECSS-Q80B § 6.3.3.4]

Coding standards shall be reviewed with the customer to ensure that they reflect product quality requirements.

EXPECTED OUTPUT: Coding standards and description of tools [PAF; PDR].

REQ-PA-8.3.3.3-50 [Source : ECSS-Q80B § 6.3.3.5]

Use of low-level programming languages shall be justified.

EXPECTED OUTPUT: Document justifying suitability of the language [DJF; PDR].

REQ-PA-8.3.3.3-60 [Source : ECSS-Q80B § 6.3.3.6]

Measurement and analysis on code (e.g. complexity) shall be performed to ensure conformance to quality requirements.

NOTE 1 : This measurement can be implemented in parallel with the coding process to ensure that the results are easily taken into account by the developers.

NOTE 2 : Automatic means to measure adherence of the code to the coding standards can be used.

EXPECTED OUTPUT: Description of measurements and tools [PAF; PDR, CDR, QR, AR, ORR].

REQ-PA-8.3.3.3-70 [Source : ECSS-Q80B § 6.3.3.7]

The nature of the measurements, the aspects of the coding standards to be checked, the tools used and the relationship to the coding team shall be described in the software product assurance plan.

EXPECTED OUTPUT: Description of measurements and tools [PAF; PDR].

REQ-PA-8.3.3.3-80 [Source : ECSS-Q80B § 6.3.3.8]

Synthesis of code analysis results and corrective actions implemented shall be described in software product assurance reports.

EXPECTED OUTPUT: Description of measurements and synthesis in software product assurance reports [PAF; CDR, QR, AR, ORR].

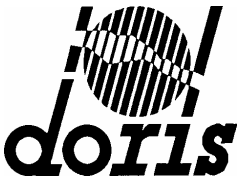
REQ-PA-8.3.3.3-90 [Source : ECSS-Q80B § 6.3.3.9]

The code shall be put under configuration control immediately after successful unit testing.

REQ-PA-8.3.3.3-100 [Source : ECSS-Q80B § 6.3.3.10]

Unreachable code shall be removed, or a justification for the decision not to remove it shall be provided.

EXPECTED OUTPUT: Justification for retention of unreachable code [DJF; CDR, QR, AR]

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8.3.3.4 Testing and validation

REQ-PA-8.3.3.4-10 [Source : ECSS-Q80B § 6.3.4.1]

Testing shall be performed in accordance with a strategy for each testing level (i.e. unit, integration, validation against the technical specification, validation against the requirements baseline, acceptance) which includes:

- the types of tests to be performed, e.g. functional, boundary, performance, and usability tests,
- the tests to be performed in accordance with the plans and procedures, and
- means and organizations to perform assurance function for testing and validation.

EXPECTED OUTPUT: Assurance activities for testing in the software product assurance plan [PAF; PDR, CDR].

REQ-PA-8.3.3.4-20 [Source : ECSS-Q80B § 6.3.4.2]

Based on the criticality of the software, test coverage goals for each testing level shall be agreed between the customer and the supplier and their achievement monitored by metrics:

- for unit level testing (such as branch coverage and decision coverage);
- for integration level testing (such as call graph and parameter passing);
- for validation against the technical specification and validation against the requirements baseline (such as all requirements, all external interfaces and using nominal, boundary, zero/nil and out of range data value).

EXPECTED OUTPUT: Assurance activities for testing in the software product assurance plan [PAF; PDR, CDR].

REQ-PA-8.3.3.4-30 [Source : ECSS-Q80B § 6.3.4.3]

The supplier shall ensure through internal review that the test procedures and data are adequate, feasible and traceable and that they satisfy requirements.

EXPECTED OUTPUT: Collected data and analysis of the results in the software product assurance report [PAF; CDR, QR, AR, ORR].

REQ-PA-8.3.3.4-40 [Source : ECSS-Q80B § 6.3.4.4]

Test readiness reviews shall be held before the commencement of key test activities.

REQ-PA-8.3.3.4-50 [Source : ECSS-Q80B § 6.3.4.5]

For each test activity, test coverage shall be checked with respect to the stated goals.

NOTE : This check can be made with an automatic tool to measure the coverage obtained.

EXPECTED OUTPUT: Collected data and analysis of the results in the software product assurance report [PAF; CDR, QR, AR, ORR].

REQ-PA-8.3.3.4-60 [Source : ECSS-Q80B § 6.3.4.6]

The measurements shall be performed throughout the test programme.

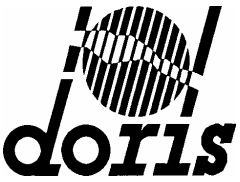
NOTE : The supplier can implement these measurements in a way that allows developers to take the results as inputs.

EXPECTED OUTPUT: Collected data and analysis of the results in the software product assurance report [PAF; CDR, QR, AR, ORR].

REQ-PA-8.3.3.4-70 [Source : ECSS-Q80B § 6.3.4.7]

The supplier shall ensure that non-conformances and software problem reports detected during testing are properly documented and reported to those concerned.

EXPECTED OUTPUT: Non-conformance report and SPR [DJF; CDR, QR, AR, ORR].

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REQ-PA-8.3.3.4-80 [Source : ECSS-Q80B § 6.3.4.8]

The test coverage of configurable code shall be checked to ensure that the stated requirements are met in each tested configuration.

EXPECTED OUTPUT: Statement of compliance with test plans and procedures [PAF; CDR, QR, AR, ORR].

REQ-PA-8.3.3.4-90 [Source : ECSS-Q80B § 6.3.4.9]

The supplier shall ensure that problem reports and subsequent actions are properly closed out.

REQ-PA-8.3.3.4-100 [Source : ECSS-Q80B § 6.3.4.10]

Provisions shall be made to allow witnessing of tests by the customer

REQ-PA-8.3.3.4-110 [Source : ECSS-Q80B § 6.3.4.11]

Provisions shall be made to allow witnessing of tests by supplier personnel independent of the development (e.g. specialist software product assurance personnel).

REQ-PA-8.3.3.4-120 [Source : ECSS-Q80B § 6.3.4.12]

The supplier shall ensure that tests are conducted in accordance with approved test procedures and data, that the configuration under test is correct, that the tests are properly documented and that the test reports are up to date and valid.

EXPECTED OUTPUT: Statement of compliance with test plans and procedures [PAF; CDR, QR, AR, ORR].

REQ-PA-8.3.3.4-130 [Source : ECSS-Q80B § 6.3.4.13]

The supplier shall ensure that tests are repeatable by verifying the storage and recording of tested software, support software, test environment, supporting documents and problems found.

EXPECTED OUTPUT: Statement of compliance with test plans and procedures [PAF; CDR, QR, AR, ORR].

REQ-PA-8.3.3.4-140 [Source : ECSS-Q80B § 6.3.4.14]

The supplier shall confirm in writing that the tests are successfully completed.

EXPECTED OUTPUT: Statement of compliance with test plans and procedures [PAF; CDR, QR, AR, ORR].

REQ-PA-8.3.3.4-150 [Source : ECSS-Q80B § 6.3.4.15]

Review boards looking to engineering and product assurance aspects shall be convened after the completion of key test phases.

REQ-PA-8.3.3.4-160 [Source : ECSS-Q80B § 6.3.4.16]

Areas affected by any modifications shall be identified and re-tested (regression testing).

REQ-PA-8.3.3.4-170 [Source : ECSS-Q80B § 6.3.4.17]

In case of re-testing, all test related documentation (test procedures and data, reports) shall be updated accordingly.

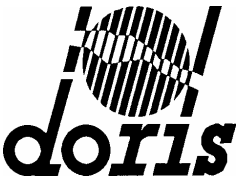
EXPECTED OUTPUT: Updated test documentation [DJF; CDR, QR, AR, ORR].

REQ-PA-8.3.3.4-180 [Source : ECSS-Q80B § 6.3.4.18]

The need for regression testing and additional verification of software shall be analysed after any change of platform hardware.

EXPECTED OUTPUT: Updated test documentation [DJF; CDR, QR, AR, ORR].

REQ-PA-8.3.3.4-190 [Source : ECSS-Q80B § 6.3.4.19]

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The need for regression testing and additional verification of software shall be analysed after a change or update of any tool used to generate it (e.g. source code or object code).

EXPECTED OUTPUT: Updated test documentation [DJF; CDR, QR, AR, ORR].

REQ-PA-8.3.3.4-200 [Source : ECSS-Q80B § 6.3.4.20]

Validation shall be carried out by staff who has not taken part in the design or coding of the software being validated.

NOTE : This can be achieved at the level of the whole software product, or on a component by component basis.

REQ-PA-8.3.3.4-210 [Source : ECSS-Q80B § 6.3.4.21]

Validation of the flight software against the requirements baseline on the flight equipment model shall be performed on a software version without any patch.

EXPECTED OUTPUT: Contribution to the test and validation documentation [DJF; PDR, CDR, QR, AR, ORR].

REQ-PA-8.3.3.4-220 [Source : ECSS-Q80B § 6.3.4.22]

The supplier shall review the test documentation to ensure that it is up to date and organized to facilitate its reuse for maintenance.

REQ-PA-8.3.3.4-230 [Source : ECSS-Q80B § 6.3.4.25]

Tests shall be organized as activities in their own right in terms of planning, resources and team composition. The necessary resources shall be identified early in the life cycle taking into account the operating and maintenance requirements.

Test tool development or acquisition (hardware and software) shall be planned for in the overall project plan.

EXPECTED OUTPUT: Contribution to the test and validation documentation [DJF; PDR, CDR, QR, AR, ORR]

REQ-PA-8.3.3.4-240 [Source : ECSS-Q80B § 6.3.4.26]

The supplier shall establish and review the test procedures and data before starting testing activities and also document the constraints of the tests concerning physical, performance, functional, controllability and observability limitations.

EXPECTED OUTPUT: Contribution to the test and validation documentation [DJF; PDR, CDR, QR, AR, ORR].

REQ-PA-8.3.3.4-250 [Source : ECSS-Q80B § 6.3.4.27]

Before offering the product for delivery and customer acceptance, the supplier shall validate its operation as a complete product, under conditions similar to the application environment as specified in the requirements baseline.

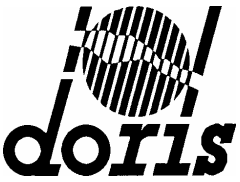
REQ-PA-8.3.3.4-260 [Source : ECSS-Q80B § 6.3.4.28]

Where testing under the operational environment occurs, the following concerns shall be addressed:

- the features to be tested in the operational environment;
- the specific responsibilities of the supplier and customer for carrying out and evaluating the test;
- restoration of the previous operational environment (after test).

EXPECTED OUTPUT: Contribution to the test and validation documentation [DJF; AR].

REQ-PA-8.3.3.4-270 [Source : ECSS-Q80B § 6.3.4.30]

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The validation shall include testing in the different configurations possible or in a representative set of them when it is evident that the number of possible configurations is too high to allow validation in all of them.

EXPECTED OUTPUT:

- a. SPA reports [PAF; CDR, QR, AR, ORR];
- b. Software problem reports [DJF; CDR, QR, AR, ORR].

REQ-PA-8.3.3.4-280 [Source : ECSS-Q80B § 6.3.4.31]

Software containing deactivated code shall be validated specifically to ensure that the deactivated code cannot be activated or that its accidental activation cannot harm the operation of the system.

EXPECTED OUTPUT:

- a. SPA reports [PAF; CDR, QR, AR, ORR];
- b. Software problem reports [DJF; CDR, QR, AR, ORR].

REQ-PA-8.3.3.4-290 [Source : modified ECSS-Q80B § 6.3.4.32]

Software containing configurable code shall be validated specifically to ensure that unintended configuration cannot be activated at run time or included during code generation.

EXPECTED OUTPUT: Testing and validation reports [DJF; CDR, QR, AR].

8.3.3.5 Software delivery and acceptance

REQ-PA-8.3.3.5-10 [Source : ECSS-Q80B § 6.3.5.1]

The roles, responsibilities and obligations of the supplier and customer during installation shall be established.

EXPECTED OUTPUT: Contribution to the installation plan [DJF; AR].

REQ-PA-8.3.3.5-20 [Source : ECSS-Q80B § 6.3.5.2]

The installation shall be performed in accordance with the installation plan.

REQ-PA-8.3.3.5-30 [Source : ECSS-Q80B § 6.3.5.3]

The customer shall establish an acceptance test plan specifying the intended acceptance tests including specific tests taking into account the target environment (see ECSS-E-40B sub clause 5.7.3.1).

NOTE 1 : The acceptance tests can be partly made up of tests used during previous test activities.

NOTE 2 : The acceptance test plan takes into account the requirement for operational demonstration, either as part of acceptance or after acceptance.

EXPECTED OUTPUT: Acceptance test plan [DJF; AR].

REQ-PA-8.3.3.5-40 [Source : ECSS-Q80B § 6.3.5.4]

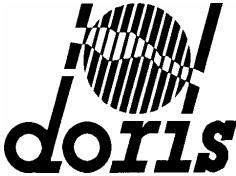
The customer shall ensure that the acceptance tests are performed in accordance with the approved acceptance test plan (see ECSS-E-40B sub clause 5.7.3.1).

NOTE : The method of handling problems detected during the acceptance procedure and their disposition are agreed between the customer and supplier and are documented.

REQ-PA-8.3.3.5-50 [Source : ECSS-Q80B § 6.3.5.5]

The supplier shall ensure before the software is presented for customer acceptance that:

- the delivered software complies with the contractual requirements (including any specified content of the software acceptance data pack);
- the source and object code supplied correspond to each other;
- all agreed changes are implemented;
- all non-conformances are either resolved or declared.

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EXPECTED OUTPUT: Acceptance test plan [DJF; AR].

REQ-PA-8.3.3.5-60 [Source : ECSS-Q80B § 6.3.5.6]

The customer shall verify that the executable code was regenerated from configuration managed source code components and installed in accordance with predefined procedures on the target environment.

REQ-PA-8.3.3.5-70 [Source : ECSS-Q80B § 6.3.5.7]

Any discovered problems shall be documented in non-conformance reports.

EXPECTED OUTPUT: Non conformance report [DJF; AR].

REQ-PA-8.3.3.5-80 [Source : ECSS-Q80B § 6.3.5.8]

On completion of the acceptance tests, a report shall be drawn up and be signed by the supplier's representatives, the customer's representatives, the software quality engineers of both parties and the representative of the organization charged with the maintenance of the software product.

EXPECTED OUTPUT: Acceptance test report [DJF; AR].

REQ-PA-8.3.3.5-90 [Source : ECSS-Q80B § 6.3.5.9]

The acceptance test report shall certify conformance to the procedures and state the conclusion concerning the test result for the software product under test (accepted, conditionally accepted, rejected).

EXPECTED OUTPUT: Acceptance test report [DJF; AR].

8.3.3.6 Maintenance

REQ-PA-8.3.3.6-10 [Source : ECSS-Q80B § 6.3.7.1]

The organization responsible for maintenance shall be identified early in the development life cycle to allow a smooth transition into the operations and maintenance.

NOTE : An organization, with representatives from both supplier and customer, can be set up to support the maintenance activities. Attention is drawn to the importance of the flexibility of this organization to cope with the unexpected occurrence of problems and the identification of facilities and resources to be used for the maintenance activities.

EXPECTED OUTPUT: Maintenance plan - assurance [MF; QR, AR, ORR].

REQ-PA-8.3.3.6-20 [Source : ECSS-Q80B § 6.3.7.2]

The maintenance organization shall specify the assurance, verification and validation activities applicable to maintenance interventions.

EXPECTED OUTPUT: Maintenance plan - assurance [MF; QR, AR, ORR].

REQ-PA-8.3.3.6-30 [Source : ECSS-Q80B § 6.3.7.3]

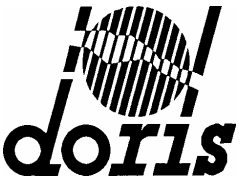
The maintenance plans shall be verified against specified requirements for maintenance of the software product.

NOTE : The maintenance plans and procedures can address corrective, improving, adaptive and preventive maintenance, differentiating between "routine" and "emergency" maintenance activities.

REQ-PA-8.3.3.6-40 [Source : ECSS-Q80B § 6.3.7.4]

The maintenance plans and procedures shall include the following as a minimum:

- scope of maintenance;
- identification of the first version of the software product for which maintenance is to be done;
- support organization;
- maintenance life cycle;

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- maintenance activities;
- quality measures to be applied during the maintenance;
- maintenance records and reports.

EXPECTED OUTPUT: Maintenance plan - assurance [MF; QR, AR, ORR].

REQ-PA-8.3.3.6-50 [Source : ECSS-Q80B § 6.3.7.5]

Rules for the submission of maintenance reports shall be established and agreed as part of the maintenance plan.

EXPECTED OUTPUT: Rules for submission of maintenance reports - Maintenance plan - assurance [MF; QR, AR, ORR].

REQ-PA-8.3.3.6-60 [Source : ECSS-Q80B § 6.3.7.6]

All maintenance activities shall be logged in predefined formats and retained.

EXPECTED OUTPUT: Maintenance records [MF; QR, AR, ORR].

REQ-PA-8.3.3.6-70 [Source : ECSS-Q80B § 6.3.7.7]

Maintenance records, including as a minimum the following information, shall be established for each software product:

- list of requests for assistance or problem reports that have been received and the current status of each;
- organization responsible for responding to requests for assistance or implementing the appropriate corrective actions;
- priorities assigned to the corrective actions;
- results of the corrective actions;
- statistical data on failure occurrences and maintenance activities.

NOTE : The record of the maintenance activities can be utilized for evaluation and enhancement of the software product and for improvement of the quality system itself.

EXPECTED OUTPUT: Maintenance records [MF; QR, AR, ORR].

8.4 SOFTWARE PRODUCT QUALITY ASSURANCE

8.4.1 PRODUCT QUALITY OBJECTIVES AND METRICATION

REQ-PA-8.4.1-10 [Source : ECSS-Q80B § 7.1.1]

Assurance activities for product quality requirements

The supplier shall define assurance activities to ensure that the product meets the quality requirements as specified in the technical specification.

EXPECTED OUTPUT: Software product assurance plan - assurance activities [PAF; SRR, PDR].

REQ-PA-8.4.1-20 [Source : ECSS-Q80B § 7.1.2]

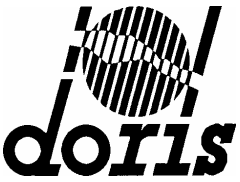
Deriving of requirements

The software quality requirements shall be derived from the reliability, safety, maintainability and quality requirements of the system.

EXPECTED OUTPUT: Software quality requirements [TS; PDR].

REQ-PA-8.4.1-30 [Source : ECSS-Q80B § 7.1.3.1]

Quality models

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Quality models shall be used to specify the quality requirements.

NOTE : This can be done by reference to a quality model such as ISO/IEC 9126.

EXPECTED OUTPUT: Software quality models [PAF; PDR].

REQ-PA-8.4.1-40 [Source : ECSS-Q80B § 7.1.3.2]

Quality models

The following characteristics shall be used to specify the quality model:

- functionality;
- reliability;
- maintainability;
- reusability;
- operability;
- documentation quality;
- suitability for safety;
- security.

EXPECTED OUTPUT: Software quality models [PAF; PDR].

REQ-PA-8.4.1-50 [Source : ECSS-Q80B § 7.1.3.3]

Quality models

Quality requirements shall be expressed in quantitative terms or constraints.

EXPECTED OUTPUT: Software quality requirements [TS; PDR].

REQ-PA-8.4.1-60 [Source : ECSS-Q80B § 7.1.4.1]

Product metrics

The supplier shall define a metrication programme to verify and prove that the project rules for design, code and documentation are properly applied and complied with.

REQ-PA-8.4.1-70 [Source : ECSS-Q80B § 7.1.4.2]

Product metrics

The supplier shall define the relevant metrics, their associated target values and the means to collect or measure them, to assess the actual quality characteristics of the product for comparison with those required.

EXPECTED OUTPUT: Products metrics specification and justification in the software product assurance plan [PAF; SRR, PDR].

REQ-PA-8.4.1-80 [Source : ECSS-Q80B § 7.1.5]

Measurement

Measurements shall be performed throughout the development and the results obtained shall be used to define corrective actions.

EXPECTED OUTPUT: Report of the analysis and remedial actions in the software product assurance report [PAF; PDR, CDR, QR, AR, ORR].

REQ-PA-8.4.1-90 [Source : ECSS-Q80B § 7.1.6]

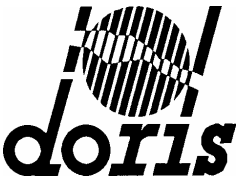
Measurement results

The results shall be used to provide the customer with an insight into the level of quality obtained through software product assurance reports.

EXPECTED OUTPUT: Report of the analysis and metrics in the software product assurance report [PAF; PDR, CDR, QR, AR, ORR].

REQ-PA-8.4.1-100 [Source : ECSS-Q80B § 7.1.7]

Basic metrics

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The following basic products metrics shall be used:

- size (design, code);
- complexity (design, code);
- fault density and failure intensity;
- test coverage;
- number of failures.

EXPECTED OUTPUT: Product metrics specification and justification in the software product assurance plan [PAF; SRR, PDR].

REQ-PA-8.4.1-110 [Source : ECSS-Q80B § 7.1.8]

Metrication process

Metrics chosen shall be collected, stored, analysed and reported.

EXPECTED OUTPUT: Report of the analysis and metrics in the software product assurance report [PAF; PDR, CDR, QR, AR, ORR].

REQ-PA-8.4.1-120 [Source : ECSS-Q80B § 7.1.9]

Metrics analysis

The metrics shall be analysed against target values or quality requirements and remedial actions shall be taken to ensure conformance to quality requirements.

EXPECTED OUTPUT: Report of the analysis and remedial actions in the software product assurance report [PAF; PDR, CDR, QR, AR, ORR].

REQ-PA-8.4.1-130 [Source : ECSS-Q80B § 7.1.10]

Numerical accuracy

Numerical accuracy shall be estimated and verified.

EXPECTED OUTPUT: Numerical accuracy analysis [DJF; PDR, CDR, QR].

REQ-PA-8.4.1-140 [Source : ECSS-Q80B § 7.1.11]

Analysis of software behaviour

The supplier shall define the organization and means implemented to collect and analyse data required for the study of software behaviour (e.g. failures, corrections, duration of runs).

EXPECTED OUTPUT: Report of the analysis of software behaviour in the software product assurance report [PAF; PDR, CDR, QR, AR, ORR].

REQ-PA-8.4.1-150 [Source : ECSS-Q80B § 7.1.12]

Metrics trend

Data shall be collected with respect to predetermined procedures, and processed to derive:

- descriptive statistics (e.g. the number of units at each level of complexity), and
- trend analysis (such as trends in software problems).

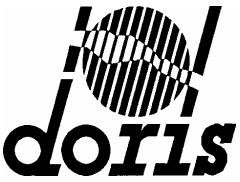
EXPECTED OUTPUT: Report of the analysis and metrics in the software product assurance report [PAF; PDR, CDR, QR, AR, ORR].

REQ-PA-8.4.1-160 [Source : ECSS-Q80B § 7.1.13]

Improvement actions

Metrics data shall be used to determine further actions to improve the software.

EXPECTED OUTPUT: Records of data collection, analysis and results and actions for improvement [PAF; PDR, CDR, QR, AR, ORR].

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8.4.2 PRODUCT QUALITY REQUIREMENTS

8.4.2.1 Technical specification

REQ-PA-8.4.2.1-10 [Source : ECSS-Q80B § 7.2.1.1]

The software quality requirements shall be documented in the technical specification.

EXPECTED OUTPUT: Software quality requirements [TS; PDR].

REQ-PA-8.4.2.1-20 [Source : modified ECSS-Q80B § 7.2.1.2]

The software requirements shall be:

- correct;
- unambiguous;
- complete;
- consistent;
- verifiable;
- traceable.

REQ-PA-8.4.2.1-30 [Source : ECSS-Q80B § 7.2.1.3]

Requirements shall be stated in terms that allow verification and validation.

NOTE : Preferably requirements are specified in measurable/quantitative terms.

REQ-PA-8.4.2.1-40 [Source : ECSS-Q80B § 7.2.1.4]

For each requirement the method for verification and validation shall be specified.

EXPECTED OUTPUT: Verification and validation method for each requirement [DJF; PDR].

8.4.2.2 Design and related documentation

REQ-PA-8.4.2.2-10 [Source : ECSS-Q80B § 7.2.2.1]

The software design shall meet the quality requirements as documented in the technical specification.

REQ-PA-8.4.2.2-20 [Source : ECSS-Q80B § 7.2.2.2]

The product shall be designed to facilitate testing and to meet the non-functional requirements.

REQ-PA-8.4.2.2-30 [Source : ECSS-Q80B § 7.2.2.3]

Software with a long planned lifetime shall be designed with minimum dependency on the operating system and the hardware, in order to aid portability.

EXPECTED OUTPUT:

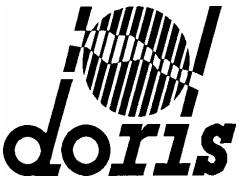
- a. Product quality requirements reflected in coding and design standards [PAF; SRR, PDR];
- b. Justification of design choices [DJF; PDR, CDR].

8.4.2.3 Software intended for reuse

REQ-PA-8.4.2.3-10 [Source : ECSS-Q80B § 7.2.3.1]

The development of software to be reused shall follow ECSS-E-40B sub clauses 5.2.5.6, 5.4.3.9 and 5.4.3.10

REQ-PA-8.4.2.3-20 [Source : ECSS-Q80B § 7.2.3.2]

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The information related to components developed for reuse shall be separated from others in the technical specification, design justification file, design definition file and the product assurance file.

REQ-PA-8.4.2.3-30 [Source : ECSS-Q80B § 7.2.3.3]

The information related to components developed for reuse in the technical specification, the design justification file, the design definition file and the product assurance file shall be self-contained.

REQ-PA-8.4.2.3-40 [Source : ECSS-Q80B § 7.2.3.4]

The technical specification of components developed for reuse shall include requirements for maintainability, portability and verification of those components for the projects intending to reuse them.

EXPECTED OUTPUT: Technical specification for reusable components in the software reuse file [DJF; SRR, PDR].

REQ-PA-8.4.2.3-50 [Source : ECSS-Q80B § 7.2.3.5]

The configuration management system shall take the specific aspects of software developed for reuse into account, such as

- longer lifetime of the components developed for reuse compared to the other components of the project,
- evolution or change of the development environment for the next project that intends to use the components, and
- transfer of the configuration and documentation management information to the next project.

EXPECTED OUTPUT: Configuration management for software reuse file [MGT; SRR, PDR].

REQ-PA-8.4.2.3-60 [Source : ECSS-Q80B § 7.2.3.6]

Where the components developed for reuse are developed to be reusable on different platforms, the testing of the software shall be performed on all those platforms.

EXPECTED OUTPUT: Test reports for the software reuse file [DJF; CDR].

REQ-PA-8.4.2.3-70 [Source : ECSS-Q80B § 7.2.3.7]

The supplier shall certify that the tests have been successfully completed on all the relevant platforms.

EXPECTED OUTPUT: Test reports for the software reuse file [DJF; SRR, PDR].

8.4.3 SUPPORTING DOCUMENTATION

8.4.3.1 Test and validation documentation

REQ-PA-8.4.3.1-10 [Source : ECSS-Q80B § 7.3.1.1]

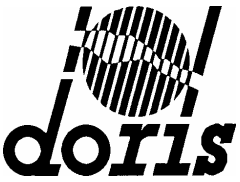
Detailed test and validation documentation (data, procedures and expected results) defined in the ECSS-E-40 DJF shall be consistent with the defined test and validation strategy (see sub clause “testing and validation” and ECSS-E-40B sub clauses 5.5.3, 5.5.4, 5.6 and 5.8).

REQ-PA-8.4.3.1-20 [Source : ECSS-Q80B § 7.3.1.2]

The test documentation shall cover the test environment, tools and test software, personnel required and associated training requirements.

REQ-PA-8.4.3.1-30 [Source : ECSS-Q80B § 7.3.1.3]

The criteria for completion of each test and any contingency steps shall be specified.

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REQ-PA-8.4.3.1-40 [Source : ECSS-Q80B § 7.3.1.4]

Test procedures, data and expected results shall be specified.

REQ-PA-8.4.3.1-50 [Source : ECSS-Q80B § 7.3.1.5]

The hardware and software configuration shall be identified and documented as part of the test documentation.

REQ-PA-8.4.3.1-60 [Source : ECSS-Q80B § 7.3.1.6]

For any requirements not covered by testing a verification report shall be drawn up documenting or referring to the verification activities performed.

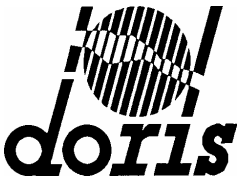
EXPECTED OUTPUT: Verification reports [DJF; CDR, QR, AR].

8.4.3.2 Reports and analysis

REQ-PA-8.4.3.2-10 [Source : ECSS-Q80B § 7.3.2]

Software product assurance reports shall report on the execution and the results of all assurance, verification and validation activities.

EXPECTED OUTPUT: Software product assurance report [PAF; SRR, PDR, CDR, QR, AR, ORR].

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9. SUMMARY OF DOCUMENTS TO BE PRODUCED

DEFINITION [source: RD1 §3.10]

Approval

The formal agreement to use or apply an item.

NOTE 1 Approval implies that the approving authority has verified that the item conforms to its requirements.

NOTE 2 Adapted from EN 13701:2001.

NOTE 3 The approval definition shall be systematically shown in the contrat field in order to precise if the customer responsibilities are committed or not.

DEFINITION [source: RD1 §3.1]

Acceptance

The act of an authorized representative of the customer by which the customer assumes for itself, or as an agent of another party, ownership of existing and specified products tendered, or confirms satisfactory performance of specific services, as partial or complete performance of the contract on the part of the supplier

DEFINITION []

Consultation means readily available for consultation (reviewable) by the Customer at the Supplier's premises.

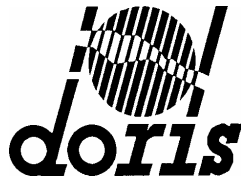
REQ-PA-9-10 [source: this document]

The Supplier shall establish all documents as defined in the below table and in § 8 "Software" for the Customer's Approval (Ap), Acceptance (Ac), Information (In) or Consultation (Co).

Note: R stands for "upon Request from the Customer"

Note: For software product assurance, the expected outputs are directly defined inside the requirements.

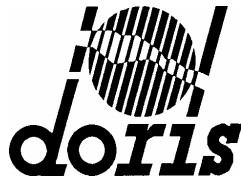
N°	DOCUMENT	§	A p	A c	I n	C o	Conformity status
POLICY PRINCIPLES							
1	Organization note / management plan / PA plan	2.1		X			
2	Training program	2.2				X	
3	Compliance matrix to the PA requirements	2.3	X				
4	Project PA Plan	2.3	X				
5	PA progress report	2.4			X		
6	Critical items list	2.6		X			
7	Experience summary report	2.7				X	
QUALITY ASSURANCE							
8	Audit plan for procurement activities	3.4				X	
9	Configuration management plan	3.5		X			



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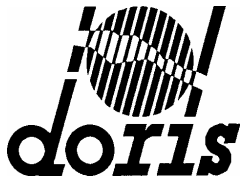
10	Definition change	3.5	X				
11	Master list document	3.7				X	
12	Quality records	3.8				X	
13	Traceability system	3.9		X			
14	Non-conformance control system	3.13		X			
15	Non-conformances List (part of the PA progress report)	3.13			X		
16	Major non-conformances	3.13	X				
17	Minor non-conformances	3.13				X	
18	Supplier internal alerts	3.14			X		
19	Procedures for handling, storage and shipping	3.15			X		
20	Verification matrix for technical specifications	3.25		X			
21	FM/QM as-built configuration differences	3.27				X	
22	Complementary qualification tests	3.27		X			
23	Qualification test procedures and facilities	3.28				X	
24	Qualification status (part of the PA progress report)	3.29			X		
25	Design changes and modifications	3.31	X				
26	List of procurement sources	3.34			R		
27	Procurement documents	3.35				X	
28	Surveillance programme of procurement sources	3.36				X	
29	Receiving inspection records	3.39			X		
30	Manufacturing plan or flow chart	3.41				X	
31	Manufacturing, assembly and integration documents	3.41				X	
32	Manufacturing processes	3.43				X	
33	Process specifications	3.43				X	
34	Workmanship standards	3.46				X	
35	Records of all manufacturing equipment	3.48				X	
36	Manufacturing, assembly and integration records	3.49				X	
37	Cleanliness and Contamination Control	3.50	X				
38	Records of temporary installations and removals	3.56				X	
39	Logbooks (part of the EIDP)	3.57			X		
40	Manufacturing, assembly and integration records	3.58				X	
41	Test procedures	3.61				X	
42	Test reports	3.62			X		
43	Eidp	3.66		X			
44	Supplier coc	3.67			X		
DEPENDABILITY							
45	All reviewable data: RDP, RCD etc...	4.12				X	
46	Reliability Prediction	4.27			X	X	Optional
47	Instrument Preliminary Functional FMEA / FMECA including Common Cause Analysis	4.28		X			



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48	Component Level Interface FMEA	4.28	X				
49	Worst Case Analysis on performance-critical functions	4.33		X			
50	Part Stress Analyses at equipment level	4.34		X			
51	Availability Analyses	4.38+4.39		X			
SAFETY							
52	Compliance matrix to the Safety requirements	5.1	X				
53	Instrument Risk Analysis (Safety Analysis)	5.3		X			
EEE COMPONENTS							
54	"as design" DCL	6.2.5	X				
55	RFW during equipment manufacturing	6.2.5	X				
56	"as built" DCL	6.2.5		X			
57	Technical note for parts having pure tin in internal cavities	6.3.2.2	X				
58	Radiation hardness assurance plan	6.3.2.3	X				
59	Equipment radiation analysis document	6.3.2.3	X				
60	Export authorisation	6.3.2.6		X			
61	Evaluation plans	6.3.3.1	X				
62	Evaluation reports	6.3.3.1	X				
63	Pad's	6.3.4	X				
64	Justification documents	6.3.4	X				
65	Procurement specifications prepared in the frame of the project	6.4.2	X				
66	Procedure for customer precap	6.4.4		X			
67	Procedure for incoming.	6.4.7		X			
68	RVT reports when RVT is performed in the frame of the project	6.4.8			X		
69	Procedure for DPA.	6.4.9		X		X	
70	DPA reports.	6.4.9			X	X	
71	Procedure for handling and storage of EEE parts	6.5		X			
72	Action plan for alerts	6.6.3		X			
73	Procedure for post-programming sequence	6.7.4		X			
MATERIALS, MECHANICAL PARTS, PROCESSES							
74	Declared materials, mechanical parts and processes lists	7.3		X			
75	Validation report	7.16		X			
76	Critical element (material, processes and mechanical parts) list	7.3		X			

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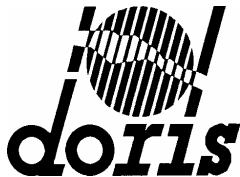
ANNEX A - MAIN DISCREPANCIES REGARDING RNC/ECSS REQUIREMENTS

ECSS-Q-00

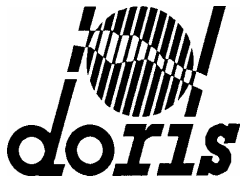
delta	§ ECSS-Q-00	Justification
deleted	§4.3.2.d documented training program	<i>le fournisseur est censé posséder les compétences en interne sur son produit.</i>
deleted	§4.3.2.e Reviews and audits by personnel not directly involved...	<i>trop formel</i>
modified	§4.3.3.a PA Manager - or at least a PA function	
modified	§4.3.3.c compliance matrix to the PA requirements	<i>Priorité 1 = matrice de conformité</i>
deleted	§4.3.3.e. The supplier shall report on a regular basis	<i>Redondant avec le §3.4</i>
deleted	§4.3.5.e . Dependability and Safety concept of technical risk...	<i>redondant avec les § Dependability et le § Safety</i>
new	from Q61 §8 EXPERIENCE SUMMARY REPORT	<i>extension au REX global AP du projet</i>

RNC-ECSS-Q-20

delta	§ RNC-ECSS-Q-20	Justification
deleted	§4.1.g to §4.1.l	<i>redondants avec les § suivants</i>
modified	§4.6.2 Supplier audit plan for procurement activities	<i>limited to CRITICAL ITEMS</i>
modified	§4.7.1	
deleted	§5.1.1.d ...proper data .. are set up throughout the project organization ...	<i>Interet mineur</i>
deleted	§ 5.3 Stamps control	<i>Trop formel</i>
modified	§5.4.1.a traceability system	<i>limited to CRITICAL ACTIVITY</i>
modified	§5.4.1.b... shall identify the level of traceability	<i>reformulation plus directive</i>
deleted	5.4.2.b+c+d+e+f identification	<i>utile selon contexte</i>
modified	§5.4.3.c available and accessible information for investigating all non-conformances ...	<i>reformulation plus directive</i>
modified	§5.5.1 ..All measuring, inspection and test equipment used during verification activities shall be ...	<i>exigences en Métrologie et étalonnage limitées aux activités de vérification</i>
modified	§5.6 ambiguïté entre RNC et ECSS -> NONCONFORMANCE dans ECSS traduit par ANOMALIE dans le RNC	<i>Titre: NONCONFORMANCE AND ANOMALY CONTROL SYSTEM</i>
new	addition to §5.6 Anomaly as failure and accident	<i>idem major non-conformance</i>
modified	§5.6.5 a formal nonconformance review board, established at all contractual levels....	<i>reformulé car trop formel</i>
new	the custom conserves the right ...	<i>Addition to § 5.6.3</i>
modified	§5.6.7 to 5.6.12	<i>reformulation plus directive</i>
new	NCR shall be closed before it is delivered	
deleted	§5.7.1 Supplier participation in the alert system established by the final customer	<i>Activité à la demande du client</i>
deleted	§5.7.2 PA experts involvement	<i>Activité du client</i>

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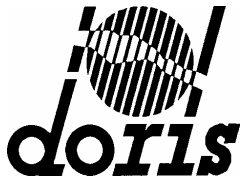
delta	§ RNC-ECSS-Q-20	Justification
modified	§5.7.3a Generation of alerts within the project	
modified	§5.7.3b An alert when all of the following criteria are met...->	replaced by DEFINITION
modified	§5.8.1 Handling + §5.8.2 Storage + §5.8.3 Preservation	reformulé
new	(after §5.8.3)...procedures in the user manual	précision
deleted	§6.1 les exigences pour la conception et les opérations doivent être cohérentes, claires et non ambiguës	généralité, exigences techniques et non strictement qualité
deleted	§6.2 -> planifier de façon logique et cohérente les activités de conception, de vérification, d'identification/évaluation/qualification des procédés/techno critiques, la philosophie des essais et des modèles	généralité, exigences management et non strictement qualité
deleted	§6.3.a. interfaces between different groups that provide input to the design and verification process are defined and supported;	<i>QA et organisation labo</i>
deleted	§6.4.1 design rules and guidelines defined in the following subclauses are properly implemented in the design . -	<i>Generalité</i>
deleted	§6.4.2.b ...§6.4.3.b ..., §6.4.4.b S'assurer qu'il existe un jeu de normes et procédures de conception	-> peu adapté à un labo, difficile à vérifier par le client
deleted	§6.5.1. STANDARDS AND PROCEDURES §6.5.2	trop formel
deleted	6.6.1	Trop general, except 6.6.1.c verification
modified	6.6.3 Design reviews	reformulé
deleted	§7.1	généralités
modified	§7.2.2 The Supplier shall select its suppliers...	reformulé
modified	§7.3.1 -> §7.3.6 procurement documents	reformulé
deleted	§7.4.1 The supplier shall exercise surveillance over all the activities.	généralités
modified	§7.4.2 +§7.4.3 surveillance programme –at least for critical procurement sources - shall include...	<i>AD selon implication du client dans le suivi des fournisseurs</i>
deleted	§7.5.1.b Inspections shall be performed in accordance with established procedures	trop formel
deleted	§7.5.1.c. Receiving inspectors shall have available the procurement document	trop formel
modified	§7.5.2. Receiving inspection activities shall include...	ajout au point j d'une mention sur le stockage après réception.
deleted	§7.5.3	trop formel
deleted	§8.2.5.2 "first off" shop travellers	Non compréhensible
new	(Before §8.8.2) compatibility with the cleanliness level during integration	Precision liée à la salle blanche CNES
modified	§8.10.2.e added in logbook content: type of operations performed, date of operations and the name of the operator.	
new	(after §9.3.1) the test procedure shall highlight the nature of the hazard	Precision liée à la sécurité

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delta	§ RNC-ECSS-Q-20	Justification
new	(after §9.3.2) Test reports shall include a conclusion stating the extent to which compliance with the relevant requirement(s) has been demonstrated, and what actions are recommended to overcome areas of non-compliance.	Complete l'exigence §9.3.2 sur le summary of test results.
modified	§9.5.2 TRR and PTR reviews shall be conducted by a Test Review Board (TRB) ...	Notion de commission de revue.
modified	§10.2.1 specific EIDP which shall contain: ...	Permet d'avoir un § autosuffisant
deleted	§10.3.4 DRBs at any lower level ...	Non applicable
deleted	§11 Operations	Not applicable

ECSS-Q-30

delta	§ ECSS-Q-30	Justification
Deleted	4.1.a Introduction	Requirement of PA organisation level.
Deleted	4.1.b Introduction ...dependability assurance program plan	Too formal and obvious.
Deleted	4.2 Organisation	Requirement of PA organisation level.
Deleted	4.3.a Dependability Programme Plan	Covered by RD2 §4.3.3c
Deleted	4.3.b Dependability Programme Plan	Covered by RD2 §4.3.3c
Deleted	4.3.c Dependability Programme Plan	Covered by RD2 §4.3.3c
Modified	4.3.d Dependability Programme Plan	Added "...or compliance matrix to the PA requirements see§ 3.3 "
Deleted	4.3.e Dependability Programme Plan	Covered by RD2 §4.3.3c (PA Plan)
Deleted	4.4.e Dependability risk assessment and control	Too formal and of system level
Deleted	4.4.f Dependability risk assessment and control	Too formal and of system level
Deleted	4.5.a Dependability critical items	No specific dependability items list. Covered by the Critical Items List (CIL) of § 3.6 PA
Deleted	4.5.b Dependability critical items	No specific dependability items list. Covered by the Critical Items List (CIL) of §3.6PA
Deleted	4.5.c Dependability critical items	No specific dependability items list. Covered by the Critical Items List (CIL) of §3.6PA
Deleted	4.5.d Dependability critical items	No specific dependability items list. Covered by the Critical Items List (CIL) of §3.6PA
Deleted	4.7 Audits	Too formal covered by 3.4
Deleted	4.8.b Use of previously designed, manufactured, qualified or flown items	Covered by §3.13 Non conformances (applicable to already flown or newly designed items)

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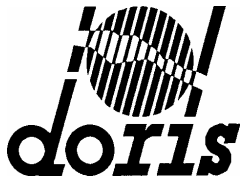
delta	§ ECSS-Q-30	Justification
Deleted	4.9 Dependability lessons learnt	Too formal.
Deleted	4.11 Progress reporting	PA level organisation
Deleted	5.1 Integration of dependability in the project	Reflected by deliverable documents from B to C phase
Deleted	5.2 Dependability requirements in technical specification	Too formal.
Deleted	5.3.1 Dependability design criteria / General	System level
Absent	5.3.2.b Dependability design criteria / Consequences	Added according to Q30C
Absent	5.3.2.c Dependability design criteria / Consequences	Added according to Q30C
Absent	5.3.2.d Dependability design criteria / Consequences	Added according to Q30C

ECSS-Q-60 [Q60] & RNC-CNES-Q-61 [Q61]

Delta	§ ECSS Q-60-B	Justification
Deleted	5.1.2.2	Ce paragraphe, traitant de la matrice de conformité est supprimé. En effet, la matrice de conformité est demandée dans une partie plus générale de la spécification AP.
Modified	5.1.3	Cette modification permet d'exiger qu'un membre du client participe au PRB
new		Nouvelle exigence permettant de rendre conforme cette spécification à la norme applicable RNC-Q-60-507 traitant des radiations
Modified	5.1.4	Modification permettant de demander les listes de composants au format Excel.
new		Nouvelle exigence demandant qu'une préférence soit accordée aux composants Hi-Rel
new & Modified	5.2.2.3	Nouvelles exigences et modification permettant de rendre conforme cette spécification à la norme applicable RNC-Q-60-507 traitant des radiations
Modified	5.2.2.4	Petite modification pour confirmer que seuls les fusibles à fil <5A sont autorisés
new		Nouvelles exigences concernant les composants commerciaux
new		Nouvelles exigences concernant les licences export
Modified	5.2.4	Modification du contenu du dossier justificatif pour les composants commerciaux.
Modified	5.3.3	Définition des tests de déverminage pour les composants commerciaux
Modified	5.3.5	Définition des tests de lot pour les composants commerciaux
Modified	5.3.8	Modification d'exigence permettant de rendre conforme cette spécification à la norme applicable RNC-Q-60-507 traitant des radiations
Modified	5.3.10	Modification d'exigence permettant de rendre applicable la norme RNC-CNES-Q-60-502 concernant le relifing.
new		Nouvelle exigence sur la durée de stockage maximum des composants commerciaux

RNC-ECSS-Q-70

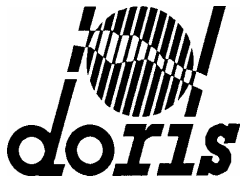
delta	§ RNC-ECSS-Q-70	Justification
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delta	§ RNC-ECSS-Q-70	Justification
Deleted	§4.2.3.f [Q70] – req § 8.4 baselines various design lists	→ <i>Peu adapté</i>
Deleted	§4.2.3.g [Q70] – notes	Already precised in Q-70-71
New	§5.1 – Pure tin prohibition	REX DORIS project
New	after §5.1.k [Q70] requirements for black-anodizing of a metal.	Prise en compte de l'alerte ESA sur Oxydation Anodique sulfurique noire

RNC-ECSS-Q-80

Delta	§ ECSS-Q-80	Justification
Modified	§5.6.4 Criticality classification	General improvement (requirement rewritten more clearly/precisely)
deleted	§5.7.1 and 5.7.2 Procurement requirements	Not clear Useless if the terms existing software and reused software are defined : Suppressed
Modified	§5.7.3 Review of procured software component list	General improvement, approval is not needed
deleted	§ 5.8.4 Tool selection	Automatic code generation is now completely covered by a new dedicated part
deleted	§ 6.1.6 Special characteristics	Not clear
Modified	§ 6.2.2.1 to 6.2.2.7 Software dependability and safety analysis	General improvement (requirement rewritten more clearly/precisely)
Modified	§ 6.2.3.5 measures to handle critical software	General improvement (requirement rewritten more clearly/precisely)
Modified	§ 6.2.3.9 failure of non-critical software	General improvement (requirement rewritten more clearly/precisely)
Modified	§ 6.2.4.3 customer approval software configuration	General improvement, approval is not needed
Modified	§ 6.2.4.9	General improvement (requirement rewritten more clearly/precisely)
Modified	§ 6.2.6.2	General improvement (requirement rewritten more clearly/precisely)
Modified	§ 6.2.6.4	General improvement (requirement rewritten more clearly/precisely)
Modified	§ 6.2.6.6	General improvement (requirement rewritten more clearly/precisely)

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Delta	§ ECSS-Q-80	Justification
deleted	§ 6.2.6.13	No ISVV requirement (Independent Software Verification and Validation) Note: requirement 6.3.4.20 ask for staff who have not taken part in the design or coding of the software being validated
Modified	§ 6.2.7.1 to § 6.2.7.11 Reuse of existing software	General improvement (requirement rewritten more clearly/precisely)
New	Automatic code generation	New part to completely cover automatic code generation.
deleted	§ 6.3.4.23	Automatic code generation is now completely covered by a new dedicated part
deleted	§ 6.3.4.24	Automatic code generation is now completely covered by a new dedicated part
deleted	§ 6.3.4.29	No ISVV requirement (Independent Software Verification and Validation) Note: requirement 6.3.4.20 ask for staff who have not taken part in the design or coding of the software being validated.
Modified	§ 6.3.4.32	General improvement (requirement rewritten more clearly/precisely)
deleted	§ 6.3.6 Operations	No special part for operations. This specification covers the development and maintenance phase. If any, operationnal requirements shall be in the requirement baseline written by the customer.
Modified	§ 7.2.1.2	General improvement (requirement rewritten more clearly/precisely)
Deleted	§ 7.4 Standard hardware for operational system	This specification define PA requirements for flight software, not for ground equipment
Deleted	§ 7.5 Firmware	Firmware development shall follow the same requirements than for any other software. Moreover, firmware is not clearly defined.

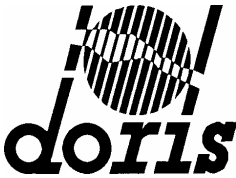
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ANNEX B - EEE PART QUALITY LEVELS

EEE PART FAMILY		QUALITY LEVEL		SUPPLEMENTARY
	ESCC	MIL	Commercial	CONDITIONS
Capacitors, chip, ceramic	ESCC 3009 level C	MIL-PRF-55681 EFR level R min MIL-PRF-123		For ceramic capacitors procured through ESCC or MIL specifications but in an extended, non qualified, range of values or not belonging to ESCC QPL or MIL QML/QPL, the humidity, steady state, low voltage test (cf ESCC 3009, § 5.2.2) is mandatory if U rated < 50V and C > 1µF.
Capacitors, molded, ceramic	ESCC 3001 level C	MIL-PRF-39014 EFR level R min MIL-PRF-20 EFR level R min MIL-PRF-123 MIL-PRF-49470 EFR level T		For ceramic capacitors procured through ESCC or MIL specifications but in an extended, non qualified, range of values or not belonging to ESCC QPL or MIL QML/QPL, the humidity, steady state, low voltage test (cf ESCC 3009, § 5.2.2) is mandatory if U rated < 50V and C > 1µF.
Capacitors, glass (CYR type)	-	MIL-PRF-23269 EFR level R min		Not recommended for new designs
Capacitors, mica	ESCC 3007 level C	MIL-PRF-39001 EFR level R min		
Capacitors, chip, solid tantalum (e.g. TAJ, T495, CWR11)	ESCC 3011 level C ESCC 3012 level C	MIL-PRF-55365 WFR level C min		All capacitors shall be surge current tested.
Capacitors, non-solid tantalum, electrolytic (CLR79)	ESCC 3003 level C	MIL-PRF-39006 EFR level R min		39006 / 22, 25, 30, 31 and "H" designated devices are recommended
Capacitors, solid tantalum, electrolytic (CSR type)	ESCC 3002 level C	MIL-PRF-39003 WFR level C min		Surge current test mandatory on low ESR capacitors (CSR21 and CSR33).
Capacitors, super metallized plastic film, (CRH type)	ESCC 3006 level C	MIL-PRF-83241 EFR level R min		
Capacitors, metallized film, (HTP86, KM94S, PM94S, PM90SR2, MKT, ...)	ESCC 3006 level C	-		
Capacitors, variable	ESCC 3010 level C	-		
Connectors, non filtered, D-sub rectangular	ESCC 3401 level B	-		
Connectors, filtered, D-sub rectangular	ESCC 3405 level B	-		Lifetest 1000h / 125°C / 1,5Ur on each tubular ceramic lot. By default, assured for ESCC products.
Connectors, printed circuit board	ESCC 3401 level B	-		
Connectors, RF coaxial	ESCC 3402 level B	-		

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Connectors, microminiature rectangular	ESCC 3401 level B	-		
Connectors, non filtered, circular	ESCC 3401 level B	-		
Connectors, filtered, circular	ESCC 3405 level B	-		Lifetest 1000h / 125°C / 1,5Ur on each tubular ceramic lot. By default, assured for ESCC products.
Crystals	ESCC 3501 level B	-		
Diodes	ESCC 5000	MIL-PRF-19500 JANTXV + PIND test		PIND test (see note 1).
Diodes microwave	ESCC 5010 level C + PIND test	MIL-PRF-19500 JANTXV + PIND test		PIND test (see note 1).
Filters	ESCC 3008 level C	MIL-PRF-28861 acc. to class S		
Fuses (wire link > 5A)	-	MIL-PRF-23419		Burn-in (168h – 85°C – 50% rated current) is mandatory on each lot
Fuses (CERMET)	-	MIL-PRF-23419		
Heaters flexible	ESCC 4009 level C	-		
Inductors, coils, (molded)	ESCC 3201 level C	MIL-STD-981 class S MIL-PRF-39010 EFR level R min		
Inductors, coils (non molded)	ESCC 3201 level C	MIL-STD-981 class S		
Integrated circuits	ESCC 9000	MIL-PRF-38535 class Q or M + PIND test	commercial parts according to JD	PIND test (see note 1).
Integrated circuits microwave (MMIC)	ESCC 9010 level C + PIND test	MIL-PRF-38535 class Q or M + PIND test	commercial parts according to JD	PIND test (see note 1).
Microwave passive parts (circulators , isolators)	ESCC 3202 level B	-		
Microwave passive parts (coupler, power dividers)	ESCC 3404 level B	MIL-DTL-23971 (dividers) "space flight"		
Microwave passive parts (attenuators, loads)	ESCC 3403 level C	MIL-DTL-39030 (loads) S letter (screened parts) MIL-DTL-3933 (attenuators) S letter (screened parts)		
Oscillators (hybrids)	ECSS Q-60-05 level 1	MIL-PRF-55310 (class 2) level S		
Relays, electromagnetic, latching and non-latching	ESCC 3601 level B ESCC 3602 level B	MIL-PRF-39016 EFR level R min + ESCC screening according to chart 3		
Resistors, fixed, film, (RNC, MB x xxxx type, except RNC90)	ESCC 4001 level C	MIL-PRF-55182 EFR level R min MIL-PRF-39017 EFR level R min		

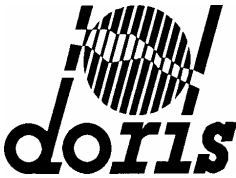
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Resistors, high precision, fixed, metal foil (RNC90)	ESCC 4001 level C	MIL-PRF-55182/9 EFR level R min		100 Kohms max allowed.
Resistors, network, thick film	ESCC 4005 level C	MIL-PRF-83401 level M		
Resistors, current sensing (RLV type)	-	MIL-PRF-49465		
Resistors, power, fixed, wirewound (RWR type)	ESCC 4002 level C	MIL-PRF-39007 EFR level R min		
Resistors, power, fixed, wirewound, chassis mounted (RER type)	ESCC 4003 level C	MIL-PRF-39009 EFR level R min		
Resistors, precision, fixed, wire wound (RBR type)	-	MIL-PRF-39005 EFR level R min		Diameter of wire shall be greater than 0,03 mm.
Resistors, fixed, film, high voltage (RHV type)	ESCC 4001 level C	-		
Resistors, fixed, thick and thin film chip	ESCC 4001 level C	MIL-PRF-55342 EFR level R min		
Switches, electromechanical	ESCC 3701 level B	MIL-PRF-8805		
Switches, thermostatic	ESCC 3702 level C	-		
Thermistors	ESCC 4006 level C	MIL-PRF-23648		
Transformers	ESCC 3201 level C	MIL-STD-981 class S		
Transistors	ESCC 5000	MIL-PRF-19500, JANTXV + PIND test		PIND test (see note 1).
Transistors microwave	ESCC 5010 level B + PIND test	MIL-PRF-19500, JANTXV + PIND test		PIND test (see note 1).
Cables & wires, low frequency	ESCC 3901 level B	MIL-W-22759		
Cables, coaxial, radio frequency	ESCC 3902 level B	MIL-C-17		
Hybrids	ECSS-Q-60-05 level 2	MIL-PRF-38534 class K		
Surface Acoustic Waves (SAW)	ESCC 3502 level C	MIL-PRF-38534 class K		
Charge coupled devices (CCD)	ESCC 9020 level B	-		
Opto discrete devices Photodiodes, LED Phototransistors Opto-couplers	ESCC 5000	MIL-PRF-19500 JANTXV + PIND test		PIND test (see note 1).

Notes :

Particle Inducted Noise Detection (PIND) test is applicable to all cavity packages of active components. This test is by default, assured for ESCC products.
For semiconductor devices the JANS criteria is applicable per MIL-PRF-19500.
The lot is submitted to 100 % PIND testing according to test condition A (per test method 2052 of MIL-STD-750).
For integrated circuits the Class V criteria is applicable per MIL-PRF-38535.
The lot is submitted to 100 % PIND testing according to test condition A (per test method 2020 of MIL-STD-883).

For active parts (transistors, diodes) packaged in TO3, DO4 or DO5, the PIND test method is submitted to the customer's approval, in order to ensure the efficiency of the operating mode.

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ANNEX C – PAD SHEET

PROJECT:		Doc n°:..... Prepared by : Issue:..... Date:.....	
Approval requested by:..... Family:..... Fcode [] Group:..... Gcode [] Component Number:..... Commercial Equivalent Designation:..... Manufacturer/ Country:..... Technology/Characteristics (value or range of values with tolerance, voltage, package etc): Pure tin free (Y/N) [] Generic specification:..... Detail specification:..... Issue:..... Rev.:..... variant :..... Specification amendment: Issue:..... Rev.:..... variant :..... Quality level:..... Procurement by :			
APPROVAL STATUS EPPL Part 1/2 listed (1/2/N) [] ESCC QPL or EQML listed. (Y/N) [] MIL QPL or QML listed (Y/N) [] If yes: QPL/QML Reference:..... Other approvals/former usage Evaluation programme required (Y/N) [] If yes reference of the Evaluation Programme :.....			
PROCUREMENT INSPECTIONS and TESTS Precap Y/N [] Lot acceptance : ESCC LAT/LVT LAT level or subgroup [] MIL QCI/TCI group [] Buy-off Y/N [] DPA Y/N [] if yes : sample size Complementary tests			
RADIATION HARDNESS DATA Radiation Hardness Assurance Plan applicable Y/N [] Doc. Ref.: Total Dose Effects : Evaluation Test Data (report) reference : Single Event Effects : SEL/SEU/SET/SEFI/SEB/SEGR/others : <i>(cross out when non applicable)</i> Evaluation Test Data (report) reference : RVT required Y/N []			
REMARKS			

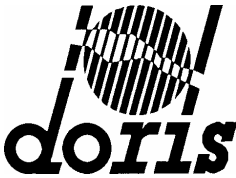
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Approval customer	Date
Approval first-level supplier	Date

GUIDANCE NOTE FOR COMPLETION OF PART APPROVAL DOCUMENT

with justification a single PAD may be generic to cover different ranges of parts

Doc No:	Unique sequential number
Issue:	Issue of document
Date:	Date of issue
Project:	Name of project using the component
Prepared by	Name of the person submitting the PAD
Approval requested by:	Name of the company submitting the PAD
Family:	Capacitor, resistor, etc. (Refer ECSS Family Code)
Group:	Ceramic, tantalum, etc. (Refer ECSS Group Code)
Component Number:	In accordance with the procurement specification May be generic to cover different range of parts (with justification) : e.g. range of resistors or capacitors or variants for connectors & accessories
Commercial Equivalent Designation	Self Explanatory
Technology/Characteristics:	Additional details of the components covered by the PAD
Pure tin free (Y/N)	When tin $\geq 97\%$ (inside the component and terminations)
Generic specification:	Relevant specification
Detail specification:	Relevant specification with issue and revisions only required for non qualified parts
Specification Amendment	Relevant specification with issue and revisions
Quality level:	As defined in Annex A.
Procurement by:	Identify the name of the company procuring the part. E.g. This can be self, CPPA, distributor, manufacturer or a combination thereof.
Manufacturer/Country:	Self-explanatory.
Approval status:	Information about known approvals (EPPL, ESCC, ESCC/QML, MIL, MIL/QML or other approvals/former usage.)
Evaluation programme required:	Y/N as applicable
Procurement inspections and test :	Y/N as applicable
DPA sample size:	Number
Complementary tests	Testing/Inspection in addition to that defined in the procurement specification shall be identified E.g. PIND, upscreening, ...
Lot Acceptance:	Identify level and subgroups
Radiation Hardness Data	Self-explanatory.
SEL/SEU/SET/SEFI/SEB/SEGR/others :	Reference of the test report for SingleEvent Latchup/ SingleEvent Upset/ Single Event Transient/Single Event Functional Interrupt/Single Event Burn out/Single Event Gate Rupture
Evaluation Test Data (report) reference	Radiation Verification Test Y/N as applicable
RVT	
REMARKS	Any additional information
Approval customer:	Signature signifies acceptance
Approval first-level supplier:	Signature signifies acceptance

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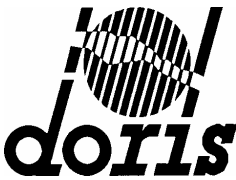
ANNEX D – DECLARED COMPONENT LIST (DCL)

The purpose of the Declared Components List (DCL) is to provide a status accounting list of all the EEE components intended to be used

The requirements for documentation management and control in ECSS-M-50B shall apply.

The DCL shall include or refer to the following information:

- A description of the purpose, objective, content and the reason prompting its preparation.
- A list the applicable and reference documents to support the generation of the document.
- Any additional terms, definition or abbreviated terms used
- Component number (commercial equivalent designation)
- Family (ESCC group code)
- Package.
- Value or range of values with tolerance for non qualified parts.
- Component manufacturer (name).
- Generic procurement specification.
- Detail procurement specification (with issue and revision for non qualified parts).
- Specification amendment (including issue and revision).
- Name of the procurement agent (CPPA, supplier, distributor).
- Quality level and lot test (ESCC LAT, MIL TCI/QCI/CI).
- Space qualified status (yes or no).
- RVT (yes or no).
- Reference of the PAD or Justification Document.
- Approval status of the part.
- Change identification between each DCL issue.
- Date-code (only for “as built” DCL).
- Country of the component manufacturer.
- Export classification (for US components : EAR 99 or EAR ECCN).
- ECCN number (when applicable).
- Export licence required (yes or no).

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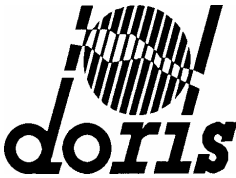
ANNEX E – PROCUREMENT SPECIFICATION

The purpose of the Procurement Specification (PS) is to establish the component technical specification baseline.

The requirements for documentation management and control in ECSS-M-50B shall apply.

The PS shall include or refer to the following information:

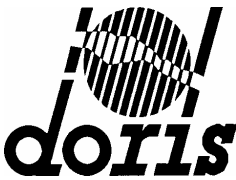
- A description of the purpose, objective, content and the reason prompting its preparation.
- A list the applicable and reference documents to support the generation of the document.
- Any additional terms, definition or abbreviated terms used.
- Absolute maximum ratings.
- Electrical and mechanical parameters and limits.
- Screening, burn-in, and acceptance requirements.
- Package material and lead finish.
- Documentation/data requirements.
- Delta limits when applicable.
- Criteria for percent defective allowable.
- Lot Validation Testing / Quality Conformance Inspections.
- Marking.
- Storage requirements.
- Requirements for lot homogeneity.
- Serialization (when applicable).
- Protective packaging and handling requirements.
- Radiation Verification Testing requirements, when applicable.

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DIFFUSION LIST

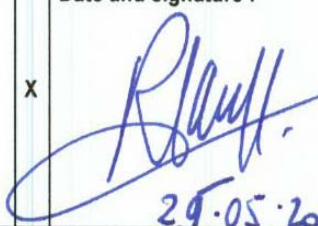
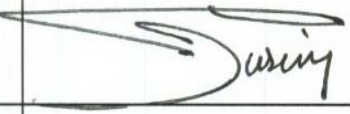
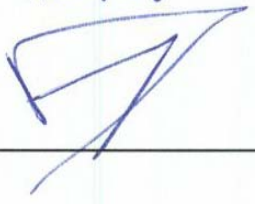
<u>Internal :</u>			Full document	Front page only
A. AURIOL	DCT/PO/AL	BPI 2002	X	
C. JAYLES	"	"	X	
M. DEJUS	"	"	X	
C.JOUVE	"	"	X	
M.VIVIES	CLS pour DCT/PO/AL	"	X	
P. BUZON	DCT/RF/IT	BPI 2013	X	
B. BESSON	"	"	X	
Ph. BOUBE	RS ASTEK pour DCT/AQ/GP	"	X	
Documentation DORIS		"	X	
T.KOLECK	DCT/RF/AN	BPI 3602	X	
G. DORLEAC	DCT/AQ/QP	BPI 1415	X	
C. MARTIN	"	"	X	
C.ROUMAGNAC	Logiquel pour DCT/AQ/QP	"	x	
P. LAY	DCT/AQ/CQ	BPI 1412	X	
F.VACHER	DCT/AQ/CQ	BPI 1412	X	
C. DURIN	DCT/AQ/MP	BPI 1413	X	
T. BATTAULT	"	"	X	
G.CIBIEL	DCT/RF/HT	BPI 2013	X	
J.P.ETIENNE	DCT/AQ/GP	BPI 2513	X	
R. LAULHERET	DCT/AQ/SF	BPI 1413	X	
J-L. VENTURIN	DCT/AQ/EC	BPI 1412	X	
F.PRESSECQ	DCT/AQ/LE	BPI 1414	X	
J.L.PEDRON	DCT/AQ/SO	BPI 3401	X	

<u>External :</u>			Full document	Front page only
M. BOUCHET	THALES SYSTEMES AEROPORTES		X	
O.VOLLARD	THALES SYSTEMES AEROPORTES		X	
P. CANZIAN	RAKON		X	
C. MERIEUX	RAKON		X	
L. PONTIER	CHELTON		X	

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Partially approved by :

(Dedicated chapters directly linked with the expertise delivered by the represented service)

DCT/AQ/CQ Ph.LAY	X	Date and signature : 29/05/2008 	DCT/AQ/SF R.LAULHERET	X	Date and signature :  29.05.2008
DCT/AQ/SO J.L.PEDRON	X	Date and signature : 29/05/2008 	DCT/AQ/EC J.L.VENTURIN	X	Date and signature : 29/05/2008 
DCT/AQ/MP C.DURIN	X	Date and signature : 29/05/2008 	DCT/AQ/LE F.PRESSECQ	X	Date and signature : 04/06/08 
DCT/AQ/GP J.P.ETIENNE	X	Date and signature : 2/06/08 Sans objet pas d'exigences dec/cad / Bpille			

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