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Normative status at a glance

Main clauses	Clauses 0-28 are read using the language conventions in 0.5: “shall” states a requirement; “should” states guidance.
Normative annexes	A-D, J-M, O-T, V, W, Y, AA-AI, AK-AT, AX and AY. Requirements apply when triggered by the activity, responsibility or evaluation route.
Mixed-status annexes	N: N.1-N.3 and specified record tables are normative; numerical examples are informative. AJ: normative records and informative filled examples. AZ: normative validation controls and informative case scenarios.
Informative annexes	E-I, U, X, Z, AU-AW, BA and BB. Examples, calculations and explanatory diagrams do not establish universal technical limits.

The approval status and dates are the publisher’s declared release particulars. Publisher approval concerns this publication; it does not assert independent technical validation, statutory approval or third-party recognition. Individual conformity decisions and operational permissions remain separate.

Publication maintenance and changes are governed by Annex Y. The edition and editorial change record is in Table BB-1. All applicable mandatory conditions remain cumulative.

Quick-start guide

Who uses AF 9100, which requirements apply, and where to begin.

1 Define the object before selecting requirements

Start with **Clauses 1-3 (pages 17-21)**, **Annex A (page 58)**, **Annex AA (page 111)** and **Annex AK (page 140)**. Record the actual object, configuration, sites, responsibility, technical domain and exclusions. Then select the relevant route below.

Route	Who / what is evaluated	Primary provisions
ORG	Organizations and management systems	1-10; 22; AL
PRD	Products and integrated systems	23; AM; relevant technical domains
SVC	Services and operational support	24; relevant service and technical controls
PRC	Process qualification and controlled use	25; L; AQ
PER	Personnel competence and task boundaries	26; AE; applicable AX controls
SUB	Suppliers and subcontracted work	27; J; AF; AM.5
CAB	Laboratories and assessment providers	28; AH; applicable AX controls

2 Add every technical domain triggered by the work

Space	14; P; AN — mission, ground, orbital, surface and human-system scope.
Aviation	15; Q; AO — aircraft, installed systems, maintenance and service interfaces.
Defense / industry	16-17; R-S; AP — platform, industrial and controlled-information responsibilities.
Materials / verification	18; L-M; AQ-AR — critical processes, tests, inspection and qualification.
Digital systems	12-13; N-O; AS — software, AI, models, autonomy and trusted evidence.
Energy / lifecycle support	19-21; T-U — energy, sustainability, human factors, maintenance and retirement.

3 Complete the profile, evidence and decision

Define: complete the parameters, methods, limits and evidence links in **Annex AY (page 267)** before evaluation. Apply criticality under Annex B and the relevant lifecycle gates under Annex C.

Demonstrate: use the complete applicable provisions, not only a checklist. Follow **Annex V (page 95)** for assessment evidence and **Annex AD (page 120)** for decisions. Annexes AT-AW explain quantitative controls, worked methods and comparisons.

Decide and maintain: preserve PASS / FAIL / HOLD / approved N/A separately. No score compensates for a failed mandatory condition. Apply the independent-decision, competence and continuing-status controls in AA-AI and AX; use AZ to challenge the actual implementation.

A personnel applicant does not inherit the whole corporate management system. Outsourcing does not remove retained responsibility. Normative and informative status is summarized on page 2; detailed contents begin on page 4.

Contents — clauses and annexes

Page numbers refer to this edition. Entries are clickable. Clause and annex identifiers are the stable references; PDF bookmarks also locate subclauses, technical cards, calculations and diagrams.

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0 Introduction and application principles

AF 9100:2026 establishes an integrated framework for quality management and lifecycle assurance. It combines an organizational core, activity-triggered technical requirements and distinct conformity routes for products, services, processes, people, subcontractors and assessment providers. It is not a catalogue of universal engineering design limits.

0.1 Purpose and intended outcomes

- a) The intended outcomes are consistent conformity of products and services; accountable safety and mission-assurance decisions; dependable delivery; competent personnel; controlled processes and external provision; trustworthy evidence; customer satisfaction; and learning across the complete value chain.
- b) The framework covers research, conception, requirements, design, procurement, production, integration, qualification, delivery, operation, maintenance, modification, reuse and retirement. Responsibility and credible effects determine coverage, rather than an industry label, company size or ownership of the work location.

0.2 AF assurance architecture

- a) The AF assurance architecture has four connected layers: organizational capability; technical and lifecycle control; object-specific evaluation; and independent conformity decisions with continuing oversight. The first two establish how work is governed and performed. The last two establish exactly what has been evaluated and how a bounded claim is maintained.
- b) Clauses 1–3 define scope, interpretation and the self-contained requirement basis. Clauses 4–10 establish the organizational core; Clauses 11–21 add activity-triggered technical controls; Clause 22 controls conformity claims; Clauses 23–28 define object and provider responsibilities. Annexes AA–AJ establish the AF assessment scheme. Annex A determines applicability; no whole-document obligation is imposed on an individual merely because that person seeks a personnel credential.

0.3 Process approach and assurance loop

- a) Each process should have an accountable owner, defined inputs and outputs, controlled interfaces, resources, operating criteria and meaningful measures. Planning should identify uncertainty and necessary controls. Execution should generate authentic evidence. Evaluation should compare outcomes with approved criteria. Improvement should remove causes rather than merely close paperwork.
- b) A requirement should lead to a controlled design or service definition, a qualified delivery route, competent people, valid acceptance evidence and an identifiable released configuration. Feedback should return to the affected requirement, supplier, process, person and version. A favorable result at one layer should never conceal a missing control at another.

Table 0-1 — The AF assurance chain

Layer	Controlling question	Required connection
Govern and commit	Who is accountable, and what is promised?	Scope, obligations, resources, risk ownership and measurable objectives.
Engineer and qualify	Can the defined output be realized under controlled conditions?	Requirements, design, validated processes, competence and verified suppliers.
Execute and demonstrate	What actually happened, to which configuration?	Work records, traceability, measurement, tests and authentic evidence.
Review and decide	Does every applicable decision criterion have adequate evidence?	Independent review, decision rules, resolved findings and precise claim scope.
Monitor and improve	Does the basis remain valid after delivery and change?	Surveillance, field learning, renewed competence, corrective action and retirement.

0.4 Proportionality without dilution

- a) Implementation should reflect consequence, complexity, novelty, uncertainty, exposure, volume and actual responsibility. Small organizations may combine records and some roles where competence and required independence are preserved. Simplified documentation should not remove a necessary control or a defensible decision basis.
- b) Novel technology should receive additional challenge where experience is limited. Bounded deployment, representative testing, independent review, monitoring and explicit residual-risk decisions should compensate for weak evidence. Commercial opportunity does not offset a missing mandatory control.

0.5 Normative language and numerical examples

- a) “Shall” expresses a requirement; “shall not” expresses a prohibition; “should” expresses a recommendation; “may” expresses permission; and “can” expresses capability. Normative requirements apply when the activity, responsibility or selected assessment route triggers them. Informative material is guidance unless an identified provision is expressly adopted in a controlled program basis.
- b) Numerical examples, model parameters, illustrative cases and datasets are synthetic. They do not establish actual product performance or universal design limits. An example inside a normative annex remains illustrative where explicitly marked. Tables defining required fields are normative; filled sample values are not. Annex H explains uncertainty mathematically; Annex AD supplies the mandatory decision governance.

1 Scope, boundaries and conformity model

1.1 Organizations and value chains covered

- a) This standard applies to organizations that design, develop, manufacture, assemble, integrate, test, inspect, procure, distribute, maintain, operate or support products and services for aviation, space, defense, heavy industry and mission-specific mobility. It includes prime contractors, equipment manufacturers, all supplier tiers, research organizations, engineering services, software providers, logistics providers and support facilities.
- b) The scope includes civil and military aircraft, rotorcraft, unmanned systems, advanced air mobility, satellites, launch and ground systems, orbital and surface infrastructure, land and maritime defense platforms, industrial machinery, process plant and associated infrastructure. Automotive-derived products are included when used for defense missions, space exploration, launch-site support or other mission-specific applications. General-road homologation and specialized mission approval remain distinct responsibilities.

1.2 Products, services, processes and people

- a) Covered outputs include hardware, materials, electronics, embedded and application software, artificial-intelligence models, datasets, technical information, digital and professional services, training affecting competence, maintenance actions and integrated systems of systems. Covered delivery resources include personnel, special processes, subcontractors, sub-tier suppliers, laboratories, inspection and assessment providers.
- b) The standard is technology-neutral. An unlisted material, energy source, computing paradigm, production method or autonomous capability shall be included in applicability and hazard analysis when its effects fall within scope. A technology not named in this edition is not exempt from assurance.
- c) The conformity object shall be selected explicitly using Annex AA. Organizational conformity, product conformity, service conformity, process qualification, personnel certification, employer task authorization, supplier qualification and assessment-body competence are distinct conclusions. Evidence may be reused when its relevance and validity are established, but no conclusion automatically grants another.

Required evidence: Conformity-object register; product and service families; process and personnel scope; external-provider map; selected route and technical profile.

1.3 Scope statement and mandatory applicability decision

- a) An organization shall maintain a controlled scope identifying legal entities, sites, remote functions, products, services, processes, lifecycle responsibilities and exclusions. It shall complete Annex A before claiming conformity. Shared services and outsourced activities shall be included where responsibility remains with the organization.
- b) The organizational route applies Clauses 1–10 and 22, with the relevant technical modules in Clauses 11–21 and object or provider controls in Clauses 23–28. A requirement may be excluded only where the activity and associated responsibility are genuinely absent and the exclusion cannot impair an assured outcome. Outsourcing, a small workforce or an existing certificate does not by itself justify exclusion.
- c) For a product, service, process, person, supplier or assessment-provider route, Annex AA identifies the applicable evaluation boundary. A personnel applicant shall demonstrate the defined role competences, not ownership of a corporate management system. The body operating that route shall nevertheless fulfill its own governance, impartiality and evidence obligations.
- d) Where product design responsibility is absent, supplied design data, manufacturing-process design, technical changes and error escalation shall remain controlled. Where only distribution occurs, authenticity, preservation, traceability and customer flow-down remain required. Incompatible obligations shall be escalated and the dependent work held until resolved.

Required evidence: Approved scope; object-route selection; Annex A matrix; exclusions with evidence; interface owners; review triggers and scope-change history.

1.4 Boundaries of conformity and authorization

- a) Conformity to this standard shall not be represented as a type certificate, airworthiness approval, launch license, defense authorization, vehicle homologation, marine class approval or statutory plant approval. Mandatory authorizations and program-specific technical requirements remain applicable. A product claim requires an evaluated product scope; an organizational certificate alone does not approve every output.
- b) Membership, sponsorship, committee participation, awards and training attendance do not establish conformity. AF marks and AF-authorized scheme operation require actual written authorization. Annexes AA–AJ define this standard's assessment rules; their publication does not automatically authorize a body, accredit a laboratory or certify an applicant.
- c) The designation AF 9100:2026 identifies an independent AF publication. Use of that identifier shall not imply adoption, sponsorship or recognition by another publisher, regional standards system or public authority.

Required evidence: Accurate claims and certificate scope; actual authorizations; mark permissions; separation of technical and statutory approvals.

1.5 System boundaries and hazardous domains

- a) The organization shall identify interactions among product safety, occupational safety, environmental protection, security, cybersecurity and mission effectiveness. Responsibilities shall cover both intended use and reasonably foreseeable misuse or abnormal conditions. Approval of one discipline shall not be interpreted as approval of the others.
- b) For controlled defense technology, energetic materials, radiological sources or other restricted activities, this standard specifies governance and assurance responsibilities only. Detailed operating procedures, design criteria, access controls and approvals shall be established by appropriately authorized specialists under applicable obligations. No clause provides instructions for weapon construction or employment.

2 AF normative framework, application and precedence

This standard contains its own management, assurance and assessment requirements. No separately published external management-system standard is incorporated by reference. Program-specific engineering and legal obligations remain controlled inputs, not substitutes for the AF requirements.

2.1 Self-contained AF requirement basis

- a) An AF 9100:2026 conformity decision shall evaluate all applicable requirements of this edition, including the triggered normative annexes and the approved object-specific application profile. A summary, checklist or training presentation shall not replace the complete applicable requirement set.
- b) The responsible organization or scheme operator shall provide controlled access to this edition at the point of use. AF clauses shall not be represented as identical to an unevaluated external scheme. Compliance evidence shall be traced to the actual AF requirement and the actual evaluated object.

Required evidence: Controlled edition; applicable-requirement register; application profile; evidence mapping.

2.2 Controlled program and application profile

- a) Before evaluation or acceptance, the responsible technical authority shall approve an application profile defining the object, configuration, intended use, operational domain, applicable obligations, measurable criteria, verification methods, uncertainty treatment, sampling rationale and release limits. The profile shall be detailed enough for different competent evaluators to reach comparable conclusions.
- b) Product tolerances, loads, environmental qualification levels, service performance limits and role-specific practical tasks shall be derived from the actual application. This standard does not invent one engineering limit for unrelated aircraft, spacecraft, vehicles, ships, plant or occupations. Absence of an adequate profile shall block a claim requiring that profile.
- c) A controlled obligation register shall identify binding law, customer commitments, approved technical data, test procedures and authority decisions with their applicable editions, owners and change triggers. Such inputs may be legally or contractually necessary without becoming external normative references in this AF publication.

Required evidence: Approved application profile; technical rationale; criteria and methods; obligation register; change controls.

2.3 Precedence and conflict resolution

- a) Applicable law and competent-authority conditions shall not be waived by AF permission, customer agreement, risk acceptance or internal concession. Compatible binding requirements shall all be fulfilled. Where obligations cannot jointly be met, affected work and claims shall be held until a documented lawful resolution is approved by the responsible technical and contractual authorities.
- b) The standard's requirements and triggered annexes shall be read together. Annex AD governs assessment decision rules; Annex AG governs scheme time limits; Annex AB governs assessor competence; Annex AE

governs personnel assessment; Annex Y governs publication control. These rules cannot weaken safety, technical acceptance or legal obligations elsewhere in the standard.

- c) An internal procedure, purchasing instruction, automated workflow or contract profile shall not remove an applicable AF requirement. More demanding program requirements may be added. A conflict shall be recorded, not resolved by silently selecting the less demanding provision.

Required evidence: Conflict register; affected scope; technical and contractual resolution; controlled amendments to working instructions.

2.4 Normative annexes and evidence conventions

- a) The status stated at each annex heading controls its use. Normative annexes impose requirements when triggered by activity or assessment route. Annex N has separately identified normative and informative portions. Other informative annexes explain methods and examples but do not create universal acceptance thresholds.
- b) Equivalent record formats are permitted where every required field, relationship, approval and integrity control is retained. "Not applicable", "accepted risk" and "covered by supplier" are not evidence without a justified applicability or decision record. Synthetic example values shall never be copied into a real record as actual observations.
- c) A compound requirement shall be assessed against every applicable condition. Checklist compression shall not remove conditions. A requirement is not satisfied merely because a document exists: appropriate implementation and outcome evidence are also required.

Required evidence: Annex applicability; complete evidence fields; evaluated conditions; justified non-applicability.

2.5 Edition, time and change control

- a) The publication identifier is AF 9100:2026; the edition is First Edition; the publication date is 29 September 2026. Amendments shall be uniquely identified and controlled under Annex Y. An edition designation does not attest that a particular organization, product or person has passed assessment.
- b) Scheme time limits shall be interpreted under Annex AG. Adoption dates in contracts, transition dates in future amendments and effective dates of individual authorizations shall be recorded separately. No date shall be backdated to hide a gap in conformity status.

Required evidence: Edition and amendment register; adoption record; actual decision dates and status history.

2.6 Engineering judgment and reproducible decisions

- a) Where a requirement calls for proportionate controls, the organization shall record the consequence, uncertainty, selected method and technical rationale supporting that judgment. Competent discretion shall not be used to waive a defined minimum, omit an essential control or approve inaccessible evidence.
- b) Calculations used for acceptance shall have verified inputs, compatible units, controlled algorithms and documented applicability assumptions. A successfully executed calculation or a digitally signed record does not by itself demonstrate a valid physical model or a true original observation.

Required evidence: Technical judgments; verified computations; assumptions and limitations; independent review when required.

3 Terms, definitions and conventions

The following definitions govern use of this standard. Where a program uses a different domain expression, the organization shall maintain an unambiguous terminology mapping without altering the AF decision or responsibility.

Table 3-1 — Core terms

Term	Meaning within this standard
Accountable executive	Person with authority to allocate resources and accept organizational responsibility for the system; delegating tasks does not remove accountability.
Assurance case	Structured argument linking a specific claim, operating context, reasoning, evidence, limitations and residual risks.
Assurance independence	Freedom and authority to challenge or decide without being subordinate to the delivery pressure or work being assessed; the necessary degree depends on criticality.
Baseline	Approved set of identifiable requirements, designs, process definitions, data or configurations under change control.
Critical item	Item, function, characteristic, software element or process whose failure or variation requires special controls because of its consequence.
Key characteristic	A measurable attribute whose variation materially affects fit, function, performance, life or producibility and therefore requires controlled variation.

Term	Meaning within this standard
Special requirement	A requirement with elevated difficulty or risk of fulfillment, such as immature technology, demanding tolerance or constrained delivery.
Safety-critical characteristic	A characteristic connected to a hazardous consequence and therefore requiring an explicit safety-related control and verification rationale.
Operational domain	Defined environment, mission, users, interfaces, modes, timing and constraints within which a function is intended to operate.
Mission assurance	Coordinated activities supporting justified confidence that mission objectives and associated constraints can be achieved.
Residual risk	Risk remaining after implemented controls, with stated assumptions, evidence, owner and acceptance authority.
Risk acceptance	Authorized decision about a stated residual risk; not the absence of information or a substitute for a mandatory requirement.
Opportunity	Potential beneficial outcome considered through a deliberate feasibility and benefit assessment, distinct from an adverse-risk register.
Special process	Process for which all relevant output characteristics cannot be adequately verified by subsequent inspection alone.
First article verification	Documented verification that the intended production configuration and route can produce an item satisfying its specified characteristics.
Configuration status accounting	Recorded history and current status of baselines, approved changes, deviations and actual item or service configurations.
Concession	Authorized permission for a specifically bounded departure, without waiving applicable legal obligations or unapproved safety constraints.
Counterfeit or suspect item	Item or record whose claimed identity, origin, condition or approval is intentionally misrepresented, or for which credible evidence raises that concern.
Traceability	Ability to connect an output with its applicable requirements, origin, processing, evidence, configuration and authorized disposition.
Digital thread	Controlled connections among lifecycle information; a particular software architecture or vendor platform is not mandated.
Digital twin	A model linked to an identified physical or operational entity and maintained for a defined decision purpose, with validated limits of credibility.
Model of record	Controlled model version authorized as an authoritative input for a stated purpose; not necessarily valid outside that purpose.
Out-of-distribution condition	Input or context insufficiently represented in a model's demonstrated operating basis, potentially invalidating expected performance.
Software bill of materials	Structured inventory of software components and relevant versions, dependencies, provenance and identification.
Measurement uncertainty	Parameter characterizing the dispersion of values reasonably attributable to a measurand under an identified model.
Decision rule	Pre-agreed method describing how measurement uncertainty and risk are considered when determining conformity.
Nonconformity	Failure to fulfill an applicable requirement; an improvement suggestion alone is not a nonconformity.
Containment	Immediate action to prevent further impact or escape while the extent and causes of a problem are being determined.
Correction	Action addressing a detected nonconformity in a particular output or situation.
Corrective action	Action addressing substantiated causes to prevent recurrence or occurrence elsewhere, with effectiveness verification.
Release authority	Identified competent person or controlled function authorized to release an output against defined acceptance conditions.
Service-life limit	Approved bound on time, cycles, exposure or condition that shall not be exceeded without an authorized engineering disposition.
Technology readiness evidence	Documented demonstration of a capability in a specified environment; a readiness label alone is not sufficient evidence.

Term	Meaning within this standard
Foreseeable misuse	Use or behavior reasonably predictable in the intended context even though not intended by the designer.
AF criticality category	Internal tailoring category C0 to C3 in Annex B; not an equivalence to any external design assurance or safety integrity classification.
Conformity object	Precisely identified organization, product, service, process, person, supplier scope or assessment-provider capability to which an evaluation and claim apply.
Application profile	Approved definition of an object, intended use, scope, technical or competence criteria, evaluation methods and limitations required by Annex AA.
Scheme owner	AF, responsible for the controlled rule set and governance of the AF scheme; not necessarily the body performing evaluations.
Scheme operator	Body with actual written authority to operate a stated AF assessment route and responsibility for its implementation.
Evaluation	Examination of evidence by audit, inspection, testing, observation, interview, examination or analysis against specified requirements.
Review	Competent examination of the sufficiency and consistency of evaluation evidence before the conformity decision.
Conformity decision	Accountable determination to grant, refuse, maintain, restrict, suspend, restore, renew or withdraw a bounded attestation.
Auditor / lead auditor	Person authorized to conduct audits / person additionally authorized to lead and integrate an audit team's work.
Technical expert	Person providing verified domain expertise who does not automatically possess audit leadership or conformity decision authority.
Personnel certification	Independent attestation that a person has demonstrated specified role competence within a defined scope and period.
Task authorization	Employer or responsible technical authority permission to perform a defined task on specified work; distinct from certification or a statutory license.
Subcontractor / sub-tier provider	External performer of assigned work / a further provider used by that performer; retained accountability does not disappear through these tiers.
Accreditation	A distinct, authorized competence attestation for a conformity-assessment body's defined activities, following the CAB route; not organizational certification or membership.
Indeterminate measurement decision	A result for which the selected uncertainty-aware rule demonstrates neither conformity nor nonconformity; acceptance is held unless valid further evidence resolves it.
Critical / major / minor finding	Finding classifications defined in Annex AD; they do not replace the separate technical hold decision.
Suspension / withdrawal	Temporary prohibition on use of an attestation / termination of that attestation; both retain an auditable status history.
Restriction	A formally evaluated reduction or limitation of scope; not a means of concealing a systemic failure affecting the remaining scope.
Ongoing attestation / instance attestation	A time-limited claim maintained through surveillance / a claim confined to an identified lot, serial, service event or evaluated instance.

Table 3-2 — Abbreviations

Abbreviation	Meaning
AI / ML	Artificial intelligence / machine learning
BOM / SBOM	Bill of materials / software bill of materials
CAPA / NCR	Corrective action management / nonconformity record
COTS	Commercial off-the-shelf
EMC / EMI / ESD	Electromagnetic compatibility / interference / electrostatic discharge
FAI / FMEA / FTA	First article inspection or verification / failure mode and effects analysis / fault tree analysis
FOD	Foreign object debris or damage, as specified by context
MRO	Maintenance, repair and overhaul
MBSE	Model-based systems engineering
MTBF / MTTR	Mean time between failures / mean time to repair

Abbreviation	Meaning
NDT	Non-destructive testing
ODD	Operational design domain
OT	Operational technology
QMS	Quality management system
RAM	Reliability, availability and maintainability
RPO / RTO	Recovery point objective / recovery time objective
SPC	Statistical process control
UAS	Unmanned aircraft system
V&V	Verification and validation

3.1 Interpretation and evidence convention

- a) A requirement identifier consists of the subclause and its lettered paragraph, for example 8.1.3(a). The complete paragraph, including each condition joined within it, is applicable unless an approved scope decision establishes otherwise. Evidence notes identify minimum record content, not the only permissible proof of implementation.
- b) “Documented” information may be digital, physical or a controlled combination. A database, model, signed workflow or automated log may satisfy a record requirement if identity, integrity, access, retention and retrievability are demonstrated. A screenshot without provenance is not sufficient evidence of the underlying transaction.

4 Organizational context and management-system design

4.1 Context, operating environment and emerging conditions

- a) The organization shall determine internal and external conditions affecting its ability to deliver conforming and dependable outputs. The review shall include mission environments, technology maturity, human capability, infrastructure, supply dependencies, market changes, public-interest effects and applicable legal and contractual conditions. Material assumptions shall have owners and review triggers.
- b) The organization shall explicitly assess whether climate change or climate-related disruption is relevant to product conformity, operational environments, infrastructure, supply continuity or interested-party requirements. It shall record the decision, evidence and necessary actions. The AF requirement extends this review to physical and transition effects without imposing a universal emissions target.
- c) Context shall be reviewed at planned intervals and following a significant incident, acquisition, mission change, relocation, severe supply disruption or relevant change in obligations. A context review shall result in decisions affecting plans or controls where necessary, not only a static list of factors.

Required evidence: Context register; climate-relevance decision; assumptions; review minutes; resulting changes to objectives, hazards or controls.

4.2 Interested parties and public-interest interfaces

- a) The organization shall identify parties whose requirements or exposure can affect the system's outcomes, including customers, end users, operators, workers, suppliers, authorities and persons exposed to credible product consequences. It shall determine which requirements are binding, which are adopted commitments and which are information to monitor.
- b) Conflicting expectations shall be resolved through a documented decision process. Customer preference shall not override a binding safety or legal requirement. Community or user concerns relevant to product use shall be assessed on evidence, while access to sensitive or controlled information shall remain restricted to authorized recipients.

Required evidence: Interested-party register; obligation classification; communication responsibilities; conflict resolutions.

4.3 System scope, boundaries and responsibility

- a) The scope and applicability matrix shall reflect actual responsibilities at every lifecycle stage, including outsourced design, remote engineering, cloud services, off-site maintenance and customer-site work. Responsibility for an interface shall be assigned to a named role on each side; shared responsibility shall not leave an unowned decision.
- b) Changes to scope shall undergo a documented capability and risk review before new work is accepted. The organization shall verify personnel, facilities, technical data, authorizations and assurance capacity for the changed scope. Public statements and any assessment certificate shall be updated when the controlled scope changes.

Required evidence: Scope statement and Annex A matrix; interface agreements; new-capability review; updated external claims.

4.4 Processes and their interactions

- a) The organization shall establish and maintain an integrated process model showing sequence, inputs, outputs, interfaces and feedback. For every process it shall assign an owner, determine resources, define operating and acceptance criteria, identify relevant risks and opportunities, and establish measures of both process performance and outcome effectiveness.
- b) The organization shall control cross-functional handovers so that requirements, configuration, unresolved issues and acceptance responsibilities remain explicit. Process measures shall include failure and escape signals where relevant, rather than relying solely on activity counts or schedule achievement.
- c) Documented operating information shall be maintained, and evidence of execution shall be retained. The organization may use a quality manual or equivalent navigable system; the chosen form shall allow personnel and assessors to locate current requirements, responsibilities and records without reconstructing them from personal knowledge.

Required evidence: Process architecture; process-owner definitions; operating criteria; interaction records; process metrics and improvement actions.

4.5 Obligation and commitment register

- a) The organization shall maintain an obligation register linking each applicable external obligation to affected products, sites, processes and accountable owners. The register shall identify evidence of fulfillment and the mechanism for detecting relevant changes. Subscription to an alert service alone shall not constitute an assessment of applicability.
- b) Where access restrictions limit an assessor's ability to view evidence, the organization shall arrange an authorized alternative that preserves competence and traceability. Restricted information shall not be replaced by an unsupported statement of compliance. Unresolved access limitations shall be identified in the assessment outcome.

Required evidence: Controlled obligation register; change assessments; authorized evidence-access arrangements.

5 Leadership, quality culture and accountable decisions

5.1 Executive accountability and customer focus

- a) Top management shall be accountable for system effectiveness and shall integrate quality, safety, reliability and delivery obligations into business decisions. It shall provide resources, resolve cross-functional conflicts and require evidence that commitments can be fulfilled before they are accepted.
- b) Top management shall ensure that customer and end-user needs, applicable obligations and foreseeable consequences are understood. Product conformity, on-time delivery, complaints, repeat escapes and effectiveness of corrective action shall be reviewed together. Delivery recovery shall not be achieved by concealing defects or bypassing release controls.

Required evidence: Executive reviews; resource decisions; commitment reviews; balanced performance measures and escalations.

5.2 Policy and measurable commitments

- a) The organization shall establish an approved quality and assurance policy appropriate to its scope and risks. The policy shall commit to fulfillment of applicable requirements, accurate evidence, ethical behavior, reporting of concerns and continual improvement. It shall provide a practical basis for objectives and decisions.
- b) The policy shall be communicated in language and forms understood by personnel and relevant external providers. Understanding shall be evaluated through observed decisions and interviews rather than a signature alone. The current policy shall be available to relevant interested parties subject to legitimate information controls.

Required evidence: Approved policy; communication records; observed application; linked objectives.

5.3 Roles, management representative and independence

- a) Top management shall appoint a management representative with authority to coordinate the system, report performance and escalate unresolved quality or assurance issues directly to the accountable executive. Technical authorities for design, safety, production, software, cybersecurity and release shall be identified according to the organization's activities.
- b) Personnel responsible for independent review or release shall have the competence, access and freedom necessary to challenge the work. For the criticality categories in Annex B, independence shall be demonstrated by the reporting or decision arrangement, not merely by a different job title. Conflicts of interest shall be recorded and managed.

- c) Delegation shall specify scope, limitations, competence, duration and supervision. A delegated supplier or automated workflow shall not acquire authority beyond the documented delegation. The delegating organization shall monitor performance and retain the ability to suspend the delegation.

Required evidence: Authority matrix; management-representative appointment; independence arrangements; delegation register.

5.4 Ethical behavior and quality culture

- a) The organization shall establish behavioral expectations prohibiting falsification of test results, concealed rework, unauthorized substitutions, misleading claims and retaliation for good-faith reporting. Management incentives and production targets shall be reviewed for pressures that could undermine these expectations.
- b) Personnel shall have accessible channels to raise concerns, including escalation outside the immediate production chain when necessary. The organization shall protect reporters within applicable requirements, investigate concerns impartially and communicate outcomes appropriately. An increase in reported concerns shall not automatically be interpreted as deteriorating culture.
- c) Culture shall be evaluated using more than a survey score. The organization shall examine response to bad news, willingness to stop work, closure quality, recurrence, supplier treatment and management follow-through.

Required evidence: Behavior code; reporting channels; investigation records; incentive review; culture evaluation and actions.

5.5 Stop-work and release protection

- a) Every person performing work affecting conformity shall know how to stop or hold an unsafe or potentially nonconforming activity. Defined hold conditions shall include loss of configuration identity, unverified critical characteristics, suspect counterfeit material, compromised evidence and operation outside an approved safety envelope.
- b) Restart or release shall require an authorized assessment of cause, extent, implemented controls and remaining obligations. Commercial management shall not override a technical hold without the required technical and, where applicable, customer or authority approval. The decision and evidence shall remain traceable.

Required evidence: Stop-work instruction; hold records; restart criteria and authorized decisions.

5.6 Governance of claims and external relationships

- a) The organization shall ensure that proposals, declarations, product literature, environmental claims and statements about certification or AF recognition are accurate, bounded and supported. A management-system assessment shall not be used as evidence of a product capability that was not evaluated.
- b) Potential conflicts arising from investment, consultancy, training, supplier ownership or commercial sponsorship shall be disclosed to relevant decision makers. Any conformity decision shall remain independent of payments or membership status. Public corrections shall be made when a materially misleading claim is identified.

Required evidence: Claim-approval process; supporting evidence; conflict disclosures; correction records.

6 Planning, risks, opportunities and controlled change

6.1 Risk planning and acceptance

- a) The organization shall identify adverse uncertainties that can affect conformity, safety, mission outcomes, integrity of evidence or continuity of supply. The method shall address organizational and operational risks, interfaces, common-cause effects and credible combinations of failures. Risk ownership and acceptance authority shall be explicit.
- b) Risk evaluations shall identify consequence, likelihood basis, exposure, existing controls and uncertainty. Ordinal categories shall not be treated as precise probabilities. A high-severity hazard shall not be accepted solely because an unsubstantiated likelihood estimate or a multiplied score is low.
- c) Controls shall be selected, implemented and verified; residual risk shall then be assessed against approved criteria. Decisions shall specify assumptions, limitations, monitoring and review triggers. Unresolved binding requirements and unacceptable residual risks shall prevent the relevant release or lifecycle transition.

Required evidence: Risk register; hazard analyses; acceptance criteria; control verification; residual-risk decisions and triggers.

6.2 Opportunity planning as a distinct activity

- a) The organization shall identify and evaluate opportunities for improved capability, customer value, reliability, resilience, resource efficiency and knowledge. Each selected opportunity shall have a benefit hypothesis, feasibility assessment, resources, accountable owner, implementation milestones and a method for evaluating achieved benefit.

- b) Opportunity decisions shall be recorded separately from adverse-risk acceptance. An opportunity may generate new risks, which shall be evaluated through the risk process. The expected benefit of innovation shall not cancel a nonconformity or justify bypassing qualification.

| **Required evidence:** Opportunity register; selected initiatives; benefit evaluations; associated risk assessments.

6.3 Objectives and execution plans

- a) Measurable objectives shall be established at relevant organizational, process and program levels. Each objective shall identify the outcome, baseline, measure definition, target rationale, owner, resources, due date and evaluation frequency. Safety and quality objectives shall include leading and lagging indicators where useful.
- b) Denominators, exclusions and data sources shall be defined before reporting. Targets shall not encourage concealment, selective deletion, denominator changes or shipment before completion of acceptance. Failure to meet an objective shall trigger analysis and appropriate action, not retroactive redefinition without disclosure.

| **Required evidence:** Objective plans; metric definitions; baseline data; progress reviews and decisions.

6.4 Management-system and operational changes

- a) Changes shall be planned with a stated purpose, affected requirements, risks, resources, competence needs, interfaces, implementation method and acceptance criteria. The organization shall identify the approved baseline, the proposed baseline and the evidence needed to authorize transition.
- b) The change process shall cover organizational restructuring, relocation, outsourcing, supplier changes, digital-platform replacement, model updates, process-parameter changes and emergency changes. Temporary changes shall have explicit expiry or restoration criteria. Unintended changes shall be assessed and contained promptly.

| **Required evidence:** Change requests; impact assessments; approvals; training; implementation and post-change verification.

6.5 Resilience and continuity planning

- a) The organization shall identify critical dependencies such as energy, utilities, specialist personnel, sole-source materials, digital services, test infrastructure and transport. It shall assess credible disruptions, time to recover and the ability to continue meeting quality and safety obligations during degraded operation.
- b) Continuity plans shall define recovery priorities, alternative sources, data restoration, communication and restart qualification. Exercises shall include loss of a critical supplier and compromise of technical records where relevant. Emergency capacity shall not be assumed capable until its configuration, competence and process controls are demonstrated.

| **Required evidence:** Business-impact analysis; continuity plans; exercise results; approved recovery and restart evidence.

6.6 Technology maturity and future readiness

- a) The organization shall evaluate new technology against the actual intended environment and integration context. Readiness claims shall identify demonstrated functions, scale, duration, interfaces, limitations and unresolved gaps. A laboratory demonstration shall not automatically establish production, operational or mission readiness.
- b) Programs involving AI, advanced autonomy, in-space manufacturing, new propulsion, quantum technologies or other emerging capabilities shall establish bounded experiments and explicit transition gates. Monitoring shall include new failure mechanisms and foreseeable misuse. Changes to assumptions shall reopen the relevant assurance decisions.

| **Required evidence:** Technology evidence dossier; experiment approvals; readiness gap list; transition-gate decisions.

7 People, infrastructure, knowledge and documented evidence

7.1 Resource and capacity assurance

- a) The organization shall determine and provide resources necessary for planned work and credible contingencies. Capacity reviews shall consider competent personnel, equipment availability, maintenance, inspection, independent review, supplier capacity and expected rework. Inspection capacity shall not be assumed unlimited when production volume increases.
- b) Before accepting accelerated schedules or significant volume changes, the organization shall verify that resources and controls remain adequate. Unfunded assurance activities shall be escalated rather than silently removed. Resource plans shall include lifecycle support and retention of necessary technical knowledge.

| **Required evidence:** Capacity reviews; staffing and equipment plans; constraint decisions; lifecycle-support commitments.

7.2 Competence, qualification and authorization

- a) Competence requirements shall be defined for roles affecting conformity and assurance, including temporary staff, contractors, reviewers, programmers, inspectors and release personnel. Competence shall be evaluated

through suitable education, experience, supervised practice, demonstration or examination appropriate to the task.

- b)** Where a license or formal qualification is required, validity and scope shall be verified. Authorization shall identify the specific task, product or process and any limitations. Training attendance alone shall not establish competence. Reassessment shall follow significant technology change, extended inactivity or evidence of deficient performance.
- c)** Auditor and assessment-role competence shall meet Annex AB where those functions are performed. Personnel certification shall follow Clause 26 and Annex AE; employer task authorization shall remain specific to actual work. Contractors and temporary personnel shall meet the same relevant competence and authorization controls as employees.

Required evidence: Role competence criteria; assessments; qualifications; task-authorization register; reassessment records.

7.3 Awareness and human-performance conditions

- a)** Personnel shall understand relevant policies, objectives, current instructions, their contribution to product safety and mission outcomes, ethical expectations and the consequences of nonconforming work. Communication shall be adapted to language, literacy, shift patterns and remote working.
- b)** The organization shall identify work conditions that increase error, including fatigue, interruption, confusing interfaces, inaccessible tools, time pressure and poor handovers. Controls shall address the system conditions as well as individual skill. Investigations shall not use "operator error" as a sufficient root-cause conclusion.

Required evidence: Awareness evaluation; human-factor assessments; shift handover and error-prevention controls.

7.4 Infrastructure, utilities and facility integrity

- a)** Facilities, utilities, equipment, communication systems and supporting software shall be suitable for intended operations and maintained. Critical infrastructure shall have defined operating limits, inspection or maintenance requirements, condition monitoring and contingency arrangements.
- b)** Changes to foundations, equipment layout, utilities, environmental controls or network connections shall undergo impact review. Commissioning shall verify configuration and protective functions before production or service use. Where facility condition can influence measurement or process output, the condition shall be recorded or monitored.

Required evidence: Infrastructure register; maintenance and commissioning records; utility limits; facility change reviews.

7.5 Work environment, cleanliness and contamination

- a)** The organization shall define necessary environmental conditions for work, storage, inspection and testing. Controls shall address relevant temperature, humidity, vibration, lighting, electromagnetic disturbance, cleanliness, electrostatic discharge, contamination and biological or chemical exposure.
- b)** Clean zones, sensitive assemblies and contamination-critical processes shall have controlled entry, materials, cleaning methods and verification. Excursions shall trigger an assessment of exposed products and evidence, including material already transferred downstream. Restoration of room conditions alone shall not close the product-impact assessment.

Required evidence: Environmental specifications; monitoring logs; excursion investigations; cleanliness verification.

7.6 Measuring equipment and metrological traceability

- a)** Measurement systems used to demonstrate conformity shall be suitable for the measurand, range, environment and decision risk. The organization shall maintain a register containing equipment identity, location, owner, range, calibration or verification method, interval, status and acceptance criteria.
- b)** Where traceability is required or necessary for confidence, calibration shall be linked through a documented chain to appropriate measurement references. Where an established reference does not exist, the technical basis of verification shall be documented. Equipment shall be protected from unauthorized adjustment and damage.
- c)** Out-of-tolerance, damaged, overdue or otherwise unsuitable equipment shall be removed or restricted from use. The organization shall assess the validity of prior results and trace affected outputs. An equipment recalibration certificate shall not, by itself, resolve the product disposition.

Required evidence: Equipment register; calibration chain; recall system; uncertainty suitability; impact and disposition records.

7.7 Measurement methods, uncertainty and decision rules

- a)** Test and inspection methods shall be validated or verified as appropriate for their intended use. The organization shall establish an uncertainty model and decision rule where measurement uncertainty can affect conformity. Personnel shall understand the distinction between specification limits, instrument resolution, uncertainty and process-control limits.

- b) Automated inspection, machine vision and in-process probing shall be evaluated against representative defects, surfaces, geometries and environmental conditions. False acceptance and false rejection shall be considered. Revalidation shall follow material changes to optics, algorithms, fixtures, software or decision thresholds.
- c) Annex AD shall govern conformity decisions relying on measurement uncertainty. The informative examples in Annex H shall not be used to select favorable acceptance criteria after results become known. The decision rule and treatment of an indeterminate result shall be fixed before evaluation.

Required evidence: Method-validation records; uncertainty budgets; decision rules; automated inspection challenge results.

7.8 Organizational knowledge and technical continuity

- a) The organization shall identify knowledge necessary for current and future obligations, including tacit process knowledge, field experience, design rationale and failure mechanisms. It shall preserve critical knowledge when personnel retire, suppliers exit or technology changes.
- b) Lessons learned shall be indexed so that relevant programs can retrieve and evaluate them. Reuse of a lesson or legacy design shall include an applicability check; similarities in name or appearance shall not establish equivalence of mission, materials or environment.

Required evidence: Knowledge map; succession and transfer records; lessons database; reuse applicability reviews.

7.9 Communication and controlled information exchange

- a) The organization shall define what information is communicated, by whom, to whom, when and through which controlled channels. Urgent information affecting released products shall have an escalation path and acknowledgement mechanism. Supplier and customer changes shall reach the functions that use the affected data.
- b) Sensitive, proprietary, personal or controlled technical information shall be shared only through authorized arrangements. Meeting attendance or federation membership shall not itself grant access. Communication restrictions shall be reconciled with required hazard and conformity reporting through an approved process.

Required evidence: Communication matrix; notification and acknowledgement logs; approved information-sharing arrangements.

7.10 Document creation, approval and distribution

- a) Documented information shall have a unique identity, title, version, owner, approval status and effective date as appropriate. Review shall verify technical accuracy, clarity, consistency and suitability before issue. Instructions shall distinguish mandatory steps, hold points, permitted alternatives and acceptance criteria.
- b) Current information shall be available at the point of use. Obsolete versions shall be removed from unintended use or clearly restricted for historical purposes. Personal copies, local spreadsheets and cached digital files shall be controlled when they influence conformity decisions.

Required evidence: Document master list; approval workflow; distribution controls; point-of-use verification.

7.11 Record integrity, retention and long-life readability

- a) Records shall preserve the identity of the subject, performer, reviewer and applicable configuration, together with time, results, units and disposition. Changes to recorded evidence shall retain the original value, reason, author and approval where relevant. Electronic signatures and acceptance media shall be individual, protected and revocable.
- b) Retention periods shall consider law, contract, product life, latent defects, liability, material traceability and long-duration missions. No universal short retention period is prescribed. Digital preservation shall address format obsolescence, cryptographic validity, migration verification, backup, recovery and readable access after supplier or platform failure.
- c) The organization shall test retrieval of selected legacy and current records, including restoration from backup. Destruction shall be authorized, recorded and suspended when subject to a relevant investigation, claim or preservation obligation.

Required evidence: Retention schedule; signature controls; audit trails; migration and restore tests; authorized disposal records.

7.12 Technical software, spreadsheets and decision tools

- a) Software, scripts, spreadsheets and computational tools that influence design, inspection, acceptance or assurance decisions shall be identified and controlled. Validation shall be proportionate to the consequence of an undetected error and shall include known-answer tests, boundary conditions, unit consistency and independent review where required.
- b) Inputs, algorithms, dependencies, versions and output interpretation shall be documented. Formula cells and approved parameters shall be protected where appropriate. An AI-generated calculation or report shall undergo competent review; fluent language or successful execution shall not constitute verification of technical correctness.

Required evidence: Tool inventory; validation plan and known-answer tests; version records; review and revalidation triggers.

8 Operational planning and product or service realization

8.1 Integrated operational planning

- a) The organization shall translate requirements into an executable program or order plan covering responsibilities, resources, lifecycle stages, work packages, suppliers, verification, validation, acceptance and delivery. Planning shall address producibility, inspectability, reliability, maintainability, safety, software, obsolescence, preservation and end-of-life obligations as relevant.
- b) Critical items, key characteristics and special requirements shall be identified early and connected to control plans. The plan shall identify required evidence and hold points before the affected work begins. Changes in schedule or resources shall trigger a review of the continuing adequacy of the plan.
- c) The organization shall verify consistency among the contract, technical baseline, purchasing requirements, manufacturing or service instructions and acceptance plan. A discrepancy shall be resolved before the affected activity proceeds. Work shall not be released merely because each department has approved a different interpretation.

Required evidence: Program assurance plan; work packages; control plans; integrated schedule; baseline consistency review.

8.1.1 Operational risk management

- a) For each program, order or family of work, the organization shall identify operational risks to requirements, delivery and lifecycle outcomes. The assessment shall cover new technology, difficult characteristics, supplier capability, work transfers, maintenance constraints and changes in the intended environment.
- b) The organization shall establish risk criteria, ownership, mitigation actions and residual-risk approval before the relevant gate. Risk records shall be updated when test evidence, nonconformities or field experience change the likelihood or consequence basis. A closed mitigation action shall be distinguished from demonstrated risk reduction.

Required evidence: Program risk register; mitigation verification; residual-risk acceptance; changes based on new evidence.

8.1.2 Configuration management

- a) The organization shall establish configuration identification, baseline control, change control, status accounting and configuration verification across hardware, software, models, manufacturing data and service information. The configuration structure shall identify relevant interfaces and distinguish as-designed, as-planned, as-built, as-tested, as-delivered and as-maintained states.
- b) Changes shall be assessed for effects on fit, form, function, safety, interchangeability, qualification, maintenance, cybersecurity, traceability and customer obligations. The affected population and implementation point shall be identifiable. Mixed configurations shall be prevented unless their compatibility is specifically justified.
- c) Configuration audits shall reconcile physical and digital evidence against approved baselines. Unauthorized substitutions or unexplained version differences shall be treated as nonconformities. A digital twin or model of record shall not conceal a discrepancy in the physical item.

Required evidence: Configuration plan; item hierarchy; baselines; change board decisions; status accounting; configuration audits.

8.1.3 Product safety and mission-critical controls

- a) The organization shall identify product and service hazards throughout the lifecycle, including interfaces, foreseeable misuse, maintenance, transport, abnormal modes and retirement. Safety responsibilities shall extend to suppliers and field support within the organization's scope.
- b) Safety-critical items and functions shall have explicit controls, acceptance criteria, independent review and traceability to hazard mitigations. Changes, concessions and nonconformities affecting these controls shall receive safety impact assessment before disposition. A generic quality approval shall not substitute for the required safety decision.
- c) The organization shall provide relevant safety information to users, maintainers and downstream organizations, monitor safety-related events and support timely corrective action. Safety concerns shall be escalated even when the contractual acceptance criteria appear to have been met.

Required evidence: Hazard log; safety-control traceability; independent reviews; safety communications; in-service event assessments.

8.1.4 Counterfeit and unapproved-item prevention

- a) The organization shall assess counterfeit and unapproved-item risk for materials, parts, electronic components, software licenses, calibration records and certificates. Procurement preference, source approval, authenticity checks and testing shall be proportionate to consequence and supply risk.
- b) Source identity, authorized-channel evidence, original manufacturer information and chain of custody shall be verified where relevant. A certificate alone shall not be accepted without evaluation of its origin, scope, consistency and credibility. Brokers and obsolete components shall receive additional controls when risks justify them.
- c) Suspect items shall be segregated and positively controlled to prevent use or re-entry into the supply chain. Investigation, notification, preservation of evidence and disposition shall follow applicable obligations. Returning suspect material to the supplier without controls shall not be the default disposition.

Required evidence: Authenticity-risk assessment; approved sources; incoming verification; suspect-item records and disposition.

8.1.5 Temporary and permanent work transfer

- a) The organization shall plan transfer of work between sites, suppliers, equipment, production lines or service locations. The transfer plan shall identify baseline data, process capability, competence, tooling, environmental conditions, technical support, traceability and delivery-continuity risks.
- b) Transferred work shall undergo appropriate first article, process requalification or service-capability verification before unrestricted release. The receiving source shall demonstrate actual capability; the sending source's records alone shall not establish equivalence. Early production shall be monitored against defined exit criteria.

Required evidence: Transfer plan; receiving-site readiness; qualification evidence; initial-output monitoring and closure.

8.2 Requirements for products and services

- a) The organization shall control customer communication, requirement definition, commitment review and changes through the complete sequence in 8.2.1–8.2.4. The approved requirements shall remain traceable to the product, service, process, performer and acceptance decision they affect.

Required evidence: Requirement lifecycle; agreed baseline; review and change records.

8.2.1 Customer and user communication

- a) The organization shall establish channels for enquiries, proposals, orders, changes, technical questions, complaints, customer property and contingency communication. Information supplied to customers shall accurately state capabilities, limitations, dependencies and required user actions.
- b) Safety, service-life and configuration information shall reach the intended operator or maintainer, not only the purchasing contact where this would be insufficient. Relevant feedback shall be reviewed and connected to engineering, supplier and process decisions.

Required evidence: Communication arrangements; technical clarifications; complaints; user-information distribution.

8.2.2 Requirement determination and completeness

- a) Before committing to an output, the organization shall identify customer requirements, applicable obligations and requirements necessary for the intended use when known. The assessment shall cover performance, interfaces, environment, reliability, safety, cybersecurity, maintenance, delivery, documentation and retirement.
- b) Special requirements and assumptions shall be visible. Claims in quotations, marketing materials or demonstrations that become commitments shall be included in the review. Requirements shall be unambiguous and verifiable, with measurable acceptance criteria or an approved qualitative evaluation method.

Required evidence: Requirements register; assumptions; applicable obligations; acceptance definitions; identified special requirements.

8.2.3 Contract and commitment review

- a) The organization shall review its ability to fulfill requirements before accepting a contract or order, including repeat orders when relevant conditions have changed. The review shall involve affected technical, quality, production, supply, service and commercial functions.
- b) Differences from prior proposals or agreements shall be resolved. Missing written requirements shall be confirmed through an appropriate controlled record. Where requirements cannot be fully met, the organization shall obtain an authorized revised agreement before commitment; it shall not rely on later concessions.
- c) Review shall include liability boundaries, data rights, access restrictions, support duration, source dependencies and customer approval points. Unresolved safety or legal obligations shall prevent acceptance of the affected commitment.

Required evidence: Multifunctional contract review; feasibility evidence; resolutions; approved deviations from the proposed offer.

8.2.4 Changes to requirements

- a) Changes shall be uniquely identified, reviewed, approved and communicated to all affected functions and external providers. The organization shall evaluate impacts on completed work, purchased material, qualification evidence, delivered products, software compatibility and maintenance information.
- b) The change implementation point shall be controlled. Obsolete requirements shall be removed from unintended use, and affected verification shall be repeated where necessary. The organization shall confirm that downstream recipients have incorporated changes requiring their action.

Required evidence: Requirement-change record; impact analysis; baseline update; implementation and acknowledgement evidence.

8.3 Design and development

- a) The organization shall apply 8.3.1–8.3.6 to its actual product, service and process design responsibilities, including outsourced design for which it remains responsible. Supplied design shall be controlled and deficiencies escalated even where the organization does not own the product design.

Required evidence: Design scope and responsibility; controlled inputs; review, verification, validation and changes.

8.3.1 Design and development governance

- a) The organization shall establish a design and development process appropriate to the complexity, novelty and consequence of the output. It shall define technical authority, independent review, design responsibility and interfaces with customer or externally provided design.
- b) Design assurance shall include hardware, software, interfaces, manufacturing methods, operational procedures and maintenance assumptions. Build-to-print work shall still assess the adequacy and controlled use of supplied data and shall escalate defects or ambiguities to the design authority.

Required evidence: Design process; responsibility allocation; design-data acceptance; escalation of ambiguities.

8.3.2 Design planning and lifecycle controls

- a) The design plan shall define stages, work breakdown, resources, reviews, verification, validation, configuration controls and transition criteria. Planning shall address ability to manufacture, inspect, integrate, test, operate, maintain, repair and retire the design.
- b) Interfaces among disciplines and organizations shall be explicitly managed. Customer and user involvement shall be planned where necessary to validate intended use. Independence and specialist competence shall be matched to criticality and uncertainty.

Required evidence: Design plan; interface agreements; review schedule; V&V strategy; required independence.

8.3.3 Design inputs and derived requirements

- a) Design inputs shall identify functions, performance, constraints, operating environments, applicable obligations, lessons learned, failure consequences, materials, lifecycle limits and obsolescence risks. The organization shall review inputs for completeness, consistency and testability before baselining.
- b) Derived requirements shall have a documented technical rationale and a traceable parent need or analysis. Safety-related derived requirements shall be reviewed by the appropriate authority. Conflicts shall be resolved rather than propagated into competing design assumptions.

Required evidence: Approved input baseline; derivation rationale; assumption register; conflict resolutions.

8.3.4 Design review, verification and validation

- a) Reviews shall evaluate whether the design can fulfill requirements and whether evidence and unresolved issues justify progression. Verification shall demonstrate that outputs satisfy specified inputs; validation shall demonstrate suitability for intended use in a representative context. These activities shall not be treated as interchangeable.
- b) Test plans shall identify the test item and configuration, objectives, methods, environment, equipment, uncertainty, data to retain, acceptance criteria and anomaly handling. Test readiness shall be approved before execution. Deviations from the plan shall be recorded and evaluated for their effect on validity.
- c) Analysis and simulation used as evidence shall have a justified model, validated range, input provenance, sensitivity analysis and uncertainty treatment. Completion of design shall require evidence covering identified operating conditions and interfaces; untested or unanalyzed conditions shall be explicitly bounded or resolved.

Required evidence: Review records; requirements-to-evidence matrix; approved test plans; raw data; model credibility; anomaly dispositions.

8.3.5 Design outputs and release

- a) Design outputs shall define the product or service sufficiently for procurement, manufacture, integration, verification, use and support. They shall identify characteristics, interfaces, materials, software versions, critical items, key characteristics, acceptance criteria and necessary handling or maintenance information.

- b) Outputs shall be approved by authorized technical personnel before release. Where a model is authoritative, its role, exchange format, version and interpretation rules shall be explicit. Manufacturing and inspection shall use consistent definitions of geometry, units, coordinate systems and tolerances.

Required evidence: Released design package; critical-characteristic list; approval; downstream usability review.

8.3.6 Design changes and continued validity

- a) Design changes shall be identified, reviewed, verified or validated as necessary and approved before implementation. Impact shall be assessed on interchangeability, interfaces, hazards, software, process capability, qualification, service instructions and the affected delivered population.
- b) The organization shall identify when customer or competent-authority approval is required. A change that appears physically small shall not be presumed low risk. Changes to materials, manufacturing routes, model training data or timing behavior shall receive a consequence-based assessment.

Required evidence: Change request; impact analysis; requalification decision; approvals; affected-item and implementation records.

8.4 Externally provided products, processes and services

- a) The organization shall apply 8.4.1–8.4.3 to selection, approval, verification and communication for external provision. Clause 27 and Annex AF additionally control actual performers, further tiers and retained responsibility. Customer nomination of a source shall not remove these obligations.

Required evidence: External-provider scope; approval, verification and flow-down evidence.

8.4.1 External-provider selection and approval

- a) The organization shall evaluate, select and approve external providers according to their ability to fulfill the assigned requirements. Controls shall consider technical capability, criticality, past performance, authenticity risk, capacity, financial continuity where relevant and sub-tier dependencies.
- b) An approved-provider register shall identify status, scope, conditions, limitations and review dates. Customer nomination or an external certificate shall not remove the organization's responsibility to verify suitability for the actual supplied scope. Conditional approval shall have defined controls and closure criteria.
- c) Provider performance shall be monitored using conformity, delivery, responsiveness, change discipline and corrective-action effectiveness. Approval shall be restricted, suspended or withdrawn when justified. Single-source and long-lead risks shall be addressed without relaxing required assurance.

Required evidence: Supplier evaluations; approval register; performance reviews; conditional approvals; sub-tier dependency map.

8.4.2 Verification of externally provided outputs

- a) The organization shall determine verification appropriate to the output and source risk, including inspection, testing, source surveillance, document review and periodic revalidation where necessary. It shall verify that supplied evidence corresponds to the correct item, lot, version and test method.
- b) External test reports shall be evaluated for consistency, adequacy and authenticity. For significant-risk raw material or critical items, a defined method shall validate report accuracy. Delegated supplier inspection shall have a controlled scope, qualified personnel, a delegation register and periodic oversight.
- c) Limited release for further processing before verification is complete shall be specifically authorized, uniquely traceable and recoverable. It shall not permit irreversible consumption or final customer release of an output whose required conformity evidence remains unresolved.

Required evidence: Incoming verification plans; report checks; delegated inspection controls; restricted-release and recall records.

8.4.3 Purchasing information and flow-down

- a) Purchasing requirements shall communicate the exact technical baseline, acceptance criteria, critical characteristics, required processes, competence, approvals, verification and evidence. Requirements shall be reviewed for adequacy before transmission and flowed down to relevant sub-tier providers.
- b) The organization shall specify change notification and approval requirements, nonconformity notification, disposition authority, counterfeit prevention, records retention, authorized access and required test specimens where relevant. Rights of access shall be implemented within applicable confidentiality and security restrictions, not omitted without resolution.
- c) Providers shall be informed of their contribution to conformity, safety and ethical conduct. The organization shall verify that important requirements reached the point of performance rather than only the first-tier purchasing office.
- d) Subcontracting and sub-tier flow-down shall also meet Clause 27 and Annex AF. An organization may use common contractual clauses, but it shall verify their applicability to the actual performer, including outsourced engineering, cloud services, laboratories and personnel agencies.

Required evidence: Purchase-order clauses; technical-data issue record; sub-tier acknowledgement; flow-down verification.

8.5 Production and service execution

- a) The organization shall apply 8.5.1–8.5.6 to the controlled execution, identification, preservation, support and modification of its outputs. Special processes and first article verification shall be triggered by the actual work rather than omitted because a supplier or customer performs part of the activity.

Required evidence: Controlled work routes; actual execution; identity, preservation, support and change records.

8.5.1 Controlled production and service execution

- a) Production and service work shall use approved instructions, suitable equipment, competent personnel and defined environmental conditions. Instructions shall identify required characteristics, sequence, workmanship criteria, inspection points, process limits and authorized alternatives.
- b) The organization shall maintain accountability for quantities and configuration through split lots, rework, scrap and partial completion. Critical items and key characteristics shall be controlled at points where their conformity can be established. A later inspection shall not be presumed to detect every earlier process failure.
- c) Evidence shall show completion of required operations and acceptance activities. Utilities, consumables, tools and software affecting output shall be controlled. Error prevention, FOD prevention and identification of work awaiting verification shall be integrated into the process.

Required evidence: Controlled route or work package; process records; in-process verification; quantity reconciliation; FOD and utility controls.

8.5.1.1 Equipment, tooling and production software

- a) Equipment, tooling, fixtures and software used to create, control, inspect or measure outputs shall be verified or validated before release for use. The assessment shall include the actual application, configuration, interfaces, failure behavior and ability to maintain required characteristics.
- b) Maintenance, storage, preservation and periodic condition checks shall be defined. Tool repairs, software updates, relocation and changes to compensation parameters shall trigger an impact-based revalidation decision. Access to editable machine programs shall be restricted and changes traceable.

Required evidence: Tool and software qualification; controlled programs; maintenance; storage checks; revalidation records.

8.5.1.2 Special-process validation and control

- a) Special processes shall have approved methods, qualified personnel, suitable equipment, validated parameter windows and defined acceptance and monitoring criteria. Qualification shall demonstrate that relevant output characteristics can be achieved reproducibly under the proposed operating conditions.
- b) The organization shall define conditions for maintaining approval, monitoring essential variables, retaining records and requalification. Changes to material, geometry, equipment, software, consumables or location shall be evaluated. Final visual inspection alone shall not replace control of hidden or irreversible characteristics.

Required evidence: Special-process qualification dossier; approved parameter ranges; operator qualifications; run records; requalification decisions.

8.5.1.3 Production-process and first article verification

- a) The organization shall verify that the planned production route, documentation, equipment and tooling can produce an item meeting requirements. Verification shall use a representative item or other justified approach and account for every applicable characteristic, including material, process, software and interface requirements.
- b) Repeat verification shall be considered after design, process, source, tooling or location changes, significant interruption or evidence that previous results no longer represent production. Partial verification shall identify and justify the unaffected portion. Approval of first article evidence shall not authorize later process drift.

Required evidence: First article record; characteristic accountability; material/process evidence; differences and repeat-verification rationale.

8.5.2 Identification, status and traceability

- a) Outputs shall be identified sufficiently to establish their configuration and acceptance status throughout the lifecycle. Where traceability is required, identity shall link material origin, lots, serials, processing, personnel, inspection, software versions and disposition as relevant to consequence and obligations.
- b) Traceability shall survive splitting, combining, packaging changes, repairs and movement between systems. Acceptance stamps, passwords and electronic signatures shall be controlled. The organization shall periodically demonstrate that a suspect source or process event can be traced to the affected population and that an item can be traced back to its evidence.

Required evidence: Identity scheme; genealogy records; status controls; signature register; forward and reverse trace exercises.

8.5.3 Customer and external-provider property

- a) Property under the organization's control shall be identified, protected and used only as authorized. This includes physical items, tooling, intellectual property, technical data, software, personal information and access credentials.
- b) Loss, damage, unsuitable condition or unauthorized use shall be reported to the owner through the agreed channel and recorded. The organization shall preserve evidence and assess product or service impact rather than treating the issue solely as an administrative property loss.

Required evidence: Property register; receipt checks; access controls; condition and incident records.

8.5.4 Preservation, packaging and transport

- a) The organization shall preserve conformity during handling, storage, packaging and transport. Controls shall address cleanliness, FOD, humidity, temperature, corrosion, ESD, shock, shelf life, material compatibility, hazardous conditions and stock rotation as applicable.
- b) Packaging methods shall be qualified for the actual route and exposure where risk warrants. Excursions or damaged packaging shall trigger a product assessment. Expired, life-limited or environmentally exposed material shall not be returned to normal stock without an authorized disposition based on technical evidence.

Required evidence: Preservation specifications; packaging qualification; environmental history; shelf-life controls; excursion dispositions.

8.5.5 Post-delivery support and field feedback

- a) The organization shall define support responsibilities for installation, operation, training, maintenance, repair, warranty, spare parts, software updates and obsolescence within the agreed lifecycle. Technical information shall be controlled and updated when experience changes safe or effective use.
- b) Field performance and failures shall be collected and analyzed with exposure and configuration context. A detected problem shall trigger investigation, communication and appropriate containment of the affected population. Off-site work shall meet the same applicable controls as equivalent work at the main facility.

Required evidence: Support plan; service information; field reliability data; notifications; off-site work controls.

8.5.6 Production and service changes

- a) Production and service changes shall be reviewed and authorized by competent persons with defined authority. The review shall consider changes to output characteristics, process capability, hidden features, qualification, measurement, configuration and contractual approvals.
- b) Emergency changes shall have temporary limits, additional checks and an expiry or conversion decision. The organization shall retain the baseline, change rationale, approval and verification of the changed output. A change implemented to restore delivery shall not bypass required design approval.

Required evidence: Process-change record; technical impact; approvals; temporary controls; changed-output verification.

8.6 Acceptance and authorized release

- a) Before release, the organization shall verify completion of the agreed acceptance plan, disposition of nonconformities, configuration consistency and availability of required documentation. Acceptance evidence shall identify actual results, applicable criteria and the authorized release person or controlled function.
- b) Open issues shall be evaluated against explicit release-blocking criteria. A concession may address only a specifically authorized and lawful departure; it shall not waive a mandatory safety approval or conceal missing verification. Products awaiting required evidence shall remain controlled.
- c) Where qualification evidence is required, it shall demonstrate the correct configuration and intended conditions. Delivery documentation shall state approved deviations, restrictions, service-life status and required user actions. Electronic release shall preserve individual accountability and tamper evidence.
- d) The release authority shall identify whether it is releasing a product, a service event, a process for use or a person for a task. Release is not equivalent to third-party certification. Conformity attestation shall additionally follow Clause 22 and Annexes AA and AD; a lifecycle conditional progression decision shall not be presented as a conditional certificate.

Required evidence: Release checklist; acceptance results; closed or authorized issues; delivery dossier; release authorization.

8.7 Nonconforming outputs and escape control

- a) The organization shall identify and control nonconforming or suspect outputs to prevent unintended use or delivery. The response shall address severity, exposure, affected populations and consequences, including outputs already delivered or incorporated into higher assemblies.
- b) Disposition authority shall be defined. Repair or use-as-is decisions affecting design requirements shall obtain design-authority approval and customer approval where the contract requires it. Reworked or repaired outputs

shall undergo appropriate verification. Scrap shall be positively controlled until re-entry into the supply chain is prevented.

- c) The organization shall notify relevant customers and other required recipients promptly within applicable deadlines, preserve evidence and initiate corrective action appropriate to the issue. The record shall describe the nonconformity, containment, affected population, disposition, concessions, approvals and verified outcome.

Required evidence: NCR; material review decisions; population trace; notifications; repair/rework verification; scrap control.

9 Performance evaluation, audit and management review

9.1 Monitoring strategy and data credibility

- a) The organization shall define what will be monitored, why it matters, how it is measured, when it is evaluated and who acts on the result. Measures shall connect process performance to product conformity, delivery, reliability, safety, customer experience and evidence integrity.
- b) Data shall retain configuration, exposure, time period and denominator information needed for interpretation. Automated dashboards shall be reconciled to source records. Missing, delayed or selectively excluded data shall be visible. Leading indicators shall be evaluated against outcomes to confirm their usefulness.

Required evidence: Monitoring plan; metric dictionary; source reconciliations; data-quality checks; action records.

9.2 Customer satisfaction and external feedback

- a) The organization shall monitor customer and relevant user perceptions through suitable methods, including complaints, delivery experience, acceptance issues, service performance and corrective-action requests. Absence of complaints shall not be the sole evidence of satisfaction.
- b) Trends shall be analyzed by meaningful product, site, supplier or configuration groups. Improvement plans shall address identified weaknesses and assess whether the customer or user experience actually improved. Contractual acceptance and user satisfaction shall be distinguished.

Required evidence: Feedback records; segment analysis; improvement plans; effectiveness evaluations.

9.3 Internal audit program

- a) The organization shall maintain an audit program covering the full applicable system, sites, shifts, remote activities and relevant external interfaces. Frequency and depth shall reflect criticality, changes, performance, prior findings and the maturity of controls. The program shall include process implementation and evidence integrity, not only procedure presence.
- b) Auditors shall be competent and sufficiently independent of the work assessed. Audit criteria and sampling rationale shall be defined. A sampled audit shall not be described as verification of every item. Critical controls and unresolved high-consequence issues shall receive explicit attention.
- c) Findings shall identify the requirement, objective evidence and the nature of the gap. The organization shall correct and address causes, verify effectiveness and escalate overdue or ineffective action. Remote auditing shall be used only where evidence reliability and access are adequate.
- d) The complete applicable internal audit program shall be completed at intervals not exceeding 12 months. C2 and C3 critical-control implementation shall additionally be examined at intervals not exceeding six months, using targeted audits where suitable. These are organizational internal-audit duties, separate from third-party surveillance under Annex AG.

Required evidence: Risk-based audit program; competence and independence; plans; evidence trails; findings; closure verification.

9.4 Management review inputs

- a) Top management shall review the system at planned intervals and when major changes or incidents require it. Inputs shall include previous actions, context and obligation changes, objectives, process outcomes, product conformity, delivery, customer feedback, supplier performance, audits, nonconformities, risks, opportunities and resource adequacy.
- b) Review shall also consider culture, reporting behavior, emerging technology, cybersecurity, resilience, climate-related relevance, field reliability and lifecycle support. The review shall distinguish recurring patterns from isolated events and examine whether assurance independence is functioning under commercial pressure.
- c) The interval between complete management reviews shall not exceed 12 months. An immediate serious concern shall be escalated when detected rather than deferred until the next scheduled review. More frequent focused reviews shall be used where criticality, rapid change or adverse performance warrants them.

Required evidence: Review agenda and input pack; trend analyses; independent assurance concerns; status of prior actions.

9.5 Management review decisions and follow-through

- a) Review outputs shall include decisions on priorities, resources, risk treatment, opportunities, process changes, capability gaps and improvement. Each action shall have an accountable owner, due date, expected result and verification method.
- b) Top management shall follow up actions and unresolved risks. Repeated deferral of an issue shall trigger escalation and an explicit decision about continued operations. Minutes stating “reviewed and accepted” without a basis or action on adverse evidence shall not establish effectiveness.

Required evidence: Recorded decisions; action ownership; resource commitments; follow-up and effectiveness evidence.

9.6 Independent assurance and systemic challenge

- a) For high-consequence programs, the organization shall obtain independent challenge of the assurance strategy and major release decisions at the level specified in Annex B. The review shall examine assumptions, common-cause dependencies, missing evidence and the credibility of residual-risk acceptance.
- b) The independence arrangement may use qualified internal or external personnel. It shall not be weakened by allowing the designer to approve their own contested evidence without the required review. Dissenting technical opinions shall be recorded and resolved through the defined authority structure.

Required evidence: Independent-review plan; challenge records; dissent resolution; release recommendations.

10 Correction, learning and continual improvement

10.1 Response to nonconformity and containment

- a) When a nonconformity or credible concern is detected, the organization shall protect affected users and outputs, determine the immediate extent and assign a response owner. Initial containment shall cover related stock, work in progress, delivered configurations and digital artifacts as relevant.
- b) Containment effectiveness shall be checked. A correction to the first detected item shall not close the investigation of the wider population. Evidence shall be preserved so that cause analysis remains possible, including raw data, software versions, material samples and process conditions.

Required evidence: Response record; containment scope; trace results; effectiveness checks; preserved evidence.

10.2 Cause analysis and corrective action

- a) The organization shall determine causes using evidence appropriate to the problem. Analysis shall consider requirement quality, design assumptions, process conditions, human factors, tooling, suppliers, management pressures, software and detection failures. Unsupported labels such as “carelessness” shall not be accepted as completed analysis.
- b) Corrective action shall address both occurrence and escape causes where relevant. Actions shall be assigned, implemented and verified against a pre-defined effectiveness measure. The organization shall assess whether similar conditions exist in other products, sites, suppliers or processes and extend action where necessary.
- c) Where an external provider is responsible, corrective requirements shall be flowed down and their effectiveness verified. Repeated or late ineffective action shall be escalated. Risk assessments, technical data, control plans and training shall be updated when the findings change their basis.

Required evidence: Evidence-based cause analysis; occurrence and escape controls; action plan; systemic extent; effectiveness results.

10.3 Continual improvement and preventive learning

- a) The organization shall select improvement opportunities using performance evidence, user experience, lessons learned, technology developments and strategic needs. Improvement shall address system effectiveness, not only cost or administrative simplification.
- b) Changes introduced as improvements shall undergo the same appropriate assurance as other changes. Benefits shall be verified against the baseline, while unintended adverse effects shall be monitored. Knowledge from unsuccessful experiments shall be retained without representing an unproven benefit as achieved.

Required evidence: Improvement portfolio; baseline and outcome evaluation; change assurance; retained learning.

10.4 Learning across the lifecycle and network

- a) The organization shall make relevant lessons available to affected functions and suppliers through controlled channels. Significant lessons shall be considered at new-program initiation, design review, supplier approval and process change.
- b) Lessons shall identify conditions of applicability and evidence, rather than only a slogan or narrative. The organization shall periodically test whether the lessons are being used and whether repeated events indicate ineffective knowledge transfer.

Required evidence: Indexed lessons; applicability reviews; supplier communication; recurrence and uptake assessment.

11 Systems engineering, lifecycle gates and mission assurance

This clause applies to system development, integration or support responsibilities, including systems of systems and technical services that influence mission outcomes.

11.1 Mission and concept definition

- a) The organization shall establish a mission or service concept identifying users, objectives, success criteria, operational scenarios, environments, external interfaces and constraints. Normal, degraded, emergency, maintenance and retirement states shall be considered. Assumptions about external services or operator behavior shall be explicit.
- b) The concept shall define the boundary between mission success and safe behavior when mission success is no longer achievable. A system shall not be permitted to continue an unsafe action merely to preserve a mission objective. Changes to the concept shall trigger reassessment of derived requirements and evidence.

Required evidence: Mission concept; scenario catalogue; boundary assumptions; success and safe-state criteria.

11.2 Requirements decomposition and interface control

- a) System requirements shall be allocated to subsystems, functions, operators and external services with traceable rationale. Interfaces shall specify physical, electrical, data, timing, environmental, human and procedural characteristics as applicable.
- b) The organization shall assess emergent behavior and incompatible assumptions between separately acceptable subsystems. Interface changes shall be jointly reviewed by the affected authorities. Verification of each component independently shall not be assumed to verify the integrated system.

Required evidence: Requirement allocation; interface-control documents; integration assumptions; cross-interface verification.

11.3 Assurance planning and lifecycle gates

- a) Programs shall define lifecycle gates with entry criteria, required evidence, accountable decision makers, independent review, open-issue rules and exit criteria. Annex C provides minimum decision content. Gate names may be adapted to the organization, but the required decisions shall remain identifiable.
- b) Gate decisions shall distinguish unconditional progression, bounded conditional progression and hold. Conditions shall have owners, deadlines and limits on work permitted before closure. A schedule milestone shall not be recorded as a passed technical gate when required evidence is missing.

Required evidence: Gate plan; review packages; decision records; conditions and verified closure.

11.4 Reliability, availability and maintainability

- a) RAM requirements shall be derived from operational needs, exposure, consequence, support concept and applicable obligations. The organization shall state the population, mission duration, failure definition, repair boundary, confidence and statistical assumptions associated with every numerical claim.
- b) Analysis shall address failure mechanisms, dependencies, common causes, wear-out, maintenance-induced failure, dormant failures and environmental stress as relevant. Predicted reliability shall be distinguished from demonstrated performance. Qualification tests shall not be interpreted as proving rare-event safety rates without a defensible statistical and engineering basis.
- c) Maintainability shall consider access, diagnosis, repair errors, tools, spares, human factors and verification after intervention. Availability claims shall identify whether logistics and administrative downtime are included. Annex F provides worked methods and limits.

Required evidence: RAM plan; models and assumptions; test plan; field exposure; repair-time and downtime definitions.

11.5 Hazard analysis and assurance case

- a) The organization shall maintain a structured safety and mission-assurance argument proportionate to criticality. Claims shall be bounded by configuration and operational domain and supported by traceable evidence. The argument shall expose uncertainty, counter-evidence and unresolved limitations.
- b) Hazard analysis shall be maintained as the design and operating context evolve. Failure-mode analysis, fault trees, scenario analysis and other methods shall be selected for the problem rather than used as paperwork substitutes. Shared resources, common software, environmental exposure and organizational dependencies shall be assessed.

Required evidence: Assurance case; hazard log; analysis rationale; evidence index; limitations and independent challenge.

11.6 Verification strategy and model credibility

- a) The organization shall select inspection, analysis, demonstration and testing methods capable of establishing each requirement. The selected method shall address representativeness, observability, uncertainty, test-article differences and required confidence.

- b) For models and simulations, credibility shall be established for the stated decision use. Verification of implementation, validation against relevant observations, input quality, sensitivity and uncertainty shall be addressed. Extrapolation beyond the demonstrated domain shall be identified and approved with compensating evidence.

Required evidence: Verification matrix; method-selection rationale; model-credibility dossier; approved extrapolations.

11.7 Technical budgets and margin management

- a) The organization shall manage relevant budgets such as mass, power, thermal capacity, memory, latency, structural loads and resource consumption. Each budget shall have a baseline, allocation, margin definition, uncertainty treatment, owner and review trigger.
- b) Margins shall be defined consistently so that reserve is not counted twice across subsystem and system levels. Changes that consume allocated margin shall be evaluated for cumulative effects and compatibility with qualification evidence. A positive arithmetic margin shall not substitute for a valid physical model.

Required evidence: Budget register; margin definitions; allocation history; uncertainty and change assessments.

11.8 Integrated readiness and handover

- a) Before operational handover, the organization shall reconcile the released configuration, validated operational procedures, support capability, training, maintenance data, open issues and contingency arrangements. The receiving organization shall acknowledge responsibilities and limitations.
- b) The handover shall include information required for continued assurance and not merely delivery acceptance. Long-duration missions shall plan how evidence, expertise, spares and secure updates remain available after original project personnel or suppliers are no longer present.

Required evidence: Integrated readiness review; handover dossier; receiving acknowledgement; long-life support arrangements.

12 Software, programmable hardware, AI and digital engineering

This clause applies when digital artifacts influence product behavior, manufacturing, inspection, maintenance or assurance decisions. The same responsibility applies to purchased, open-source, legacy and AI-generated artifacts; assurance depth is tailored to consequence.

12.1 Digital lifecycle and architectural assurance

- a) The organization shall establish a lifecycle for software and programmable hardware covering requirements, architecture, implementation, integration, verification, release, maintenance and retirement. Safety and mission allocations shall be reflected in architecture and verification independence.
- b) The architecture shall address partitioning, timing, resource exhaustion, fault containment, recovery and interfaces. An assumption that software does not wear out shall not be used to dismiss systematic defects, data corruption, configuration errors or changes in the environment.

Required evidence: Digital lifecycle plan; allocated requirements; architecture; fault-containment and timing analyses.

12.2 Implementation, review and build control

- a) Source code, programmable logic, generated code and build definitions shall be version controlled with attributable changes. Review and analysis shall be suitable for the language, platform and criticality. Coding or modeling constraints shall be justified and enforced by competent review and appropriate tools.
- b) Builds shall identify source versions, dependencies, toolchain versions, compiler settings, configuration and resulting artifact hashes. Reproducibility shall be demonstrated where necessary to establish that the released binary corresponds to reviewed sources. Secrets and unapproved dependencies shall not be embedded in released artifacts.

Required evidence: Source and review records; build manifest; dependency inventory; reproducibility and artifact identity checks.

12.3 Verification, test coverage and independence

- a) Digital verification shall address requirements, interfaces, boundary values, abnormal inputs, timing, failure handling and regression. Structural or functional coverage criteria shall be chosen based on the assurance rationale and applicable domain obligations, not on a universal percentage in this standard.
- b) Test results shall identify the target environment and configuration. Differences between simulation, host execution and deployed hardware shall be assessed. Uncovered behavior, unresolved anomalies and tool limitations shall be evaluated explicitly before release.

Required evidence: Verification plan; traceable tests; coverage analysis; anomaly disposition; target-representativeness assessment.

12.4 AI and machine-learning use-case governance

- a) Every AI use case affecting assured outcomes shall have an accountable owner, intended use, prohibited use, operational domain, performance criteria, hazard assessment and monitoring plan. The organization shall assess whether AI is necessary and whether simpler, more verifiable alternatives meet the need.
- b) Authority granted to the model shall be bounded. Human oversight shall be designed so that the responsible person has adequate information, time and ability to intervene. A nominal human approval step shall not be treated as effective control when the person cannot meaningfully review the output.

Required evidence: AI use-case inventory; intended-use statement; alternatives assessment; authority limits; oversight validation.

12.5 Dataset quality, lineage and evaluation design

- a) Datasets shall have documented provenance, rights, collection methods, labeling procedures, relevant populations, environmental coverage and known limitations. Training, tuning and evaluation partitions shall be controlled to prevent leakage or unjustified overlap.
- b) Evaluation shall include relevant rare conditions, degraded sensors, out-of-domain inputs and important subgroups. Performance shall be reported with denominators, uncertainty and failure analysis. Aggregate accuracy shall not conceal unacceptable failure in a critical operating condition. Annex N specifies a minimum model and dataset evidence card.

Required evidence: Dataset manifest; labeling assurance; partition controls; scenario coverage; stratified evaluation and uncertainty.

12.6 Model release, drift and bounded adaptation

- a) Model weights, preprocessing, inference configuration, dependencies and decision thresholds shall be controlled as a single released configuration. The organization shall demonstrate safe behavior for invalid, missing, adversarial or out-of-distribution inputs within the defined threat and hazard model.
- b) Post-release monitoring shall detect relevant drift, performance degradation and unexpected behavior. Online learning or autonomous adaptation shall not change safety-relevant behavior outside an approved envelope. Material changes shall undergo a new impact assessment, verification and authorized release.
- c) Fallback and rollback shall be technically feasible and tested. A model shall not be retained merely because replacing it would disrupt operations when its approved performance basis is no longer valid.

Required evidence: Model release card; drift thresholds and rationale; fallback tests; update approvals; monitoring records.

12.7 Generative AI and engineering evidence

- a) Generative AI used in engineering, procurement, inspection, coding or technical documentation shall have controlled inputs, access and review requirements. Generated claims, citations, calculations and design details shall be verified by competent personnel before becoming controlled evidence.
- b) The organization shall prevent unauthorized disclosure of proprietary or controlled technical data to external services. Prompt history or a generated explanation shall not substitute for a validated calculation, traceable test or approved design rationale. The human or organizational approval responsibility shall remain identifiable.

Required evidence: Approved use cases; data-access rules; review records; verified calculations and references.

12.8 Digital twins, MBSE and model-based acceptance

- a) Model-based engineering artifacts shall have defined authority, scope, interfaces, configuration and exchange rules. A digital twin shall state its decision purpose, physical association, update mechanism and validated domain. Synchronization errors and stale data shall be detectable.
- b) When a model replaces or reduces physical testing, the organization shall provide a documented equivalence argument, uncertainty assessment, validation evidence and required independent approval. Model convenience shall not be sufficient justification for removing a test.

Required evidence: Model authority map; twin identity and update controls; validation; model-based acceptance rationale.

12.9 Long-term digital maintainability and obsolescence

- a) The organization shall plan preservation of source, build environments, licenses, tools and technical knowledge needed to maintain or reconstruct long-life digital products. Dependence on a discontinued cloud service or supplier shall be assessed before release.
- b) Obsolescence plans shall address migration, emulation, replacement, security support and requalification. A digitally signed record shall remain interpretable after algorithm or certificate changes through an approved preservation strategy; cryptographic signing alone shall not guarantee permanent readability.

Required evidence: Digital support plan; escrow or access arrangements where needed; migration tests; obsolescence decisions.

13 Cybersecurity, OT resilience and trusted evidence

The controls in this clause address protection and defensive assurance of products, operations and lifecycle evidence. They do not authorize intrusive testing outside an agreed scope.

13.1 Security scope and integrated risk assessment

- a) The organization shall identify digital assets, trust boundaries, dependencies, users and interfaces affecting assured outcomes. Threat scenarios shall be evaluated together with safety and mission consequences, including loss of integrity, availability, authenticity and confidentiality.
- b) Security assumptions shall be reviewed across suppliers, remote services, maintenance access and physical access. The organization shall identify where a security measure could impair emergency operation or safety and resolve the conflict through a joint technical decision.

Required evidence: Asset and trust-boundary inventory; threat assessment; safety-security interface decisions.

13.2 Identity, access and privileged actions

- a) Access shall be based on verified identity, least necessary privilege and approved roles. Privileged access, remote maintenance and release-authority actions shall have strengthened authentication and traceable authorization appropriate to risk.
- b) Access shall be removed or changed promptly when responsibilities end or change. Shared credentials shall not obscure accountability. Emergency access shall be controlled, logged, time-bounded and reviewed after use. Service accounts and machine identities shall be governed as well as human accounts.

Required evidence: Access matrix; privileged approvals; identity lifecycle; emergency-access reviews.

13.3 Secure development and supply-chain integrity

- a) Security requirements shall be integrated into development, procurement and maintenance. The organization shall assess dependency provenance, vulnerability exposure, secure configuration, supported versions and mechanisms for receiving security information.
- b) A software bill of materials or equivalent controlled inventory shall identify relevant components and dependencies. Vulnerability disposition shall consider exploitability, exposure, safety consequences and available mitigations. Presence of a component in an inventory shall not itself demonstrate that it is secure.

Required evidence: Secure-development plan; SBOM; dependency reviews; vulnerability decisions and mitigations.

13.4 OT and connected-production safeguards

- a) Industrial networks and connected equipment shall be designed to limit unauthorized changes and propagation of failures. Appropriate segmentation, access control, backup, monitoring and safe degraded operation shall be established based on the process risk.
- b) Patches, remote connections and security tools shall be evaluated for compatibility with timing, availability and safety. Where immediate patching is inappropriate, a time-bounded compensating-control decision shall be documented. Production data and machine-program integrity shall remain verifiable.

Required evidence: OT architecture; authorized connections; patch assessments; compensating controls; restoration tests.

13.5 Secure updates, rollback and cryptographic agility

- a) Updates shall verify origin, integrity, compatibility, authorization and intended target configuration before installation. The organization shall define interruption handling, recovery, anti-rollback needs and conditions for safe rollback without reintroducing an unacceptable vulnerability.
- b) Cryptographic dependencies shall be inventoried and reviewed for supported algorithms, key management, certificate validity and migration capability. Future algorithm replacement shall be planned according to product life and threat exposure; this standard does not mandate a particular algorithm or claim universal post-quantum readiness.

Required evidence: Update architecture; signed release manifest; interruption and rollback tests; cryptographic inventory and migration plan.

13.6 Security testing and vulnerability handling

- a) Security testing shall have documented authorization, boundaries, safety precautions, data handling and restoration requirements. Methods shall be selected for the architecture and threat model. Test-induced operational or physical hazards shall be assessed before execution.
- b) The organization shall provide a channel for vulnerability reports, assess credibility and impact, track remediation and communicate relevant actions to affected parties. Security findings shall remain connected to product configuration and safety assessment; closure shall require evidence, not only a changed status field.

Required evidence: Authorized test plans; results; vulnerability register; remediation verification; customer communication.

13.7 Incident response and recovery assurance

- a) The organization shall establish incident triage, containment, evidence preservation, technical escalation, communication and recovery responsibilities. Plans shall consider compromised engineering records, manufacturing programs, product updates and supplier credentials, not only office systems.
- b) Recovery shall verify authenticity and consistency of restored data and configurations. A system shall not be returned to assured service solely because it is operational. Exercises shall demonstrate recovery time, recoverable data age and product-impact assessment under representative conditions.

Required evidence: Incident plan; exercise records; RTO/RPO basis; integrity verification; return-to-service decision.

14 Space systems, operations and long-duration missions

14.1 Space program and mission-product assurance

- a) Space programs shall define product and mission assurance across spacecraft, payload, launch interfaces, ground segments, communication links and operations. Responsibility for each interface and lifecycle decision shall be established before integration.
- b) The assurance plan shall address mission duration, repairability, access limitations, launch exposure, environmental extremes, reliability, contamination, software updates and end-of-life constraints. A commercial or rapid-development schedule shall not remove necessary evidence for an irreversible mission decision.

Required evidence: Space assurance plan; mission interface allocation; environmental and lifecycle assumptions; gate evidence.

14.2 Space environment and qualification rationale

- a) The organization shall identify relevant mechanical, thermal, vacuum, radiation, electrical, electromagnetic, charging, contamination and material-degradation environments. Requirements and test levels shall be derived from the actual mission and approved technical basis.
- b) Qualification and acceptance test strategies shall distinguish design demonstration from workmanship screening. Test-article representativeness, margins, notching or limitation decisions, cumulative exposure and over-test risk shall be assessed. No universal test profile is specified by this standard.

Required evidence: Environmental specification; qualification matrix; test-article differences; margin and exposure rationale.

14.3 Components, materials and contamination control

- a) Critical components and materials shall have evidence appropriate to mission consequence, including provenance, process control, screening, derating, radiation susceptibility or other environment-specific properties as applicable. Commercial components shall be assessed for the intended use rather than accepted or rejected by label alone.
- b) Contamination control shall address particulate, molecular and biological concerns where relevant. Materials, cleaning, storage, integration and transport shall preserve the required condition. When planetary-protection obligations apply, responsibilities and verified controls shall be recorded without substituting an AF declaration for the required authorization.

Required evidence: Parts and materials lists; environmental suitability; contamination plan; applicable protection-control evidence.

14.4 Ground segment, command and mission operations

- a) Ground systems and operational procedures shall be configuration controlled and validated for normal, degraded and emergency modes. Command authority, authentication, timing, data integrity and prevention of unintended actions shall be addressed.
- b) Operational readiness shall include training, rehearsals, anomaly response, time synchronization, communication outages and handovers. Critical commands shall have suitable review or protective controls. Telemetry limitations shall be understood before using telemetry absence as evidence that a hazardous condition is absent.

Required evidence: Ground-segment baseline; command-authority rules; rehearsals; anomaly procedures; telemetry interpretation limits.

14.5 Orbital responsibility and end-of-life planning

- a) The organization shall identify applicable responsibilities for tracking, coordination, collision-risk information, debris prevention, disposal and re-entry. Plans shall be established early enough to affect design and resource allocation.
- b) End-of-life capability shall be assessed against credible failures and remaining resources. Disposal success shall not be assumed solely from nominal mission performance. Changes in mission duration, orbit or operating strategy shall trigger reassessment. Public statements about disposal or sustainability shall identify assumptions and uncertainty.

Required evidence: Responsibility allocation; disposal concept; resource budgets; failure cases; end-of-life decision and verification records.

14.6 Human spaceflight and habitation interfaces

- a) Where people are exposed to spaceflight or habitation systems, the organization shall identify life-support, habitability, crew interface, emergency response, medical-support interface and rescue or safe-return assumptions within its responsibility. Human-centered evaluation shall address workload, fatigue, communication delay and maintainability.
- b) Independent safety review and integrated testing shall be matched to consequence. Crew or passenger acceptance of risk shall not replace required technical controls or authorizations. Degraded conditions and loss of a supporting service shall be included in validation.

Required evidence: Human-system requirements; life-support interface assurance; emergency scenarios; independent review; integrated validation.

14.7 Surface mobility, in-space servicing and manufacturing

- a) Lunar, planetary and other space-purpose vehicles shall be treated as mission systems, including mobility, energy, autonomy, communications, dust or contamination, maintainability and support interfaces. Terrestrial automotive qualification shall not be assumed valid for the space environment.
- b) In-space servicing, robotic assembly and manufacturing shall define inspection access, remote verification, material behavior, configuration control and abort or safe-state conditions. Where physical retrieval is impossible, evidence strategy shall be established before deployment and shall acknowledge unresolved observability limits.

Required evidence: Surface or servicing concept; environment-specific qualification; remote acceptance strategy; safe-state and evidence limitations.

15 Aviation, unmanned systems and advanced air mobility

15.1 Airworthiness and operational approval interfaces

- a) The organization shall identify the applicable civil or military approval basis and its own authorized scope. Design, production, maintenance and operational responsibilities shall be mapped to the relevant approval holders and interfaces.
- b) AF conformity shall not be presented as an airworthiness approval. Technical changes, repairs and service information shall follow required approval routes. The organization shall maintain traceable evidence supporting the obligations assigned to it by the approval holder, customer or competent authority.

Required evidence: Approval-interface matrix; assigned obligations; change and repair approvals; supporting evidence.

15.2 Aircraft and equipment integration

- a) The organization shall assess installation effects, interface compatibility, environmental qualification, human factors and failure propagation when integrating equipment. Compliance at component level shall not automatically establish safe installation or aircraft-level compatibility.
- b) Integration shall address power quality, electromagnetic effects, cooling, structural attachment, data behavior, timing, maintenance access and operational procedures as relevant. Modifications shall consider affected instructions, spares, training and configuration tracking.

Required evidence: Installation assessment; integration verification; affected-system analysis; updated support data.

15.3 Unmanned and remotely operated systems

- a) Unmanned-system assurance shall include the aircraft, control station, communication links, remote personnel, software, supporting services and operational environment. Loss or degradation of command, navigation, surveillance or external services shall have defined safe behavior.
- b) Operational-domain boundaries, contingency procedures and human workload shall be validated. The organization shall assess behavior outside intended conditions, unauthorized control and foreseeable operator mistakes. A geofence or remote pilot shall not be assumed effective without evidence for the relevant failure conditions.

Required evidence: System-level UAS assessment; domain definition; link-loss tests; workload and contingency validation.

15.4 Electric, hybrid and hydrogen aviation

- a) Programs using alternative energy or distributed propulsion shall identify coupled electrical, thermal, mechanical, chemical and software hazards. Energy availability, isolation, containment, degradation and ground-support interfaces shall be included in requirements.
- b) The organization shall demonstrate that qualification and maintenance assumptions address the specific architecture and duty cycle. Ground charging, fueling, transport and emergency responders shall receive the

necessary controlled information. Environmental benefit claims shall be supported independently of airworthiness evidence.

Required evidence: Integrated energy-hazard assessment; architecture qualification; degradation limits; ground-support and emergency information.

15.5 Airports, ground support and air-navigation services

- a) Organizations providing airport, ground-support, air-navigation or related digital services shall identify how their output affects aircraft and people. Service interfaces, equipment compatibility, operational handovers and failure communication shall be controlled.
- b) Changes to service procedures, infrastructure, data feeds or equipment shall be assessed for operational and safety effects. Maintenance and inspection shall preserve the service configuration and performance. Incompatible aircraft or vehicle interfaces shall be identified before use.

Required evidence: Service assurance plan; interface compatibility; change assessments; maintenance and operational verification.

15.6 Continuing airworthiness and aviation maintenance

- a) Maintenance responsibilities shall include current approved data, authorized personnel, parts eligibility, life limits, configuration, required inspections and release documentation. Independent inspections shall be provided where required by the task or consequence.
- b) New maintenance capability shall be verified before accepting work. Work interruptions, shift changes, remote locations and tool control shall be addressed. An AF management-system claim shall not replace the maintenance authorization required for the specific task or jurisdiction.

Required evidence: Capability list; approved maintenance data; personnel authorization; life-status records; maintenance release evidence.

16 Defense systems and mission-specific land and maritime mobility

16.1 Defense program assurance and contractual obligations

- a) The organization shall define the defense program's quality, safety, security, configuration, verification and support obligations across all assigned domains. Contractual acceptance, mission performance and lawful authorization shall be treated as distinct requirements.
- b) The assurance plan shall identify government or customer quality-assurance access, classified or controlled evidence, delegated authority and required approvals where applicable. Restricted access shall be resolved through authorized procedures while preserving the credibility of evidence.

Required evidence: Defense assurance plan; contractual obligation matrix; access arrangements; approval responsibilities.

16.2 Multi-domain platforms and interfaces

- a) Air, land, maritime, space and cyber-connected systems shall be assessed for interface compatibility, environmental exposure, common dependencies and safe degraded behavior. Integration shall address the complete system rather than only separately accepted equipment.
- b) The organization shall define safe states for training, transport, maintenance, storage and non-operational use. Test activities involving hazardous functions shall be separately authorized and controlled. This standard does not specify weapon effects, targeting methods or tactical employment.

Required evidence: Cross-domain interface baseline; integration tests; safe-state definition; authorized test controls.

16.3 Defense-purpose road and off-road vehicles

- a) Defense-purpose automotive systems shall include chassis, propulsion, braking, steering, energy storage, communications, payload interfaces and support equipment within the assigned scope. Duty cycles, loads, terrain, climate, transport and recovery conditions shall be specified.
- b) Mission equipment integration shall assess effects on stability, structural integrity, electrical capacity, thermal behavior, occupant safety, visibility and maintainability. A commercial chassis approval shall not establish suitability of the modified mission configuration. Civil-road requirements and mission-specific requirements shall both be addressed when applicable.

Required evidence: Vehicle duty profile; integration impact assessment; configuration-specific qualification; maintenance and transport limits.

16.4 Maritime platforms and underwater systems

- a) Maritime assurance shall identify relevant structural, corrosion, pressure, electrical, propulsion, environmental and human-system requirements. Surface, submerged, unmanned and support-system interfaces shall be addressed according to the actual operating domain.

- b) Welding, coatings, pressure boundaries, watertight integrity and critical machinery shall have appropriate process qualification and inspection evidence. Applicable marine, customer and authority approvals shall be identified independently of AF conformity. Inspection access and through-life deterioration shall be considered during design.

Required evidence: Maritime requirement basis; critical-boundary records; process and inspection evidence; deterioration-management plan.

16.5 Autonomy, remote systems and human authority

- a) Autonomous or remotely operated defense platforms shall have a bounded operational domain, defined human authority, safe response to lost communications and controls against unauthorized commands. The organization shall validate the ability to intervene within the required response time and information limits.
- b) Changes to autonomy logic, mission data or sensor interpretation shall undergo configuration and safety review. Performance in simulation shall not be assumed to cover the complete operational environment. Assurance of lawful and authorized use shall remain an explicit program responsibility.

Required evidence: Authority model; domain constraints; intervention validation; simulation limits; change and release records.

16.6 Controlled technology, ethics and supply integrity

- a) The organization shall establish a process to identify applicable export, transfer, end-use, security and information-handling obligations. Access, collaboration, publication and technical-support arrangements shall be reviewed by competent authorized personnel.
- b) Due diligence shall address source authenticity, unauthorized substitutions, bribery, conflicts of interest and misuse concerns relevant to the activity. Neither an AF document nor membership shall be treated as permission to transfer controlled information or conduct restricted work.

Required evidence: Controlled-technology review; authorized access; due diligence; ethical escalation and disposition.

16.7 Long-life support and obsolescence

- a) Defense systems shall have a support plan addressing long service life, configuration diversity, spares, repair data, training, software support and diminishing sources. Replacement parts and substitutions shall undergo engineering assessment and appropriate requalification.
- b) The organization shall preserve the technical ability to identify and support the actual field configuration. Cannibalization, refurbishment and remanufacture shall retain source, life status and inspection evidence. Unknown life or origin shall be treated as a controlled uncertainty, not reset to zero.

Required evidence: Support and obsolescence plan; substitution approvals; field configuration; life and refurbishment records.

17 Heavy industry, critical plant and industrial infrastructure

17.1 Industrial system boundary and lifecycle integrity

- a) The organization shall define the industrial asset or service boundary, design basis, operating limits, interfaces and lifecycle responsibilities. Heavy machinery, process equipment, energy infrastructure, lifting systems and supporting civil works shall be included when they affect the assured output.
- b) Applicable engineering codes, statutory inspections and operating authorizations shall be identified in the program register. This standard provides assurance requirements, not a replacement design code for structures, pressure systems, nuclear installations or lifting equipment.

Required evidence: Asset design basis; boundary drawings; applicable-code register; lifecycle responsibility allocation.

17.2 Mechanical integrity and essential services

- a) Critical equipment shall have design, material, fabrication, inspection, maintenance and degradation-management evidence appropriate to the duty. Pressure, temperature, load, corrosion, fatigue, vibration and protective-function limits shall be identified as relevant.
- b) Essential utilities and protective systems shall be evaluated for dependency and common-cause failure. Bypasses, overrides and temporary repairs shall have authorization, duration, compensating controls and restoration verification. An operational plant shall not be presumed conforming because it has not yet failed.

Required evidence: Integrity-management plan; equipment dossiers; degradation assessments; override and temporary-repair controls.

17.3 Fabrication, installation and construction interfaces

- a) The organization shall control materials, fabrication procedures, welds or joints, inspection stages, dimensional interfaces and installation sequence. Construction or installation changes shall be assessed against the approved design basis before concealment or energization.

- b) Foundation, alignment, anchorage, lifting, access and utility interfaces shall be verified where relevant. Hidden work shall have inspection evidence before it becomes inaccessible. The final as-built record shall reflect actual installed conditions, not only the original drawings.

Required evidence: Fabrication and installation records; hidden-work inspections; alignment and interface checks; as-built configuration.

17.4 Commissioning and operational readiness

- a) Commissioning shall follow an approved plan separating completion checks, functional verification, integrated testing and operational acceptance. The plan shall define safe test conditions, competent personnel, isolation, emergency arrangements and acceptance criteria.
- b) Before handover, protective functions, alarms, interlocks, training, maintenance, spare parts and operating instructions shall be verified. Open items shall be classified according to whether they prevent safe or conforming operation. Production pressure shall not reclassify a blocking item as cosmetic.

Required evidence: Commissioning plan; test records; protective-function verification; open-item disposition; handover acceptance.

17.5 Asset inspection and condition-based maintenance

- a) Inspection and maintenance intervals shall be based on applicable obligations, consequence, degradation mechanisms, duty and evidence. Condition-monitoring models shall be validated for their decision purpose and shall not remove mandatory inspections without authorized justification.
- b) Inspection findings shall be trended and connected to remaining-life or repair decisions made by competent technical authorities. Changes in duty or environment shall trigger reassessment. Absence of an alarm shall not establish integrity when the monitoring system cannot detect the relevant failure mode.

Required evidence: Inspection strategy; condition data; detection capability; remaining-life or repair decisions; interval review.

17.6 Industrial modernization and decommissioning

- a) Retrofits and modernization shall assess compatibility between legacy and new systems, undocumented conditions, cybersecurity, protection functions and operational procedures. Existing equipment shall not be assumed equivalent to current design records without verification.
- b) Decommissioning shall plan isolation, hazardous inventories, structural stability, data retention, waste handling and prevention of unauthorized reuse. Transfer or sale of used equipment shall accurately state condition, known limitations and missing evidence.

Required evidence: Modernization assessment; verified legacy baseline; decommissioning plan; disposition and transfer records.

18 Materials, advanced manufacturing and special technologies

18.1 Material and process specification control

- a) Materials shall be specified by properties, condition, composition, processing history and acceptance requirements appropriate to intended use. Equivalent material claims shall be reviewed by the design authority and supported by relevant evidence.
- b) The organization shall control batch identity, storage, shelf life, contamination, substitutions and supplier changes. Recycled or reclaimed content shall meet the same applicable performance and traceability obligations; environmental benefit shall not substitute for material qualification.

Required evidence: Material specifications; batch certificates and verification; substitution approvals; storage and life records.

18.2 Metals, castings, forgings and heat treatment

- a) Processes shall control relevant material state, geometry, essential variables, equipment condition, thermal history and inspection. Defects that may not be visible in final inspection shall be addressed through validated process controls and suitable NDT or destructive verification.
- b) Repair, weld blending, additional heat treatment or other disposition shall be authorized and traceable. Mechanical-property test specimens shall be representative of the relevant material and processing. Certificate values without verified relationship to the supplied batch shall not establish acceptance.

Required evidence: Process qualification; batch and thermal records; representative test evidence; repair approvals.

18.3 Composites, polymers, adhesives and bonded structures

- a) The organization shall control constituent identity, storage, out-time, mixing, surface preparation, lay-up, cure, environmental conditions and handling as relevant. Bond quality shall not be inferred solely from external appearance.

- b) Qualification shall address relevant geometries, defects, aging, moisture, thermal exposure and inspectability. Essential process changes shall trigger requalification review. Traceability shall connect constituent lots, cure or process history, inspection and the final assembly.

Required evidence: Composite or bond qualification; constituent genealogy; process history; inspection capability; change review.

18.4 Additive and digitally driven manufacturing

- a) Additive manufacturing shall control feedstock, reuse history, machine state, build orientation, parameters, digital file identity, in-process monitoring and post-processing. Qualification shall address location within the build, material anisotropy, defects and the intended geometry or qualified family.
- b) A qualified machine or material alone shall not qualify every component. Changes to algorithms, slicing, software, feedstock source or post-processing shall be assessed for effects on the qualified process. In-process sensor data shall supplement rather than automatically replace validated acceptance methods.

Required evidence: Build qualification; feedstock history; signed build package; monitoring validation; post-process and acceptance records.

18.5 Electronics, semiconductors and interconnections

- a) Electronic-part assurance shall address source authenticity, component suitability, assembly processes, handling, ESD, moisture sensitivity, contamination and relevant environmental stresses. Programmable devices shall have controlled design and loaded configuration.
- b) Assembly and inspection shall control soldering, bonding, coatings, connectors and other critical interconnections. Screening and burn-in, where used, shall have a justified purpose and shall not be represented as removing all latent defects. Obsolete or substituted components shall receive impact review.

Required evidence: Component assurance plan; approved parts list; assembly qualification; configuration and screening evidence.

18.6 NDT, inspection capability and probability of detection

- a) NDT methods shall be qualified for the relevant material, geometry, defect type, size range and access condition. Personnel, equipment, reference artifacts, procedures and environmental conditions shall be controlled.
- b) Where detection capability is used quantitatively in an integrity argument, the organization shall establish a statistically and physically justified evaluation with uncertainty and representative defects. A nominal detectable flaw size or a single successful demonstration shall not establish a probability-of-detection claim.

Required evidence: NDT procedure qualification; personnel authorization; reference-artifact control; detection capability and limitations.

18.7 Surface engineering, cleanliness and contamination-sensitive products

- a) Coatings, plating, surface treatments, lubrication and cleaning shall be controlled for material compatibility, essential variables, residue, thickness or other relevant characteristics. The organization shall assess effects on fatigue, corrosion, bonding, electrical contact and contamination.
- b) Changes in chemicals, suppliers, bath condition, preparation or cure shall be reviewed. Cleanliness acceptance shall use a defined method and sampling location. A generic statement that an item is "clean" shall not establish conformity to a contamination-sensitive requirement.

Required evidence: Surface-process qualification; bath or chemical controls; test results; cleanliness criteria and records.

19 Propulsion, energy storage and hazardous-energy assurance

19.1 Energy-system boundary and coupled hazards

- a) The organization shall assess energy generation, storage, conversion, distribution and isolation as an integrated system. Mechanical, thermal, electrical, chemical and control-system interactions shall be considered under normal and credible abnormal conditions.
- b) Energy budgets, protection, degradation and support interfaces shall be traceable to requirements. The assurance plan shall address transport, storage, charging or fueling, operation, maintenance and emergency response. Detailed hazardous procedures shall be approved by appropriately authorized specialists.

Required evidence: Energy-system architecture; integrated hazard analysis; lifecycle controls; specialist approvals.

19.2 Electrical storage and battery systems

- a) Battery assurance shall control cell and module provenance, configuration, manufacturing consistency, state estimation, electrical protection, thermal management and mechanical integration. The program shall define relevant operating and storage limits and the evidence supporting them.

- b) Qualification shall address credible failure propagation, abnormal charging, damage, aging and environmental exposure within the applicable technical basis. Service decisions shall consider actual history and condition. Reuse or second-life application shall require a new suitability assessment; history shall not be erased.

Required evidence: Battery configuration; qualification basis; life and condition data; protection verification; reuse assessment.

19.3 Hydrogen, fuels and chemical-energy systems

- a) The organization shall define material compatibility, containment, leak detection, isolation, ventilation, ignition control and emergency interfaces appropriate to the system. Supply quality and contamination shall be controlled where they affect safety or performance.
- b) Test, maintenance and fueling procedures shall specify authorized personnel, boundaries and acceptance criteria under the applicable engineering basis. Alternative fuel claims shall identify compatibility and limitations; sustainability evidence shall not be interpreted as proof of technical interchangeability.

Required evidence: Compatibility assessment; containment and protection evidence; supply controls; authorized procedures.

19.4 Propulsion and rotating-machinery assurance

- a) Propulsion and rotating equipment shall have controlled requirements for operating envelope, life, materials, balance, lubrication, thermal behavior, control and protective functions as relevant. Critical parts and process histories shall be traceable.
- b) Qualification and acceptance shall address the intended duty and credible degradation. Changes affecting speed, load, control logic, materials or interfaces shall be assessed against the approved basis. This clause establishes assurance responsibilities and does not prescribe propulsion design parameters.

Required evidence: Operating-envelope basis; critical-part genealogy; qualification and acceptance; life-management records.

19.5 Hazardous tests and emergency preparedness

- a) Tests involving hazardous energy shall have a documented safety review, approved boundaries, instrumentation, protective arrangements, personnel authorization and emergency response. Test acceptance criteria and safety-abort criteria shall be distinguished.
- b) After a test anomaly or protective-system intervention, restart shall require an authorized assessment. The organization shall preserve data and inspect affected equipment or articles before reuse. Lessons shall be incorporated into subsequent test readiness.

Required evidence: Test safety review; readiness approval; abort rules; anomaly evidence; restart and reuse decisions.

20 Sustainability, human factors and responsible lifecycle stewardship

20.1 Lifecycle environmental responsibilities

- a) The organization shall identify environmental aspects and obligations relevant to its products, services and operations, including resource use, emissions, noise, hazardous substances, waste and end-of-life effects. The assessment shall consider the declared lifecycle boundary and significant upstream or downstream dependencies.
- b) Environmental actions shall be integrated with safety, quality and mission requirements. A change intended to reduce environmental impact shall undergo technical assurance. The organization shall not trade an unassessed safety risk for a favorable environmental metric.

Required evidence: Lifecycle aspect register; obligations; action plans; integrated change assessments.

20.2 Quantification and credible environmental claims

- a) Quantified claims shall state functional unit, boundary, time period, activity data, factors, allocation, uncertainty and exclusions. Different scenarios shall be compared on a consistent basis. Avoided emissions, offsets and direct inventory reductions shall be reported separately.
- b) Data quality and supplier information shall be assessed. Estimates shall be distinguished from measurements and independently verified claims from self-declarations. Annex U provides a synthetic calculation example; its factors are not prescribed real-world emission factors.

Required evidence: Inventory model; data sources; factors and editions; uncertainty; claim review and verification status.

20.3 Circularity, repair and responsible material recovery

- a) Design and support planning shall consider repairability, reusable resources, remanufacture and recovery where compatible with technical and legal obligations. Reused material or components shall retain sufficient identity, life status and suitability evidence.

- b) Life-limited or safety-critical items shall not be returned to service solely because they pass a superficial inspection. End-of-life disposition shall prevent counterfeit re-entry and protect sensitive information. Claims of recyclability shall identify actual material streams and relevant limitations.

Required evidence: Repair and recovery strategy; life-status controls; qualification of reused inputs; secure disposition records.

20.4 Human-system integration and ergonomics

- a) The organization shall incorporate human capabilities, limitations and reasonably foreseeable behavior into design and validation. Interfaces shall consider workload, physical access, visibility, language, training, alarms, accessibility and error recovery.
- b) Validation shall use representative users and relevant operating conditions where practicable. The organization shall identify limitations of simulation or non-representative participants. A warning label shall not be the sole mitigation when a feasible design control is necessary to address a serious hazard.

Required evidence: Human-system requirements; representative evaluations; workload and error analyses; design decisions.

20.5 Worker competence, health and safe work interfaces

- a) The organization shall identify work-related hazards that can affect people or conformity, including fatigue, exposure, access, lifting, hazardous energy and emergency conditions. Applicable workplace obligations shall be identified and addressed through competent arrangements.
- b) Contractors and temporary personnel shall be included in relevant communication and controls. Quality investigations shall consider whether work design or unsafe conditions contributed to the event. This standard does not replace a complete occupational health and safety management framework where one is required.

Required evidence: Work-risk interfaces; competence and contractor controls; incident learning; emergency arrangements.

20.6 Responsible innovation and future-technology review

- a) Before deployment of materially novel technology, the organization shall examine intended benefit, foreseeable harm, distribution of consequences, security, misuse, human authority and evidence gaps. The review shall include relevant technical and non-technical expertise without replacing required legal decisions.
- b) Claims about future capability shall distinguish demonstration, planned development and validated operational performance. Experimental deployments shall be bounded, monitored and reversible where possible. An experimental designation shall not remove obligations to protect affected people and systems.

Required evidence: Responsible-innovation review; evidence gap assessment; bounded-deployment plan; claim approval.

21 Maintenance, distribution, logistics and end-of-life services

21.1 Service scope and new-capability approval

- a) Service organizations shall define the activities, products, sites and authorizations within their capability. New capability shall be verified against competence, tools, technical data, parts access, inspection, environmental conditions and release authority before work is accepted.
- b) Service scope shall distinguish maintenance, repair, overhaul, modification, inspection, distribution and engineering advice. A distributor performing value-adding work shall apply the relevant production or design controls to that work rather than relying solely on distribution status.

Required evidence: Service capability list; new-capability review; applicable authorizations; activity-based scope.

21.2 Maintenance planning and execution

- a) Maintenance work shall use current approved data, verified configuration, service history and applicable life limits. Work packages shall identify required tasks, hold points, parts, tools, independent checks and release conditions.
- b) Interrupted work, shift handovers, inaccessible features and off-site conditions shall be controlled. The organization shall verify completion and configuration after maintenance, including restoration of protective features and removal of temporary devices. Parts removed and installed shall remain traceable.

Required evidence: Maintenance package; current-data verification; handovers; parts traceability; post-maintenance verification.

21.3 Repair, overhaul and remanufacture

- a) Repair and overhaul shall have an approved technical basis and defined acceptance criteria. The organization shall assess hidden damage, prior repairs, service exposure, material degradation and remaining life as relevant.

- b) Remanufactured or overhauled status shall not imply “as new” unless that claim is technically justified and authorized. Replaced or restored characteristics, retained life consumption and operating restrictions shall be disclosed in the release evidence. Design deviations shall follow the appropriate approval route.

Required evidence: Repair basis; condition assessment; process records; remaining-life decisions; release limitations.

21.4 Distribution, stock splitting and chain of custody

- a) Distributors shall verify source identity, item status, accompanying evidence, storage conditions and customer requirements. Repackaging or splitting shall preserve original lot links, quantity reconciliation and the relationship to certificates and inspection records.
- b) Suspect, expired, damaged, recalled or unapproved items shall be physically or electronically segregated with effective prevention of shipment. A copied certificate shall not be altered to imply a different origin, test scope or approval. Customers shall receive the evidence required for the actual supplied quantity and configuration.

Required evidence: Source verification; split-lot records; stock status; certificate linkage; customer delivery evidence.

21.5 Logistics, storage and remote support

- a) Logistics providers shall establish preservation and security controls appropriate to the product, route, mode and duration. Transfer points shall have defined custody, inspection and environmental responsibilities. Transport restrictions and hazardous-goods obligations shall be identified by competent personnel.
- b) Remote support shall verify asset identity, configuration, authorization and the reliability of available information before directing an action. Advice affecting safety or configuration shall be controlled and recorded. Loss of communication shall have a defined safe response.

Required evidence: Logistics plan; custody records; excursion assessments; remote-support authorization and advice records.

21.6 Retirement, disposal and record handover

- a) The organization shall plan retirement so that hazardous inventories, sensitive information, reusable items, waste and required records are appropriately controlled. Responsibilities shall be assigned before organizational closure or supplier exit creates an evidence gap.
- b) Items unsuitable for further use shall be rendered unusable or otherwise positively controlled against re-entry. Records necessary for remaining users or legal obligations shall be transferred or retained under an approved arrangement. Disposal shall be verifiable, not only declared.

Required evidence: Retirement plan; material and data disposition; record-transfer arrangements; disposal verification.

22 Conformity evidence, independent decisions and authorized claims

This clause governs every claim made under the standard. It connects the organizational and technical requirements to the distinct assessment routes in Annex AA. A conformity claim remains bounded by the evaluated object, criteria, configuration, sites and period.

22.1 Conformity evidence dossier

- a) The applicant shall maintain an indexed dossier linking the defined object, approved scope, applicability decisions, application profile, technical modules, implementation evidence, internal evaluations and corrective actions. Evidence shall permit a competent reviewer to follow a requirement to the relevant activity, result and decision.
- b) The dossier shall identify missing, inaccessible, obsolete or unrepresentative evidence. Procedures and questionnaires alone shall not establish implementation. Confidentiality shall be protected through authorized access; a secrecy claim shall not convert unsupported assertions into verified evidence.

Required evidence: Object-specific dossier; applicable requirement set; evidence index; configuration and population coverage; limitations.

22.2 Evaluation, review and decision separation

- a) The scheme operator shall appoint evaluators competent for the object, sector, criticality and methods involved. Technical expertise shall be added where an auditor's competence does not cover the evaluated activity. Assignment, competence and conflicts shall be checked before work begins.
- b) For third-party attestation, the decision maker shall not have performed that evaluation or supplied the relevant consultancy. A competent independent person may combine evidence review and the decision, but shall not certify their own evaluation. Internal release and internal audit independence shall follow their applicable role and criticality rules, not an inappropriate assumption that every employee is independent.

Required evidence: Assignment matrix; competence and conflict checks; evaluation record; independent review and decision identities.

22.3 Criteria, sampling and findings

- a) The evaluation plan shall identify criteria, locations, periods, methods and sampling limitations. Audits shall examine process implementation and actual outputs; product, service, process and personnel evaluations shall additionally apply the relevant object criteria.
- b) Each nonconformity shall identify a requirement, objective evidence and the gap. Classification and decision consequences shall follow Annex AD. Audit-time planning shall follow Annex AC; personnel examinations shall follow Annex AE. A sampled review shall not be claimed to verify every item or person.

Required evidence: Evaluation plan; sample rationale; objective evidence; requirement-linked findings; assessed limitations.

22.4 Decision conditions and release blockers

- a) Initial grant, renewal and scope extension shall require closure of all nonconformities in the proposed scope and satisfactory independent review. Missing critical evidence, unresolved major breakdowns, falsified evidence and unfulfilled mandatory criteria shall prevent a positive decision. A percentage score shall not offset such a blocker.
- b) For an existing attestation, a localized minor finding may be handled through a bounded continuation decision only under Annexes AD and AG. That decision is not a new certificate with open findings. Technical product holds, personnel restrictions and legal reporting shall be applied independently of certificate administration.

Required evidence: Requirement-by-requirement conclusion; finding closure; blocker check; reasoned and dated decision.

22.5 Statements, certificates and mark use

- a) A conformity statement shall identify AF 9100:2026, First Edition, the route, evaluated object, applicable profile, scope, sites or configurations, issuer, decision date, status and limitations. Self-declaration, customer assessment and independent third-party attestation shall be clearly distinguished.
- b) AF marks shall require written permission for the exact use. An organizational mark shall not be placed so that it implies unevaluated product approval. No claim of official recognition, legal equivalence, accreditation or global acceptance shall be made without an actual supporting authorization or arrangement.

Required evidence: Approved claim text; certificate data; mark permission; actual recognition scope where claimed.

22.6 Continuing validity and changes

- a) The attestation holder shall report changes that can affect conformity, including new sites, ownership or legal identity, product configuration, service architecture, essential process variables, competence, critical subcontractors and serious incidents. Changes shall be evaluated before the affected extended claim is used.
- b) Surveillance, renewal, suspension, restoration, expiry and withdrawal shall follow Annex AG. Status records shall preserve dates and scope history. Reissue of a document, payment of a fee or filing an appeal shall not extend an expired or suspended authorization.

Required evidence: Change notifications; surveillance findings; renewal evidence; current and historical status records.

22.7 Complaints, appeals and corrective communication

- a) A transparent complaint and appeal process shall be available under Annex AI. Persons deciding an appeal shall be independent of the contested decision and its evaluation. Good-faith complaints shall not result in retaliation or reduced access to fair assessment.
- b) A substantiated concern shall trigger correction of affected outputs, evidence or public claims. Confidential information shall remain protected, while necessary safety communication shall not be suppressed to avoid reputational harm.

Required evidence: Case records; independent reviewer appointment; reasoned outcomes; affected-population action and communication.

22.8 Scheme operation and competence attestations

- a) Bodies operating AF assessment routes shall fulfill Clause 28 and Annex AH, in addition to the route-specific rules. A laboratory, inspection body or certification body seeking a CAB competence attestation shall undergo evaluation of its actual technical activities, not merely an organizational audit.
- b) Accreditation and AF authorization shall not be self-awarded by a body using this publication. They require the separately identified authorized decision described in Annex AH. Organizations without that authorization may use the standard internally or contractually but shall describe the basis accurately.

Required evidence: Operator authority; body competence evaluation; written scope; independent decision; accurate accreditation and authorization claims.

23 Product and integrated-system assurance

This clause applies to physical and digital products, materials, components, assemblies, equipment and integrated systems for which the organization has design, production, integration, acceptance or through-life responsibility. A product conformity claim requires its own defined technical basis.

23.1 Product identity, families and intended application

- a) The organization shall define the product identity, configuration, intended application, operational domain and boundaries of its responsibility. Hardware, software, model weights, supplied data and operating instructions shall be included when they affect the claim. A family shall have a documented grouping rationale and identifiable differences between variants.
- b) A result from a representative variant may support another variant only where a technical review establishes that the evaluated conditions cover the relevant differences and failure mechanisms. The worst case shall be justified for each characteristic; one variant need not be worst case for every test.

Required evidence: Product definition; configuration baseline; family matrix; variant-difference and representativeness analyses.

23.2 Product application profile and acceptance plan

- a) The profile shall translate intended functions and obligations into verifiable characteristics, numerical limits or controlled attribute criteria. It shall identify essential safety functions, interfaces, environmental and service-life assumptions, test conditions, sampling and decision rules. Criteria shall be approved before the evaluators examine acceptance results.
- b) The product plan shall distinguish design qualification, production-route qualification, routine acceptance, installation verification and field monitoring. Passing one of these activities shall not be used as evidence that the others were completed. Data or assumptions supplied by the customer shall be checked for applicability and unresolved deficiencies escalated.

Required evidence: Approved product profile; characteristic-to-method matrix; qualification and acceptance distinction; unresolved-input decisions.

23.3 Design qualification and integration evidence

- a) Qualification shall demonstrate the relevant design requirements for an identified configuration and defined conditions. Test articles, analysis models, equipment, procedures, uncertainty and differences from production shall be recorded. Failed, interrupted and repeated trials shall remain visible with their technical disposition.
- b) Integration evidence shall address interactions, common resources and emergent behavior that cannot be established through independent component tests. Where safety depends on a supporting service, operator action or maintenance interval, the dependency shall be validated and controlled as part of the product basis.

Required evidence: Qualification dossier; test-article differences; system-interface verification; validated support assumptions.

23.4 Production, unit and lot acceptance

- a) Each released unit or lot shall be linked to the applicable configuration, material and component origin, approved process route, required inspections and authorized disposition. Critical-characteristic evidence shall not be replaced by a generic certificate of conformity. Any permitted sampling shall meet the application profile and Annex AD.
- b) A known nonconforming sampled unit shall be controlled even when a statistical lot rule permits lot acceptance. Repair, rework and concessions shall preserve identity, life consumption and the distinction between original conformity and an authorized departure. Product acceptance shall follow Clause 8.6 independently of an organization's certificate status.

Required evidence: Unit or lot dossier; critical characteristics; sampling decision; controlled departures; final release record.

23.5 Changes, family extensions and digital updates

- a) The organization shall assess changes to materials, components, dimensions, firmware, algorithms, model parameters, energy architecture, production site and intended use for their cumulative effect. Approval shall identify which prior evidence remains valid and which evaluation must be repeated.
- b) A product-family extension or digital update affecting the attested scope shall be evaluated before the extended claim is used. Fielded instances shall be traceable to the actual installed configuration. A new software version shall not inherit approval solely because its commercial product name is unchanged.

Required evidence: Change-impact record; evidence reuse rationale; repeated qualification; instance effectivity; updated scope.

23.6 Product statements, labeling and user information

- a) Statements shall identify exactly which characteristics or requirement set were evaluated and which configurations, sites or lots are covered. Restrictions, safety information, life limits and installation dependencies shall accompany the product where needed for correct use. A label shall not imply whole-system approval from a component evaluation.
- b) The organization shall control label content, serial linkage and mark authorization, including labels printed by subcontractors. Misleading, obsolete or counterfeit labels shall trigger containment and correction. Claims of space suitability, mission readiness or equivalent performance shall require application-specific evidence, not an unqualified grade label.

Required evidence: Approved claim and label master; mark authorization; traceable labeling records; user-information delivery.

23.7 In-service evidence, corrective campaigns and retirement

- a) Field information shall be analyzed with configuration, exposure and failure-definition context. The organization shall identify whether a new issue invalidates product qualification, acceptance methods, life limits or other products using a shared element. Required notifications and protective actions shall not await a scheduled surveillance audit.
- b) A corrective campaign shall define the affected population, interim restrictions, approved correction, verification, completion tracking and residual users. Retirement and reuse decisions shall preserve life and condition history. A repaired or transferred product shall not receive an unsupported new-life status.

Required evidence: Field data and exposure; affected-population analysis; campaign records; verified completion; retirement and reuse decisions.

24 Service assurance and service continuity

This clause applies to operational, engineering, maintenance, logistics, digital, research, training and other services that can affect an assured outcome. Service conformity is evaluated against the specified service and period, not inferred solely from a provider's management system.

24.1 Service catalog, boundary and responsibility

- a) The provider shall define each service, intended users, delivery channels, locations, interfaces, exclusions and customer responsibilities. The boundary shall include third-party platforms, personnel, data feeds and facilities where service performance depends on them. Required handovers and acknowledgement points shall be explicit.
- b) The service profile shall distinguish what is supplied from what is assumed or merely advised. An engineering opinion, test report, training attendance record or remote instruction shall not imply a broader approval than the provider is competent and authorized to give.

Required evidence: Service catalog; service profile; dependency and responsibility map; controlled exclusions.

24.2 Service design and measurable outcomes

- a) Service requirements shall include relevant quality, timeliness, accuracy, availability, capacity, safety, confidentiality, accessibility and continuity criteria. Each measure shall define its population, time window, denominator, allowed exclusions, data source and method of evaluation. Obligations shall be confirmed before commitment.
- b) Service design shall assess normal demand, peak demand, degraded operation, handover failures and termination. A trial shall demonstrate that people, technology, procedures and interfaces can achieve the intended outcome. Validation shall include the customer interface and not only successful internal processing.

Required evidence: Requirements and metrics; capacity assumptions; validated service design; customer-interface results.

24.3 Delivery planning and competent execution

- a) Each service engagement or recurring delivery period shall have a controlled plan identifying tasks, personnel authorization, applicable data, resources, customer inputs, hold points and required records. The provider shall verify readiness before starting work and manage changes to scope or conditions.
- b) Work instructions and handovers shall address interrupted tasks, shift changes, remote execution and escalation. The provider shall confirm that essential customer inputs are usable and current. Missing inputs shall be resolved or the dependent service restricted rather than replaced by undocumented assumptions.

Required evidence: Service work package; competence and readiness checks; current inputs; handovers and escalation records.

24.4 Service acceptance and performance decisions

- a) Acceptance shall compare actual service outcomes with the approved criteria. Customer receipt or payment shall not alone establish technical conformity. Where outputs include measurements, calculations or inspection conclusions, the underlying methods and decision rules shall meet Clauses 7.7 and 7.12 and Annex AD.
- b) An availability percentage shall not conceal incorrect results, failed safety functions or unacceptable response times. A recurring service may be evaluated over a defined window, but critical events shall be reviewed individually. Excluded downtime or transactions shall be disclosed under the pre-agreed metric definition.

Required evidence: Actual outcome records; acceptance decision; metric calculations and exclusions; critical-event review.

24.5 Digital services, data and external platforms

- a) Digital and cloud-dependent services shall identify data ownership, authorized processing, configuration, access, backup, recovery, update and exit responsibilities. The provider shall assess external platform changes and supplier dependence for their effect on assured outcomes.
- b) Automated decisions and AI-assisted advice shall remain within an approved domain with suitable human accountability. A restored application shall not be returned to assured service until the integrity of relevant data, configuration and transaction history is demonstrated. Annex O applies to recovery evidence.

Required evidence: Digital service architecture; data and access agreements; supplier controls; recovery and integrity verification.

24.6 Continuity, disruption and customer protection

- a) The provider shall define disruption triggers, prioritization, communication, safe degraded operation, restoration objectives and acceptance after recovery. Exercises shall test actual dependencies and personnel availability. Alternative delivery arrangements shall be qualified before being relied upon for critical work.
- b) When an incident may have affected earlier service outputs, the provider shall trace and assess those outputs, notify affected recipients as required and correct consequential errors. Meeting restoration-time objectives shall not close an unresolved accuracy, safety or evidence-integrity issue.

Required evidence: Continuity plan; exercised recovery; qualified alternatives; affected-output analysis; customer notifications.

24.7 Service change, completion and exit

- a) Changes shall be reviewed for their effects on customers, interfaces, training, data, performance and existing commitments. Transition criteria and rollback or alternative-service arrangements shall be established where relevant. No extended conformity claim shall be used before the changed scope has been evaluated.
- b) Completion or termination shall include agreed records, return of property, transfer of knowledge, retention responsibilities and revocation of access. Unresolved limitations shall be disclosed. Transfer to another provider shall preserve necessary traceability and shall not erase outstanding obligations.

Required evidence: Change and transition approvals; revised scope; service completion dossier; property/data handover and access closure.

25 Process qualification, capability and controlled use

This clause applies to processes whose reproducible performance supports conformity, including manufacturing, special processing, inspection, software deployment, service execution and outsourced processes. Process qualification is specific to demonstrated conditions.

25.1 Process identity, scope and essential variables

- a) The process owner shall define the purpose, inputs, outputs, sequence, equipment, software, materials, personnel, environment and interfaces. Essential variables that can affect conformity shall be identified with approved limits and monitoring methods. Boundaries shall include preparation and downstream steps where they influence hidden characteristics.
- b) Process families may be grouped only through a justified relationship between operating conditions, failure mechanisms and relevant output properties. A machine, operator or material qualification alone shall not qualify every process or product made using it.

Required evidence: Process definition; essential-variable register; qualified family rationale; interface controls.

25.2 Qualification strategy and demonstration

- a) Before unrestricted use, qualification shall demonstrate that the actual process can achieve specified output criteria under the proposed operating conditions. The plan shall justify samples, extremes, repetitions, measurement capability, uncertainty and the treatment of failed or excluded runs.

- b) Special processes shall meet Annex L. Service or digital processes shall use representative end-to-end trials appropriate to their failure modes. Simulation may supplement demonstration where its credibility is established, but convenience alone shall not justify removal of necessary physical or operational evidence.

Required evidence: Qualification plan; representative results; method suitability; failed-run disposition; approved process window.

25.3 Capability, stability and statistical interpretation

- a) The organization shall distinguish process stability, process capability and conformity of an individual output. A capability index shall be used only with sufficient suitable data, a defined estimator, justified grouping, measurement suitability and a distribution or model appropriate to the interpretation.
- b) Control-chart limits shall describe process behavior and shall not replace product specifications. Unstable or dependent data shall not be treated as independent normal observations merely to obtain a favorable index. Low-volume work shall use suitable engineering and verification evidence where statistical capability cannot be established.

Required evidence: Study design; data and model assumptions; stability review; capability calculation; justified alternative evidence.

25.4 Operating approval and release for use

- a) Process approval shall identify the qualified scope, equipment and site, authorized personnel, approved instructions, parameter limits, inspection requirements, monitoring and requalification triggers. Qualification conditions shall be available at the point of use.
- b) The authority releasing a process for use shall verify closure of blocking deficiencies and adequacy of continuing controls. A process-qualification attestation does not certify every output; product or service release still requires the corresponding acceptance evidence.

Required evidence: Process approval record; released instructions; authorization and limitations; ongoing acceptance controls.

25.5 Monitoring, drift and excursions

- a) Monitoring shall detect relevant drift, tool wear, environmental changes, material variability, software changes and loss of operator capability. Response plans shall identify the last demonstrated valid state, potentially affected output and conditions requiring immediate hold.
- b) An excursion shall be evaluated against the relevant failure mechanism. Additional inspection may support disposition only when it can detect the potential effect. Restoring process settings or obtaining one conforming sample shall not retrospectively demonstrate conformity of the affected population.

Required evidence: Monitoring records; reaction plan; affected-population trace; technically justified disposition and restart.

25.6 Changes, transfer and requalification

- a) Requalification review shall follow changes to essential variables, material source, software, equipment, tooling, location, personnel arrangements or inspection method, and adverse trends or significant interruption. The review shall define whether full or partial demonstration is necessary.
- b) Work transferred to another source or site shall demonstrate receiving capability. Partial requalification shall identify evidence retained as valid and explain why unaffected characteristics remain covered. Commercial urgency shall not substitute for receiving-site evidence.

Required evidence: Requalification trigger review; transfer readiness; retained-evidence rationale; actual receiving-site results.

25.7 Process records, traceability and retirement

- a) Execution records shall link actual inputs, parameters, personnel, equipment, time and output identity to the qualified configuration. Data used to support a process claim shall preserve unsuccessful runs and any authorized corrections. Automated collection shall be verified for completeness and correct mapping.
- b) Withdrawal of process approval shall identify affected work, prohibit unauthorized reuse and preserve records needed for existing products or services. Obsolete tools, software and instructions shall be controlled so that they cannot silently re-enter production.

Required evidence: Traceable process history; automated-data verification; withdrawn approval controls; preserved lifecycle evidence.

26 Personnel competence, qualification and task authorization

This clause applies to employees, contractors, temporary workers and independent professionals whose work affects conformity or assurance. The PER route provides a bounded competence attestation; an employer's task authorization and any required professional license remain separate.

26.1 Role analysis and competence criteria

- a) The responsible organization shall analyze the tasks, decisions, hazards, tools, interfaces and consequences associated with each role. Criteria shall identify required knowledge, practical skill, experience, communication and ethical behavior. Prerequisites shall be relevant to the actual tasks rather than selected solely by title or seniority.
- b) Roles involving technical review, inspection, testing, special processing, maintenance, software release, safety, cybersecurity or conformity decisions shall include the ability to recognize limitations and escalate work beyond personal competence. Auditors and decision makers shall additionally meet Annex AB.

Required evidence: Job/task analysis; role profile; required competences; relevant prerequisites and assessment methods.

26.2 Development and verified competence

- a) The organization shall address competence gaps through suitable education, training, supervised practice or experience and verify the result. Training attendance, a degree or length of service alone shall not establish current task competence.
- b) Assessment shall use evidence representative of the work, including practical demonstration where performance can affect an assured outcome. A competence assessor shall be qualified for the task and sufficiently independent to avoid approving inadequate performance under delivery pressure.

Required evidence: Gap assessment; development activities; observed demonstration; competent assessor conclusion.

26.3 Personnel certification and fair assessment

- a) A personnel-certification scheme shall use the role profile, examination and practical-assessment controls in Annex AE. The candidate shall be informed of scope, prerequisites, methods, passing rules, restrictions, conduct expectations and appeal rights before assessment.
- b) Methods shall be fair and accessible without weakening essential competence. Language and accommodations shall be suitable for the work. Unsupported assumptions about personal attributes shall not replace task-relevant evidence. A candidate who fails an essential practical control shall not pass through a high aggregate score.

Required evidence: Published role profile; candidate information; validated assessment; fair-access arrangements; decision rationale.

26.4 Employer task authorization and supervision

- a) Before independent work, the employer or responsible technical authority shall issue task authorization specifying the person, task, product or process family, location or equipment limits, required supervision and expiry. The authority shall verify competence and any mandatory license for that exact task.
- b) A personnel certificate may support this decision but shall not itself authorize work on every configuration or in every jurisdiction. Work outside the authorized scope shall require supervision by an appropriately authorized person or a new competence and authorization decision.

Required evidence: Task-authorization register; scope and limitations; competence and license checks; supervision arrangements.

26.5 Continued competence and reassessment

- a) Continued competence shall be reviewed using relevant practice, professional development, changes in technology, observed performance, errors and complaints. Renewal shall require evidence of current ability, not simply a fee or confirmation of employment.
- b) The time limits and inactivity triggers in Annex AE shall apply to the relevant personnel scope. A significant technology change or evidence of unsafe or unreliable performance shall trigger reassessment immediately, even when a certificate or task authorization has not expired.

Required evidence: Practice and development record; performance review; reassessment; renewal and inactivity decisions.

26.6 Restriction, suspension and restoration

- a) Where confidence in competence or ethical conduct is lost, the organization shall protect affected work, restrict or suspend the relevant authorization and assess prior outputs. Restrictions shall be proportionate to the affected task but shall not conceal a systemic competence deficiency.
- b) Restoration shall require verified corrective development, necessary reassessment and an authorized decision. Appeals shall be available, but a pending appeal shall not automatically remove a protective restriction. Credential status and employer task authorization shall be updated consistently.

Required evidence: Protective action; affected-work review; reassessment; reasoned restoration or withdrawal; status updates.

26.7 Personnel records and responsible use of credentials

- a) Records shall preserve identity, assessed scope, criteria, methods, results, assessor and decision identities, restrictions, development and status history. Access and retention shall respect legitimate confidentiality and applicable data obligations.
- b) Public verification shall expose only information necessary to confirm the credential and scope. Competence records shall not be altered to imply that a person passed unperformed tests. The holder shall use the credential accurately and report relevant changes under the scheme conditions.

Required evidence: Protected competence dossier; current credential status; accurate claims; controlled access and retention.

27 Subcontractor and multi-tier delivery assurance

This clause supplements Clause 8.4 and Annex J. It applies to outsourced engineering, manufacture, services, tests, inspection, personnel supply, digital platforms and further subcontracting. Accountability follows the assigned obligation throughout the chain.

27.1 Retained accountability and actual performers

- a) The commissioning organization shall retain responsibility for conformity of assigned outputs, including customer-nominated sources. It shall identify the actual performer, location, work scope, critical dependencies and authorized interfaces. An intermediary's commercial identity shall not obscure the production or service source.
- b) Contracts shall state which decisions may be delegated and which remain with the commissioning organization. Subcontracting does not transfer final responsibility for acceptance, confidential information, required notification or an independent conformity decision.

Required evidence: Performer and sub-tier map; responsibility matrix; documented delegations and retained decisions.

27.2 Qualification, risk and source status

- a) Qualification shall consider the source's actual technical and organizational capability for the assigned scope, consequence, capacity, continuity, integrity and sub-tier dependence. A company-wide certificate shall not substitute for evaluation of an unassessed site or process.
- b) Source status shall distinguish approved scope, conditional development or trial use, restricted scope, suspension and disapproval. Conditional trial status shall prohibit unrestricted production release until the stated technical conditions are closed. It shall not be advertised as a conformity certificate.

Required evidence: Scope-specific supplier dossier; risk assessment; source-status conditions; verified closure and approval.

27.3 Contractual flow-down and acknowledgement

- a) Applicable technical requirements, configuration, acceptance rules, competence, traceability, change approval, nonconformity reporting, records, authorized access and sub-tier obligations shall reach the point of performance. Annex AF specifies the minimum flow-down review.
- b) The organization shall obtain acknowledgement of important requirements and resolve conflicting or missing instructions before dependent work begins. Acceptance of a purchase order shall not be treated as proof that every sub-tier has received and understood the required technical data.

Required evidence: Reviewed purchase scope; flow-down matrix; performer acknowledgement; resolved ambiguities.

27.4 Ongoing oversight and delegated verification

- a) Oversight shall evaluate actual conformity, escapes, delivery, change discipline, evidence authenticity and corrective-action effectiveness. The organization shall use source visits, witnessed work, verification and representative record checks where justified by risk.
- b) Delegated verification shall identify competent individuals, approved methods, authority limits and independent oversight. Evidence of inconsistent or unreliable decisions shall trigger withdrawal or restriction of delegation and review of affected earlier outputs.

Required evidence: Surveillance plan; performance trends; witnessed and verification records; delegation reviews and affected-output checks.

27.5 Changes and further subcontracting

- a) Changes to the performer, site, critical sub-tier, essential process, material, software or relevant control shall receive the required prior review and approval. Further subcontracting shall not reduce access to evidence or weaken the original obligations.

- b) Emergency substitutions shall remain bounded and traceable. Where prior approval cannot be obtained, the dependent work shall be held rather than falsely represented as approved. The organization shall establish receiving capability and any necessary requalification before unrestricted delivery.

Required evidence: Change notices; approved sub-tier use; emergency restrictions; receiving capability and requalification.

27.6 Escapes, continuity and controlled exit

- a) A subcontractor issue shall be traced through lots, configurations, services and downstream recipients. Required notifications and containment shall be implemented under the applicable contract, law and Annex AG where an AF attestation is affected. Cause analysis shall address failures in the commissioning organization's oversight as well as the supplier's process.
- b) Exit, insolvency, relocation or termination plans shall preserve necessary tooling, technical information, evidence and support capability. Transition shall not erase outstanding nonconformities, data obligations or responsibilities to users of previously delivered outputs.

Required evidence: Population trace; notifications; joint corrective action; continuity and termination record; preserved evidence.

28 Assessment-provider competence and impartial operation

This clause applies to bodies performing evaluation, testing, calibration, inspection, personnel examination, certification or AF competence assessment. Its purpose is defensible evidence and impartial decisions; fulfilling it does not automatically confer authority to use AF marks.

28.1 Legal responsibility, resources and impartiality

- a) The provider shall identify the legal entity responsible for its work, governance, authorized signatories, resources and arrangements for financial and professional liabilities. Its commercial model shall not condition a favorable result on purchasing consultancy, training, membership or other services.
- b) Impartiality risks from ownership, employment, shared staff, referrals, finance, close relationships and previous work shall be identified, reviewed and controlled. Where a conflict cannot be reduced to an acceptable level, the assignment shall be refused or reassigned. A signed declaration alone shall not neutralize an actual conflict.

Required evidence: Legal and governance records; resource and liability arrangements; impartiality analysis; conflict decisions.

28.2 Competence by function and technical scope

- a) Competence shall be defined separately for application review, evaluation, audit leadership, technical expertise, method approval, evidence review, decision and appeal. Authorization shall be based on verified ability for the object, sector, criticality and methods, not a generic job description.
- b) The provider shall maintain an authorization matrix and monitor performance through witnessed work, record review and continuing development. A technical expert may supplement an auditor but shall not compensate for absence of a competent decision maker. Annexes AB and AH apply.

Required evidence: Competence criteria; witnessed assessments; role and technical-scope authorizations; performance monitoring.

28.3 Valid methods, equipment and technical evidence

- a) The provider shall demonstrate that selected methods, equipment, personnel and environments are suitable for the intended conclusion. Testing and calibration shall address metrological traceability, uncertainty, method validation or verification and continuing validity of results. Inspection shall address detection capability and access limitations.
- b) Technical records shall retain the actual subject, configuration, method, data, corrections, uncertainty where relevant and authorized conclusion. Subcontracted results shall be evaluated for relevance and credibility; a report from another body is not automatically sufficient evidence.

Required evidence: Method and equipment records; validity checks; raw and processed results; subcontracted-evidence evaluation.

28.4 Independent review and final decision

- a) Before attestation, an independent competent reviewer shall confirm the adequacy of scope, methods, evidence, findings and closure. The decision maker shall have authority to refuse or restrict a claim despite commercial pressure and shall record the reasons for the actual decision.
- b) For third-party certification, the provider shall retain final decision responsibility and shall not outsource it to the applicant, its consultant or the evaluator. An independent reviewer may also make the decision if authorized and free of those conflicts. The decision shall follow Annex AD.

Required evidence: Independent review; conflict-free decision authorization; recorded rationale; actual decision date.

28.5 Outsourced evaluators and supporting services

- a) Use of external personnel or technical resources shall be controlled by competence verification, confidentiality, impartiality, methods, supervision and records obligations. The provider shall verify their work before relying on it and retain responsibility for the issued conclusion.
- b) An applicant-selected laboratory or expert may supply evidence only after scope, method, independence and result validity are reviewed. The applicant shall not control the provider's finding classification, sample selection or final decision.

Required evidence: External-personnel agreements; verified competence; technical review of external evidence; retained responsibility.

28.6 Information, complaints and continuity

- a) The provider shall protect confidential and personal information, preserve decision records and maintain accurate status information. Complaints and appeals shall be resolved through independent arrangements under Annex AI. Necessary corrections shall reach affected users of reports and attestations.
- b) Continuity arrangements shall preserve records, outstanding cases, surveillance obligations and status verification if the provider ceases operation. Technical records shall remain available to appropriately authorized parties for required retention periods without unauthorized disclosure.

Required evidence: Protected records; status controls; complaint and appeal outcomes; provider continuity and closure arrangements.

28.7 CAB competence route and limits of accreditation

- a) A provider seeking an AF CAB competence attestation shall undergo the scope-specific evaluation, witnessing, independent review and authorized decision in Annex AH. Organizational certification shall not substitute for this evaluation.
- b) Use of "accredited", "AF authorized" or equivalent claims shall require the corresponding actual written decision and scope. The provider shall not self-accredit or infer recognition in another jurisdiction from this standard. An AF body evaluating a related operation shall preserve independent competence assessment and decision governance.

Required evidence: CAB evaluation and witnessing; independent decision; exact authorized scope; accurate accreditation and recognition claims.

Annex A — Scope and activity-based applicability matrix

Normative

This annex applies to every organization using the standard. It prevents both blanket exclusions and unnecessary application of irrelevant technical modules.

A.1 Required applicability process

- The organization shall identify each product or service family, site and lifecycle role; assess the activities and effects below; select all triggered clauses and normative annexes; and record exclusions with evidence. A module applies when an activity is performed directly or when the organization retains responsibility for an externally performed activity.
- The matrix shall be approved by the management representative and relevant technical authorities. It shall be reviewed at least within management review and whenever scope, configuration, technology, suppliers or obligations materially change. Applicable legal and contractual obligations remain binding; AF tailoring shall not remove them.
- For a PER route, the individual scope record shall select Clause 26 and Annex AE, plus Annex AB for an assessor credential and the relevant technical competences from the job profile. The individual is not required to operate the organizational core. The scheme operator is assessed separately for its organizational and provider duties.

Required evidence: Versioned activity matrix; product/site coverage; reasons for exclusions; technical approval; review triggers.

Table A-1 — Module selection rules

Activity or effect	Required AF coverage	Additional evidence focus
All organizations	Clauses 1–10; 22; relevant 23–28; Annexes A, B, D, V, W	Scope, processes, competence, evidence integrity, evaluation and claims.
System design or integration	11; relevant parts of 8.3; Annex C	Requirements allocation, interfaces, lifecycle gates and assurance case.
Software or programmable hardware	12; 13; Annexes N, O	Controlled digital lifecycle, configuration, verification and security.
AI in product, inspection or engineering	12.4–12.7; Annex N	Use case, data lineage, independent evaluation and bounded authority.
Connected product, OT or remote service	13; Annex O	Trust boundaries, identity, updates, incident response and recovery.
Space mission or space-purpose equipment	14; Annex P	Mission environment, ground/space interfaces, end-of-life and remote assurance.
Aircraft, UAS, aviation equipment or services	15; Annex Q	Approval interfaces, installation, operational domain and continued support.
Defense land, maritime, air or multi-domain work	16; Annex R	Contract obligations, controlled information, integration and lifecycle support.
Defense automotive or mission vehicles	16.3; relevant 12–13, 18–21; Annex R	Duty cycle, modified-platform effects, road/mission approval boundaries.
Lunar or planetary mobility	14.7; relevant 11–13, 18–21; Annex P	Space-environment qualification; terrestrial qualification limitations.
Industrial machinery, plant or infrastructure	17; Annex S	Design basis, code interfaces, installation, commissioning and integrity.
Materials, manufacture or special processing	18; 8.5; Annexes K, L	Process qualification, essential variables, genealogy and first article evidence.
Energy storage, fuel or propulsion	19; relevant sector annex	Coupled hazards, operating limits, degradation and emergency interfaces.
External provision or supply responsibility	8.4; Annex J	Source approval, flow-down, delegated verification and authenticity.
Test, calibration or inspection service	7.6–7.7; 8.3.4; Annex M	Method validity, uncertainty, traceability and decision rules.
Maintenance, overhaul, distribution or logistics	21; Annex T	Capability, current data, life status, custody and authorized release.
Lifecycle environmental or human-system effects	20; relevant sector requirements	Impact boundaries, human factors, credible claims and retirement controls.
Novel or previously unlisted activity	6.6; 11; 20.6; applicable existing modules	Hazard-driven extension; evidence gaps; approved technical basis.
Product or integrated-system claim	23; Annexes AA, AD, AG; relevant K–S	Exact configuration/family and technical profile; qualification versus instance acceptance.

Activity or effect	Required AF coverage	Additional evidence focus
Service conformity claim	24; Annexes AA, AD, AG; relevant T	Service boundary, outcomes, capacity, continuity and observed delivery.
Process qualification claim	25; Annexes AA, AD, AG; relevant L	Qualified process window, site, equipment, essential variables and monitoring.
Personnel competence or task authorization	26; Annex AE; AB for assessment roles	Role and task criteria, demonstrated competence and bounded authorization.
Subcontracted or multi-tier work	27; Annexes AF, J	Accountability, actual performer, flow-down, changes, evidence and exit.
Assessment, inspection or laboratory operation	28; Annexes AB, AH; applicable AA–AI	Body competence, impartiality, valid methods and independent decisions.

A.2 Minimum scope-record fields

- Each matrix row shall contain entity, site, product or service, customer or mission, lifecycle responsibility, triggered clause, applicability decision, reason, evidence reference, accountable owner and approval date. Remote functions and critical suppliers shall be linked to the relevant row.
- An exclusion shall not be accepted when the activity is merely subcontracted. For a design exclusion, the record shall identify the actual design authority and demonstrate controls over supplied design data, change requests and escalation of errors.

Required evidence: Completed matrix with each mandatory field and approved interface responsibilities.

Table A-2 — Illustrative scope decisions, not actual AF approvals

Organization example	Decision	Reason and retained controls
Build-to-print aircraft bracket manufacturer	Own product design not performed; manufacturing process design remains applicable.	Customer holds design authority. Apply 8.3 data controls, 8.4, 8.5, 15 and 18; escalate drawing errors and unauthorized changes.
Satellite battery supplier	Space, software/security and energy modules apply.	Product includes embedded control and contributes to mission hazards. Apply 11–14, 18–20 and relevant normative annexes.
Defense vehicle integrator using a commercial chassis	Vehicle and defense modules apply to the modified configuration.	Chassis evidence does not establish payload integration or mission-duty suitability. Apply 16.3 and energy/software modules as triggered.
Stockist splitting sealed fastener lots	Distribution and authenticity controls apply; no manufacturing claim.	Preserve source/lot identity, certificate linkage, quantity and storage. Any rework would trigger additional manufacturing controls.
Software-only inspection-service provider	Digital and measurement-method controls apply.	No physical manufacture, but algorithms influence acceptance. Apply 7.7, 7.12, 12, 13 and verification-service controls.

Annex B — Criticality classification and assurance tailoring

Normative

The AF categories below are an internal tailoring mechanism. They are not equivalent to an external airworthiness design-assurance level, automotive safety-integrity level, marine class, military category or any other authority classification.

B.1 Classification method

- a) The organization shall classify functions, items, processes and evidence-producing tools by the highest credible consequence of their failure within the defined context. It shall consider exposure, combinations, common causes, detectability, recovery and uncertainty. Classification shall not be based only on financial value or a single multiplied risk score.
- b) The classification shall be reviewed by competent technical personnel and approved by the assigned acceptance authority. Where the consequence is uncertain, the organization shall use a conservative provisional category or obtain the missing evidence before lowering assurance. An external mandatory classification shall remain applicable independently.

Required evidence: Classification record; hazard link; assumptions; reviewers; approval and change rationale.

Table B-1 — AF consequence categories

Category	Consequence basis	Minimum assurance response
C0 — Ordinary	No credible safety effect or significant mission/service consequence within the stated use.	Controlled requirements, competent execution, acceptance evidence and proportionate internal review.
C1 — Significant	Recoverable degradation, material rework or service interruption with no credible severe injury or comparable high-consequence effect.	Documented risk and interface review; verification plan; reviewer not the sole originator where practicable; defined recovery.
C2 — Critical	Credible serious injury, major mission loss, major environmental harm or prolonged loss of an essential service.	Formal hazard analysis; independent technical review; controlled critical characteristics; demonstrated mitigations; authorized residual-risk decision.
C3 — Catastrophic	Credible fatalities, catastrophic system loss with safety consequences, or comparable catastrophic harm in the applicable domain.	Organizationally independent assurance challenge; explicit safety case; rigorous evidence and configuration control; highest designated technical and accountable approvals.

Table B-2 — Tailoring dimensions

Dimension	C0 / C1 baseline	C2 / C3 additional expectation
Requirements	Defined acceptance criteria and controlled changes.	Bidirectional traceability of safety/mission controls; independent review of derived requirements.
Design and evidence	Review appropriate to complexity.	Independent verification of critical assumptions and evidence; unresolved counter-evidence escalated.
Suppliers	Scope-based approval and monitoring.	Critical sub-tier visibility; process qualification; authenticity strategy; change and escape notification.
Measurement	Suitable method and equipment.	Uncertainty and decision risk explicitly justified for critical acceptance characteristics.
Software and AI	Controlled versions and functional verification.	Assurance independence, failure-domain analysis, robust anomaly control and bounded adaptation.
Release	Authorized person confirms completed plan.	Critical-control completeness, safety review and independent challenge of remaining limitations.
Field support	Feedback and corrective action.	Population traceability, urgent notification, monitored safety assumptions and lifecycle support.
Change	Impact-based review.	Reopen affected safety arguments and qualification; approval at an equivalent authority level.

B.2 No averaging across critical failures

- a) A favorable average score shall not compensate for a missing critical control, failed mandatory criterion or unsupported residual-risk acceptance. The organization shall identify release-blocking conditions and apply them before considering aggregate maturity or performance measures.

- b) Quantitative safety or reliability objectives shall be derived from the applicable mission and authority basis. This annex does not prescribe universal probability targets. Evidence requirements shall consider uncertainty and the capability of the selected method to support the claimed objective.
- c) The C0–C3 category controls technical assurance and surveillance intensity; it does not relax the independent review and decision requirements for a third-party attestation in Annexes AA and AD.

B.3 Example classification decision

- a) Illustrative case: a software-controlled ground-support cart can move an expensive payload while personnel work nearby. The initial assessment identifies credible severe crush injury if unintended motion occurs. The relevant motion-control function is provisionally C2, not C0 merely because the cart is a support device. A qualified assessment may determine a different category when actual exposure and safeguards are known.
- b) The example decision requires independently reviewed motion limits, verified stop functions, configuration control, operator validation and a residual-risk decision. It does not assign a universal automotive safety-integrity level or establish a certified cart design.

Annex C — Lifecycle-gate evidence and transition decisions

Normative

Equivalent gate names and iterative development are permitted. The organization shall preserve the decision content and shall not omit integration, operational or retirement responsibilities because the project uses an agile or incremental delivery method.

C.1 Gate governance and evidence package

- For each gate, the program shall identify the decision authority, required specialists, independence, entry criteria, evidence package and permissible outcomes. Evidence shall correspond to the reviewed configuration. A gate package shall include open issues, dissent, assumptions and the limitations of analysis or testing.
- The decision record shall state pass, conditional progression or hold, with permitted downstream activity and conditions. Conditional progression shall not permit an irreversible action that depends on missing critical evidence. Closure shall be verified before the dependent activity occurs.

Table C-1 — Lifecycle transition requirements

Gate	Required evidence before decision	Exit condition
G0 — Concept and feasibility	User need; intended domain; candidate architecture; initial hazards; applicable obligations; technology gaps; support concept.	The mission is defined, feasibility gaps are owned and unacceptable concepts are eliminated or bounded.
G1 — Requirements baseline	Traceable requirements; acceptance methods; interfaces; special requirements; constraints; initial assurance allocation.	Requirements are coherent and verifiable; open assumptions cannot invalidate the next work stage.
G2 — Architecture and preliminary design	Allocated functions; hazard controls; budgets; supplier strategy; model assumptions; planned V&V; independence.	Architecture plausibly satisfies requirements and critical assumptions have a verification path.
G3 — Detailed design release	Controlled design outputs; analyses; software architecture; process and material suitability; updated hazards; interface agreement.	Design data are sufficient for controlled realization; required reviews and approvals are complete.
G4 — Manufacturing or service readiness	Qualified processes; competent personnel; equipment; work instructions; inspection methods; source approvals; traceability.	The actual route can produce or perform the defined output with valid acceptance evidence.
G5 — Test and integration readiness	Test configuration; procedures; instrumentation; uncertainty; safety arrangements; acceptance criteria; anomaly rules.	The test or integration can proceed safely and produce interpretable evidence for the intended claims.
G6 — Qualification and operational readiness	Verification results; validation; configuration reconciliation; resolved anomalies; training; support; contingency capability.	Required performance and controls are demonstrated for the approved domain; limitations are accepted by authorized parties.
G7 — Delivery or deployment	Acceptance dossier; authorized deviations; life status; software manifest; required documentation; release checklist.	All release-blocking obligations are closed and the receiving party has the necessary information.
G8 — Change or life extension	Current condition; field evidence; changed requirements; remaining life; impact analysis; requalification and support.	Continued or modified use is justified for a bounded configuration and period; unsupported assumptions are not carried forward.
G9 — Retirement and disposal	Isolation plan; hazardous inventory; reuse restrictions; disposal route; sensitive data; records and remaining-user support.	Disposition is verified and remaining obligations have an owner and accessible evidence.

C.2 Iterative and emergency development

- Incremental delivery shall define the assurance boundary of each increment and its compatibility with existing configurations. An increment shall not rely on a future increment to make current operation safe unless operation is explicitly restricted until that future control is verified.
- Emergency development shall preserve necessary technical authority and evidence. Compressed scheduling may change sequencing, but it shall not reclassify unknown performance as verified. Temporary deployment shall have limitations, monitoring, expiry and recovery arrangements.

Table C-2 — Minimum gate-decision record

Field	Required content
Identity	Program, gate, date, reviewed configuration, evidence-package version.
Participants	Decision authority, technical reviewers, independent reviewer and conflicts of interest.
Criteria	Entry and exit criteria, status against each criterion and evidence references.
Open matters	Issues, assumptions, risk decisions, dissent and required external approvals.
Decision	Pass, conditional progression or hold; exact activities permitted or prohibited.
Conditions	Owner, due date, verification method, dependent activity and escalation trigger.
Closure	Evidence of completion, independent verification where required, and authority to release the dependency.

Annex D — Requirements, configuration and digital evidence data model

Normative

The organization may implement these fields in a database, engineering tool, document or interoperable combination. The information relationships are mandatory when applicable; a particular software vendor or format is not required.

D.1 Requirement-record integrity

- Every controlled product or service requirement shall have an identifier, statement, source, owner, version, rationale, applicability, verification method and acceptance criteria. Derived and safety-related requirements shall include their parent link and approving authority.
- The organization shall maintain traceability through allocation, implementation, verification, anomaly resolution and release. Traceability completeness shall be evaluated for meaning and validity, not only the presence of hyperlinks. Broken or circular links shall be investigated.

Table D-1 — Required lifecycle data entities

Entity	Minimum fields	Required relationships
Requirement	ID; version; statement; source; rationale; criticality; owner; acceptance criterion; status.	Parent need; allocated item/function; verification case; applicable obligation.
Configuration item	ID; type; version; physical/software identity; owner; baseline; approved use.	Requirements; BOM; interfaces; change history; as-built or deployed instances.
Material or component lot	Source; manufacturer; lot/batch; quantity; condition; certificate; received date.	Incoming verification; process route; consumed serials; split/merge history.
Verification case	ID; method; requirement; configuration; procedure; environment; uncertainty; acceptance rule.	Test article; equipment; raw data; result; anomaly and disposition.
Process execution	Route version; operation; performer; date/time; equipment; parameters; material; result.	Lot/serial; qualified procedure; inspection; nonconformity; next authorized step.
Change	ID; reason; baseline before/after; impact; approvals; effectivity; verification.	Affected requirements/items; delivered population; suppliers; support information.
Hazard or risk	ID; scenario; consequence; likelihood basis; exposure; controls; owner; residual decision.	Requirements; mitigations; verification evidence; operational limitations.
Release	ID; configuration; scope; acceptance evidence; concessions; restrictions; authorized identity; date.	Requirements baseline; product serial/lot; delivery dossier; service-life status.
Digital artifact	Artifact ID; version; source/build; dependencies; hash; signature; provenance; access class.	Requirements; verification; release; deployment instances; vulnerabilities.
Retirement	Asset identity; condition; hazardous inventory; reuse restrictions; disposition; verifier.	Life history; disposal evidence; retained records; remaining obligations.

D.2 Identifiers, versioning and time

- Identifiers shall remain unique within the defined repository and resolvable after migration. Version and status shall be distinct; an approved obsolete version shall not appear current. Time records shall identify the relevant time basis and sequence sufficient to reconstruct events.
- Units, coordinate systems, reference frames and data encodings shall be explicit where misinterpretation could affect conformity. Imported supplier data shall be checked for mapping errors, truncated precision and semantic differences. Automated exchange shall retain validation results.

D.3 Evidence provenance and tamper indication

- An evidence record shall identify the source system or person, acquisition method, processing, transformations and approvals. Cryptographic hashes or signatures may support integrity but shall not be treated as proof that the original observation was correct.
- Corrections shall preserve the prior evidence and explain why it changed. Access and modification logs shall be protected in accordance with consequence and obligations. Migration shall verify relationships as well as files; a readable PDF without its underlying configuration links may be insufficient.

Table D-2 — Filled illustrative trace chain

Record	Example value	Connection
Need	NEED-GSC-01: controlled motion during payload handling.	Allocated to SYS-GSC-R12.
Requirement	SYS-GSC-R12 rev B: stop response within a program-defined limit under stated load and speed.	Hazard H-GSC-02; verification V-GSC-12.

Record	Example value	Connection
Configuration	Controller CTRL-07 rev C; firmware 2.4.1; cart serial GSC-004.	Build manifest BM-241; interface ICD-09 rev D.
Verification	V-GSC-12 rev 3; test article GSC-004; report TR-012.	Raw records RAW-012; calibrated timer TM-08; approved decision rule DR-03.
Disposition	Anomaly AN-04 closed after independent retest.	NCR-026; verified corrective action CA-026.
Release	REL-GSC-004 rev 1; approved operating-domain restriction attached.	Release authority RA-02; receiving acknowledgement ACK-004.

The filled chain demonstrates structure only. It deliberately does not supply a universal stopping-time value, load or speed; those values require a valid system-specific safety basis.

Annex E — Risk methods, hazard records and uncertainty

Informative

This annex gives original AF implementation guidance and synthetic examples. It does not set universal risk tolerability limits. The mandatory risk process is specified in Clauses 6.1 and 8.1.1–8.1.3.

E.1 Choosing an analysis method

- a) A useful assessment begins with the decision and the system boundary. Process FMEA is appropriate for examining operation-level failure and escape mechanisms; design FMEA helps examine component or function failures; fault trees examine combinations contributing to an event; scenario analysis addresses interactions and unusual operating states. None is automatically sufficient for every system.
- b) The analysis should record credible failure modes, initiating conditions, local and system effects, exposed populations, detection, mitigation, evidence and ownership. The analyst should actively seek shared dependencies and conditions that can defeat multiple safeguards. Negative evidence, uncertainty and model limitations should remain visible.

Table E-1 — Minimum useful hazard-log content

Record element	Purpose and example
Identity and configuration	H-GSC-02; ground-support cart GSC-004; configuration baseline CB-03.
Scenario and phase	Unintended movement during payload handling while personnel are in the access zone.
Initiating conditions	Incorrect command, stale state information, control failure or maintenance misconfiguration.
Consequences and exposure	Potential personnel injury and payload damage; exposure depends on task and exclusion-zone effectiveness.
Existing controls	Physical access control, motion authorization, stop function, operator procedure; each linked to a requirement.
Likelihood basis	Relevant field data or analysis with conditions and uncertainty; “unlikely” without evidence is not a quantitative estimate.
Verification and evidence	Test case, representative load, software version, independent review and anomaly disposition.
Residual decision	Named authority; accepted operating boundary; unresolved limitations; monitoring and review date.
Change triggers	Software, payload, speed, terrain, access zone, operator procedure or failure evidence changes.

E.2 Severity-first FMEA interpretation

- a) A priority index may help organize work, but multiplying ordinal severity, occurrence and detection scores does not create a physical risk quantity. Two rows with the same product can represent very different consequences. A serious hazard with uncertain occurrence should remain visible even when its numerical ranking is lower than a frequent cosmetic defect.
- b) For example, an illustrative severity score of 10 with occurrence 1 and detection 2 produces 20, while a cosmetic issue with scores 2, 8 and 8 produces 128. The larger product does not make the cosmetic issue more safety-critical. A sensible response uses severity gates, evidence quality and explicit critical-control decisions in addition to prioritization.

Table E-2 — Filled illustrative FMEA extract

Failure / effect	Occurrence control	Escape control and evidence	Decision
Incorrect controller version / motion behavior differs from validated baseline.	Signed release manifest and controlled installation; prevent unauthorized update.	Read-back version/hash and functional verification at deployment.	Hold release until identity is reconciled; review actual installed population.
Measurement bias / nonconforming dimension accepted.	Calibration, temperature control and validated method.	Uncertainty-aware decision rule; independent check of affected interval.	Assess prior accepted output; recalibration alone does not close the event.
Supplier material substitution / hidden strength or environmental mismatch.	Approved source and change notification; controlled specification.	Identity and certificate validation plus risk-based confirmatory testing.	Obtain design-authority disposition; no automatic equivalence.
Scratched non-functional label / reduced readability.	Handling improvements and suitable label material.	Visual criterion and readability check.	Correct according to actual function; escalate if identification or warnings are impaired.

E.3 Probability calculations and dependence

- a) Consider two synthetic failure events with probabilities $P(A)=0.002$ and $P(B)=0.003$ over the same defined exposure. Under independence, the probability of either event is $1-(1-0.002)(1-0.003)=0.004994$. The probability of both is $0.002 \times 0.003 = 0.000006$. These calculations are conditional on the stated model, not measured performance.
- b) Without independence, $P(A \text{ and } B)$ cannot be obtained by multiplication. The general union relation is $P(A \text{ or } B) = P(A) + P(B) - P(A \text{ and } B)$. From the given marginals alone, the intersection lies between 0 and 0.002; the union lies between 0.003 and 0.005. Shared power, common software or environmental exposure can invalidate the independent model.

$$(E-1) P(A \cup B) = P(A) + P(B) - P(A \cap B)$$

All probabilities must refer to the same population and exposure. The equation is an identity; the independent-product approximation is an additional assumption, not part of the identity.

E.4 Common-cause sensitivity example

- a) Assume, purely for illustration, a common-cause event has probability $q=0.001$ and causes both channels to fail. Conditional on no common cause, the channel failure probabilities are 0.002 and 0.003 and are independent. The combined loss probability is $q + (1-q) \times 0.002 \times 0.003 = 0.001005994$, much larger than 0.000006.
- b) This is a sensitivity demonstration, not a validated common-cause model. It shows why a redundancy claim needs evidence about independence, common environments, implementation diversity and shared resources. A reviewer should challenge an analysis whose impressive result comes mainly from assuming every dependency away.

E.5 Risk acceptance record and review

- a) A defensible record states the scenario, configuration, applicable obligations, controls, evidence, uncertainty, residual risk, decision authority, operating restrictions and review trigger. Acceptance should be withdrawn or reconsidered when an assumption is violated or material counter-evidence appears.
- b) The record should distinguish a technical decision from an administrative acknowledgement. "Customer informed" is not the same as "customer authorized the specific departure", and neither can waive an applicable authority requirement. Acceptance should not be retroactively inferred from use of the product.

Annex F — Reliability, availability and demonstration calculations

Informative

All values in this annex are synthetic. Equations are accompanied by assumptions and interpretation limits. The stated inputs and formulas support independent checking of each example.

F.1 Exponential mission-reliability example

- Assume a non-repairable item has a constant failure rate $\lambda=2 \times 10^{-5}$ per operating hour over the demonstrated domain. For mission duration t , $R(t)=\exp(-\lambda t)$. At 1,000 hours, $R=\exp(-0.02)=0.9801987$; at 5,000 hours, $R=\exp(-0.10)=0.9048374$.
- The model requires a credible constant-rate region and a consistent failure definition. It does not describe wear-out, early failures, changing stress, systematic software defects or maintenance effects unless those phenomena are separately represented. A numerical prediction is not a confidence bound or proof of mission safety.

$$(F-1) R(t) = \exp(-\lambda t); \lambda = 1 / \theta$$

λ is the constant failure rate in h^{-1} ; t is operating time in h ; θ is the corresponding mean life or mean inter-failure interval under the applicable exponential/HPP model. λt is dimensionless.

F.2 Series and parallel systems

- Three independent series elements with mission reliabilities 0.990, 0.995 and 0.998 produce system reliability $0.990 \times 0.995 \times 0.998 = 0.9830799$. Every series element is required for the modeled success event.
- Two independent active parallel elements, each with mission reliability 0.98, give $1 - (1 - 0.98)^2 = 0.9996$ if either element alone provides the required function. This assumes perfect switching or load-sharing behavior where relevant, no common-cause failure and no harmful interaction. Annex E demonstrates how a shared failure can dominate the result.

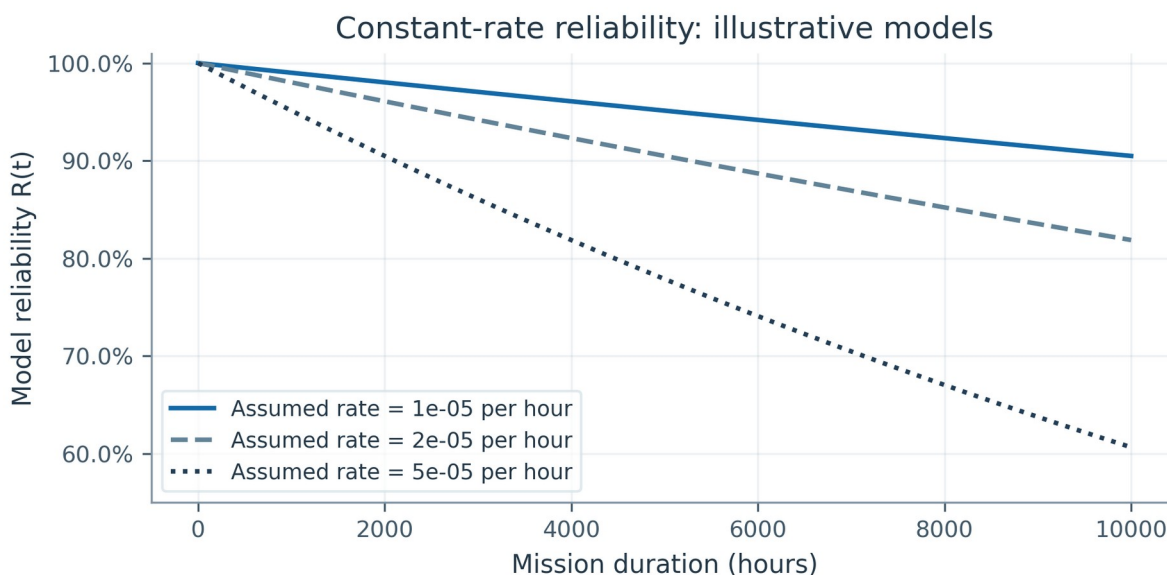


Figure F-1 — Synthetic exponential reliability curves. The three constant rates are illustrative model assumptions, not measured aircraft, vehicle or spacecraft failure rates.

$$(F-2) R_{\text{series}} = \prod R_i; R_{\text{parallel}} = 1 - \prod (1 - R_i)$$

The product formulas require appropriate independence. The parallel formula also requires that any one surviving element is sufficient for the modeled mission function.

F.3 Zero-failure binomial demonstration

- For n independent, identically distributed trials with all n successes, a one-sided exact lower confidence bound on the success probability is $R_L = \alpha^{(1/n)}$. To demonstrate R_L at least R_0 with confidence $1 - \alpha$, choose n at least $\ln(\alpha) / \ln(R_0)$ and round upward.
- At 95% confidence and target $R_0=0.99$, $n = \text{ceil}[\ln(0.05) / \ln(0.99)] = 299$ successful trials with no failures. With 300 successes, the bound is 0.9900639. This is not a claim that the next trial is guaranteed to succeed. The confidence statement describes the coverage of the procedure under its model.

$$(F-3) n = \text{ceil}[\ln(\alpha) / \ln(R_0)]; R_L = \alpha^{(1/n)}$$

$0 < \alpha < 1$ and $0 < R_0 < 1$. Trials must have the declared mission conditions and failure criteria. Repeated dependent trials on the same article may not provide n independent observations.

Table F-1 — Calculated zero-failure sample sizes at 95% confidence

Target success probability R_0	Required all-success trials	Interpretation
0.9000	29	A modest target still requires independent representative trials.
0.9500	59	Zero observed failures is not the same as zero true failure probability.
0.9900	299	Useful illustrative demonstration level; not an AF safety target.
0.9990	2,995	Sample burden grows rapidly as the target approaches one.
0.9999	29,956	Rare-event assurance normally requires broader engineering evidence, not a small test campaign.

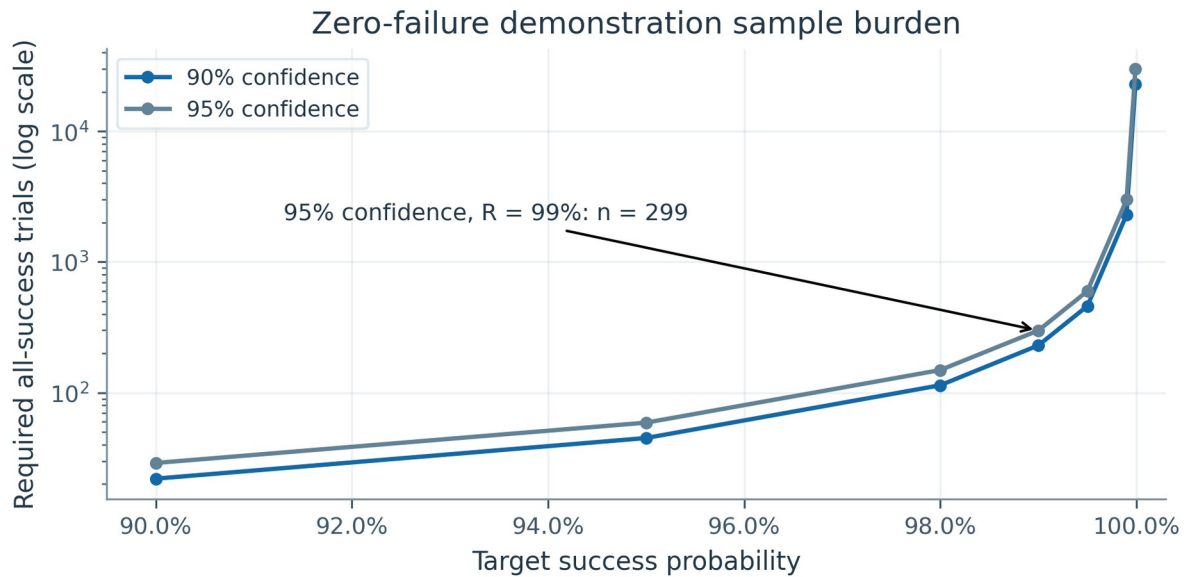


Figure F-2 — Required all-success trials versus target reliability at 90% and 95% confidence. Logarithmic vertical scale; independent Bernoulli trials assumed.

F.4 Time-on-test with no failures

- For a constant-rate model with total valid exposure T and zero failures, the one-sided upper rate bound is $\lambda_U = -\ln(\alpha)/T$. With $T=60,000$ item-hours and 95% confidence, $\lambda_U = 4.992887 \times 10^{-5} \text{ h}^{-1}$. The corresponding lower mean-life bound is 20,028.492 hours.
- Pooling exposure across units requires the same relevant failure mechanism and rate model. Parallel testing reduces calendar time, not the required total exposure. A 60,000-hour exposure does not mean that one article has demonstrated a 60,000-hour wear-out life.

$$(F-4) \lambda_U = -\ln(\alpha)/T; \theta_L = T/[-\ln(\alpha)]$$

T is valid accumulated item-hours under a constant-rate model. Censoring and test interruptions must be recorded; excluded exposure requires a justified rule established before analysis.

F.5 Time-on-test with observed failures

- For a fixed-time Poisson/HPP assessment with r observed failures and exposure T , a one-sided upper rate bound is $\chi^2(1-\alpha; 2r+2)/(2T)$. With $r=3$, $T=100,000$ hours and 95% confidence, the upper bound is $7.753657 \times 10^{-5} \text{ h}^{-1}$. The corresponding lower mean interval is approximately 12,897 hours.
- The test plan and failure classification should be fixed before observing outcomes. Deleting early failures or treating repaired versions as unchanged units can invalidate the claim. If the rate changes over time, a reliability-growth or other suitable model is needed instead of mechanically applying this expression.

$$(F-5) \lambda_U = \chi^2(1-\alpha; 2r+2) / (2T)$$

$\chi^2(p; v)$ denotes the lower-tail p quantile of a chi-square distribution with v degrees of freedom. This notation avoids the ambiguity between upper-tail and lower-tail tables.

F.6 Weibull life and B10 example

- For an illustrative two-parameter Weibull model with shape $\beta=1.5$ and scale $\eta=10,000$ hours, $R(t)=\exp[-(t/\eta)^\beta]$. At 5,000 hours, reliability is 0.7021885. The B10 life, where 10% of the modeled population has failed, is $\eta[-\ln(0.9)]^{1/\beta}=2,230.755$ hours.

- b) The example parameters are assumed, not fitted. In an actual program, estimation should address censoring, sample representativeness, uncertainty and mechanism validity. A B10 point estimate without a confidence bound may be insufficient for a life-limit decision. Extrapolating accelerated tests requires a validated acceleration relationship.

$$(F-6) R(t) = \exp[-(t/\eta)^\beta]; B_p = \eta[-\ln(1-p)]^{1/\beta}$$

η has units of time; β is dimensionless; p is the cumulative failed fraction. The two-parameter model assumes zero location parameter.

F.7 Availability and repair boundaries

- a) For an ideal alternating failure/repair model, intrinsic availability is $A_i = \text{MTBF}/(\text{MTBF} + \text{MTTR})$. With $\text{MTBF} = 1,200$ hours and mean active repair time 6 hours, $A_i = 0.9950249$, or 99.50249%. This excludes logistics and administrative delay.
- b) For observed operational availability, a synthetic record of 960 available hours and 40 unavailable hours gives $A_o = 960/(960 + 40) = 0.96$, or 96%. The two values are not contradictory: their downtime boundaries differ. Reports should state whether scheduled maintenance, spares waiting, software recovery and external-service outages are included.

$$(F-7) A_i = \text{MTBF}/(\text{MTBF} + \text{MTTR}); A_o = \text{uptime}/(\text{uptime} + \text{downtime})$$

Use consistent time units and an explicitly defined observation window. Availability does not imply that all operations performed while available are safe or successful.

F.8 Evidence checklist for reliability claims

- a) A reliability report should state the failure definition, mission profile, population, configuration, exposure, censoring, independence assumptions, model choice, parameter estimation, confidence level and sensitivity. It should distinguish analysis, demonstration, qualification and field observation.
- b) Before accepting a claim, the reviewer should ask whether common causes, software/systematic failures, environmental changes, repair effects and selection bias are represented. Confidence arithmetic cannot rescue an invalid physical or sampling model.

Annex G — Process capability and statistical process-control example

Informative

This annex uses 25 baseline subgroups of five synthetic dimensional observations, followed by five deliberately shifted monitoring subgroups. The baseline observations are listed in Table G-1.

G.1 Study design and prerequisites

- The characteristic is a nominal 50 mm dimension with illustrative limits LSL=49.970 mm and USL=50.030 mm. Five consecutive observations form each rational subgroup. The baseline consists of 125 observations; the monitoring phase is not included in estimating the initial limits.
- Before using capability in an actual decision, establish measurement suitability, stable sampling conditions, rational subgrouping and a plausible distribution. Control limits describe process behavior; specification limits describe product requirements. A process can be stable but incapable, or unstable even while every observed part is within specification.

Table G-1 — Synthetic baseline subgroup observations, all values in mm

Group	x1	x2	x3	x4	x5
1	50.00360	49.99847	49.99553	49.99564	49.99348
2	50.00608	50.01104	49.99296	50.01950	50.00521
3	50.01358	49.99691	50.00846	50.00043	49.99748
4	50.00472	50.00662	49.99983	50.00743	50.00366
5	49.99772	49.99707	50.00542	49.99806	50.01451
6	49.99882	50.00341	50.00199	49.98671	50.00330
7	50.00215	49.99646	50.00545	50.01276	50.00179
8	50.00699	50.00468	50.00162	50.00792	50.00174
9	49.99533	50.00905	50.01122	50.00081	50.00936
10	50.00073	49.99843	50.00226	50.00110	49.99407
11	50.00426	50.00845	49.99463	50.00068	50.00972
12	49.99867	49.99745	50.00764	49.99987	50.00170
13	50.00493	50.00357	49.98537	50.00312	50.00678
14	50.00594	50.02176	50.00760	49.99043	49.99179
15	50.01139	50.00160	50.00324	50.00033	50.01734
16	50.00121	50.00414	50.00671	49.99506	50.00182
17	50.00084	49.99297	50.00002	49.99796	49.99446
18	50.00212	50.00970	49.99828	49.99881	50.00194
19	49.99487	49.99982	49.99708	49.99695	49.99959
20	50.00436	49.99617	50.00586	50.00352	49.99479
21	50.00206	49.99973	50.00537	50.00999	50.00272
22	49.99839	49.99820	50.00605	49.99644	49.99962
23	50.00754	49.99969	50.00422	50.00166	50.00125
24	50.00307	49.99512	49.99926	50.00234	50.00672
25	50.00799	49.99657	49.99980	50.00433	50.01216

G.2 Within-subgroup variation and chart limits

- The baseline grand mean is 50.00215328 mm and the average subgroup range is 0.013546 mm. For subgroup size five, use $d_2=2.326$, $A_2=0.577$, $D_3=0$ and $D_4=2.115$. The within-subgroup standard-deviation estimate is $R\text{-bar}/d_2=0.00582373$ mm.
- The calculated X-bar limits are 49.99433724 and 50.00996932 mm. The range-chart upper limit is 0.02864979 mm and its lower limit is zero. These Phase-I estimates should be evaluated for stability; they should not be recalculated after every adverse point to hide a shift.

$$(G-1) \ s_{\text{within}} = \bar{R}/d_2; \ \bar{X} \text{ limits} = \bar{\bar{X}} \pm A_2\bar{R}; \ R \text{ limits} = D_3\bar{R}, D_4\bar{R}$$

$\bar{\bar{X}}$ is the mean of subgroup means. $\bar{R}$ is the mean subgroup range. Constants depend on subgroup size; these values apply to $n=5$, not to arbitrary sample sizes.

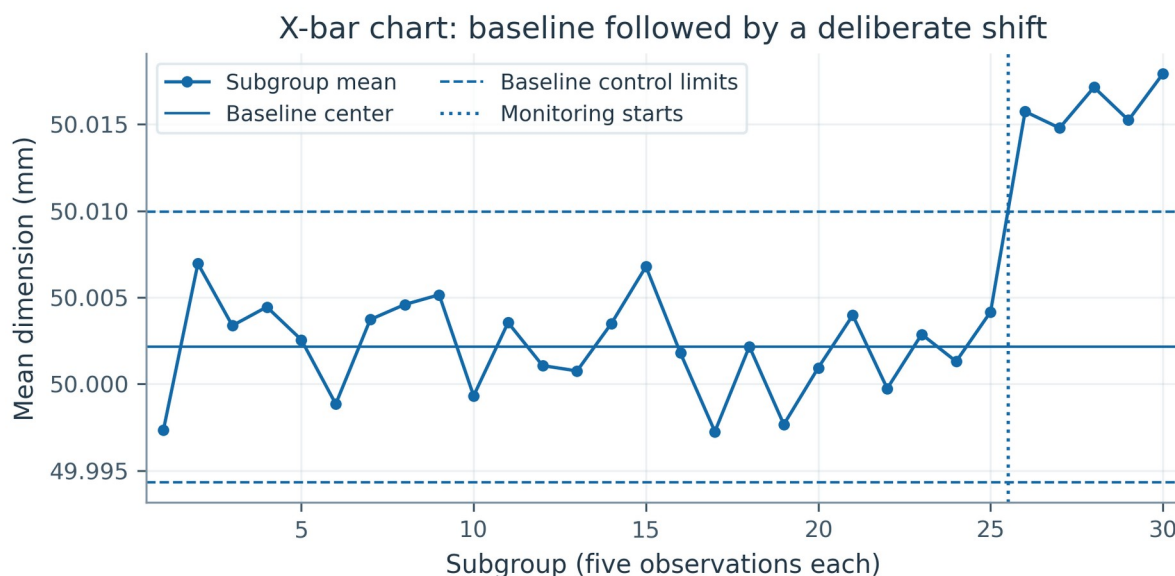


Figure G-1 — Baseline and subsequent monitoring subgroup means. Limits are estimated from groups 1–25 only; groups 26–30 deliberately illustrate a mean shift.

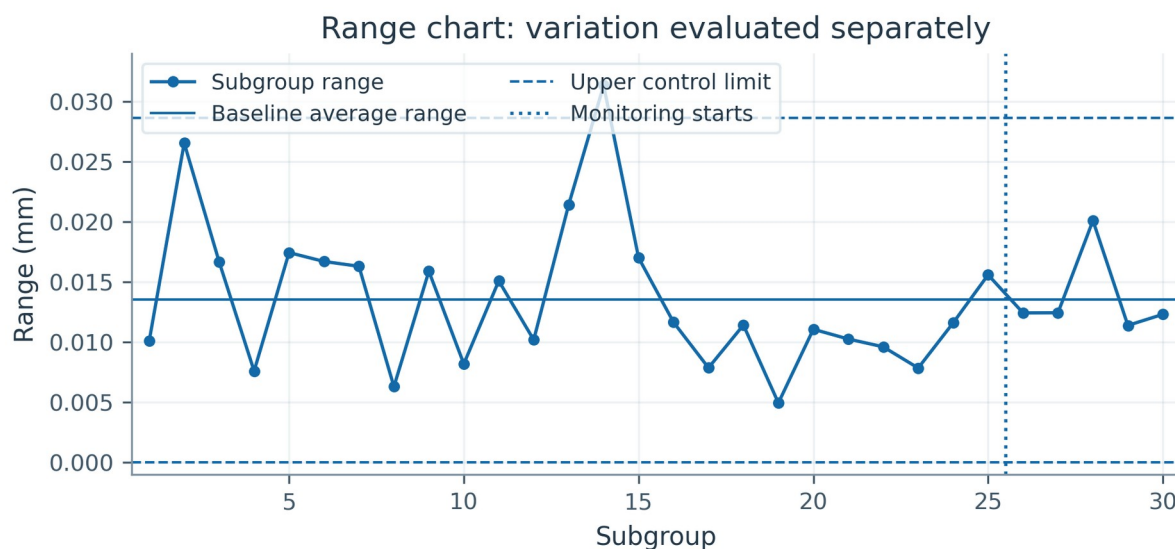


Figure G-2 — Separate range chart for the same synthetic process. A stable range does not rule out a shifted process mean.

G.3 Capability and performance calculations

- a) Using the within-subgroup estimate gives $C_p=1.717112$ and $C_{pk}=1.593865$. Using the overall sample standard deviation $s=0.00603166$ mm gives $P_p=1.657919$ and $P_{pk}=1.538920$. The definitions are stated explicitly because organizations sometimes use inconsistent naming conventions.
- b) These point estimates are descriptive, not a universal acceptance decision. The program must define the required capability, estimation method and confidence treatment based on consequences and obligations. This standard does not declare that $C_{pk}=1.33$, 1.67 or any other number is sufficient for every critical characteristic.

$$(G-2) \quad C_p = (USL - LSL) / (6s_{\text{within}}); \quad C_{pk} = \min[(USL - \bar{x}) / (3s_{\text{within}}), (\bar{x} - LSL) / (3s_{\text{within}})]$$

P_p and P_{pk} use the corresponding formulas with the overall sample standard deviation s_{overall} . Capability interpretations based on normal tails require an appropriate distribution and a stable process.

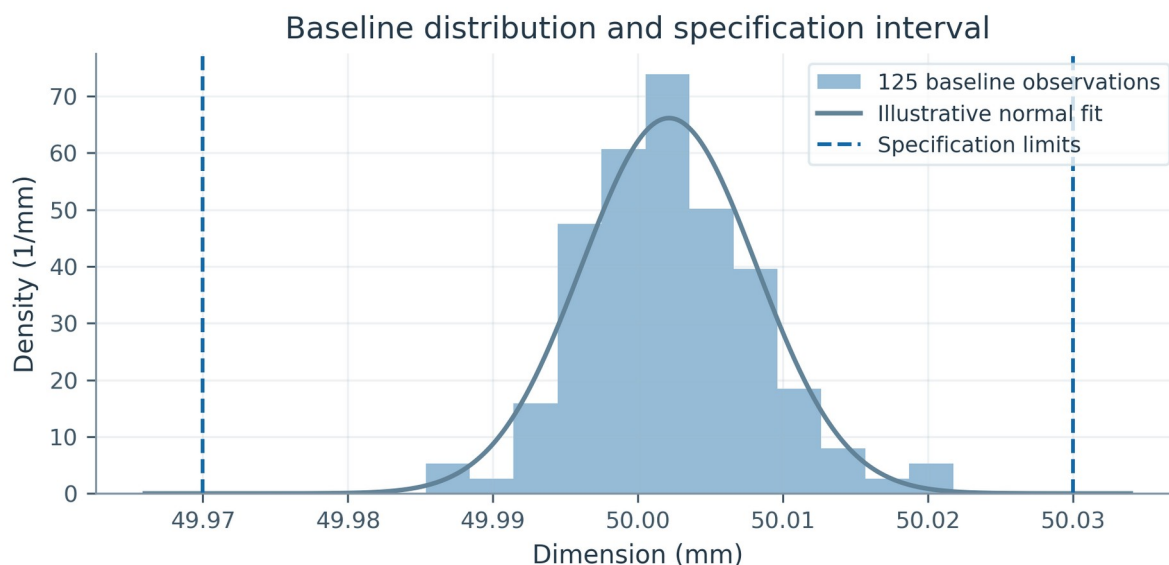


Figure G-3 — Histogram of the 125 synthetic baseline values with an illustrative fitted normal density and specification limits. The fit is not proof of normality.

G.4 Reaction to a special-cause signal

- a) The monitoring subgroups were generated with a higher mean. A signal should trigger containment of the potentially affected interval, verification of the measurement system, investigation of process changes and appropriate product assessment. The range chart should be reviewed as well as the mean chart.
- b) After an identified cause is corrected, the organization should verify stable operation before recalculating limits under an approved rule. Neither a favorable historical Cpk nor a high final inspection pass rate justifies ignoring a persistent shift.

G.5 Non-normal, dependent and low-volume data

- a) For non-normal distributions, use a justified transformation or distribution-specific/percentile method and retain the interpretation of original specification limits. For autocorrelated data, select a model that accounts for dependence rather than assuming the nominal number of readings equals independent information.
- b) Low-volume or one-off work may require engineering verification, validated processes and individual characteristic evidence instead of a capability index estimated from inadequate data. The absence of sufficient statistical data should be stated honestly; it should not be disguised by pooling unlike products.

G.6 Measurement-system variation example

- a) As a separate synthetic illustration, suppose repeatability standard deviation is 0.0015 mm and reproducibility standard deviation is 0.0010 mm, with independent components. Combined gauge variation is $\sqrt{0.0015^2 + 0.0010^2} = 0.0018028$ mm. If observed total variation is 0.0060 mm, the ratio is 30.05%.
- b) This calculation is only a component combination, not a complete gauge R&R study. A real study needs a suitable crossed or nested design, representative parts, operators, interactions and uncertainty. No universal accept/reject percentage is imposed; the effect on the actual measurement decision must be evaluated.

Annex H — Measurement uncertainty and conformity decision rules

Informative

The example concerns a dimensional measurement and is not an accredited calibration result. The calculations illustrate uncertainty and guard bands. Mandatory decision governance is established in Annex AD; these worked values are not universal acceptance limits.

H.1 Measurement model and components

- Consider a corrected measurement y with four independent standard-uncertainty components expressed in millimetres. Known significant systematic effects have already been corrected; the remaining uncertainty of each correction is included. Standard uncertainty is not the same quantity as a known measurement error.
- For a general model $y=f(x_1, \dots, x_m)$, use sensitivity coefficients $c_i=\partial f/\partial x_i$ and include covariance terms. The simplified root-sum-of-squares expression is appropriate only when the linear approximation and independence assumptions are suitable.

Table H-1 — Synthetic uncertainty budget

Component	Standard uncertainty, mm	Basis and treatment
Calibration correction	0.0012	Assumed standard uncertainty after applying the correction.
Repeatability of reported result	0.0015	Assumed applicable to the actual reported result, not automatically divided by sample size.
Temperature correction	0.0010	Residual standard uncertainty after compensation.
Resolution / quantization	0.0005	Assumed already converted from its distribution to standard uncertainty.

$$(H-1) u_c^2(y) = \sum c_i^2 u_i^2 + 2 \sum (i < j) c_i c_j \text{cov}(x_i, x_j)$$

For the additive independent example, all $c_i=1$ and covariance terms are zero. Units remain mm^2 before the square root.

H.2 Calculated combined and expanded uncertainty

- The independent-component result is $u_c = \sqrt{0.0012^2 + 0.0015^2 + 0.0010^2 + 0.0005^2} = 0.00222261$ mm. With illustrative coverage factor $k=2$, expanded uncertainty $U=0.00444522$ mm.
- The coverage factor must be justified for the distribution, effective information and required coverage. $k=2$ is approximately 95% coverage under suitable normal/large-information conditions; it is not an exact universal 95% confidence rule. For limited degrees of freedom or nonlinear models, use an appropriate alternative analysis.

$$(H-2) U = k u_c$$

Report the measurement, units, expanded uncertainty, coverage factor, basis of coverage and decision rule. Rounding must not make the stated uncertainty appear smaller than justified.

H.3 Guard-band example

- For specification interval $[49.970, 50.030]$ mm, an illustrative conservative acceptance rule requires $y-U \geq \text{LSL}$ and $y+U \leq \text{USL}$. The resulting acceptance interval for y is $[49.97444522, 50.02555478]$ mm.
- A corrected result of 50.0240 mm has its full stated interval inside specification and passes this particular rule. A result of 50.0280 mm is inside the nominal specification but its uncertainty interval extends beyond the upper limit; conformity is not demonstrated under this rule and the item is held for disposition. This does not prove the item is physically nonconforming.

$$(H-3) \text{Accept only if } \text{LSL} + U \leq y \leq \text{USL} - U$$

This is one pre-agreed decision rule, not a universal requirement. A different rule must identify and justify its treatment of false-acceptance and false-rejection risk.

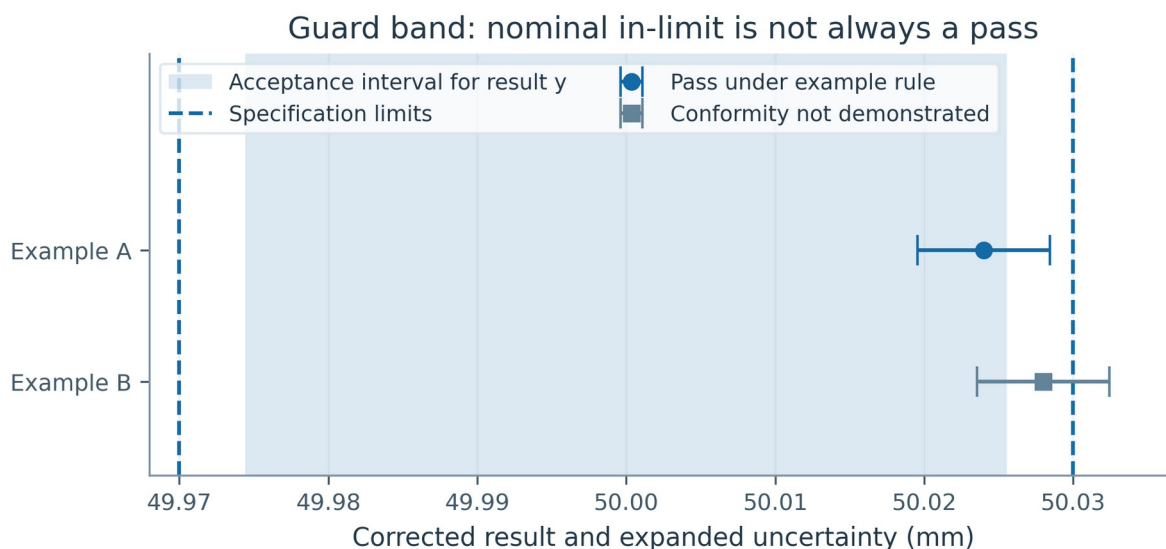


Figure H-1 — Two synthetic measurement results with expanded-uncertainty intervals. Dashed specification limits and the narrower acceptance interval illustrate why nominal in-limit results can require further disposition.

H.4 Correlation sensitivity

- a) If the calibration and temperature components have correlation coefficient 0.5, their covariance is $0.5 \times 0.0012 \times 0.0010 \text{ mm}^2$. Adding twice this covariance gives $u_c = 0.00247790 \text{ mm}$, larger than the independent result.
- b) The example shows why shared reference or environmental influences should not be ignored. Correlation should be based on a defensible model or study, not selected to obtain a favorable uncertainty. Sensitivity analysis is useful where the dependence is poorly known.

H.5 Decision-rule report content

- a) A report should identify the measurand, method, corrected result, uncertainty budget, significant assumptions, coverage factor, specification, chosen decision rule and resulting disposition. The rule should be agreed before results are evaluated.
- b) When a decision is indeterminate under the chosen rule, available responses include a better measurement, additional relevant evidence or an authorized technical disposition. Repeated measurement until one reading passes is not a valid resolution unless a predefined statistical method controls that practice.

Annex I — Acceptance sampling and operating-characteristic calculations

Informative

This annex illustrates statistical lot disposition. It does not authorize acceptance of known critical defects. Sampling does not replace mandatory inspection, process validation or individually required critical-characteristic evidence.

I.1 Define the sampling decision first

- A sampling plan should identify lot formation, defect definition, random selection, sample size n , acceptance number c , measurement method, treatment of found defects, rejected-lot disposition and resubmission controls. The relevant consumer and producer risks should be agreed before inspection.
- For a large homogeneous lot with independent Bernoulli defect status, the probability of acceptance is the binomial cumulative probability of at most c defective items. For finite lots sampled without replacement, the hypergeometric model is exact under random sampling.

$$(I-1) P_a(p) = \sum_{k=0}^c C(n,k) p^k (1-p)^{n-k}$$

p is the defective fraction. The plan accepts the lot statistically when the observed number of defectives is at most c ; detected nonconforming items still require controlled disposition.

I.2 Plan selected from stated risk constraints

- Assume an illustrative acceptable-quality point $p_A=0.005$ and poor-quality point $p_L=0.05$, with producer-risk limit $\alpha \leq 0.05$ and consumer-risk limit $\beta \leq 0.10$. Searching integer single-sample binomial plans gives the minimum sample size $n=105$ with $c=2$.
- For this plan, $\alpha=1-P_a(0.005)=0.01605316$, or 1.6053%, and $\beta=P_a(0.05)=0.09918726$, or 9.9187%. These are calculated properties of the stated model; the chosen quality points are examples, not AF acceptance limits.

Table I-1 — Comparison of two synthetic sampling plans

Plan	Producer risk at $p=0.5\%$	Consumer risk at $p=5\%$	Interpretation
$n=105, c=2$	1.6053%	9.9187%	Meets both illustrative risk constraints.
$n=80, c=0$	33.0352%	1.6515%	Stricter against a poor lot but rejects many good-quality lots; zero acceptance is not risk-free.

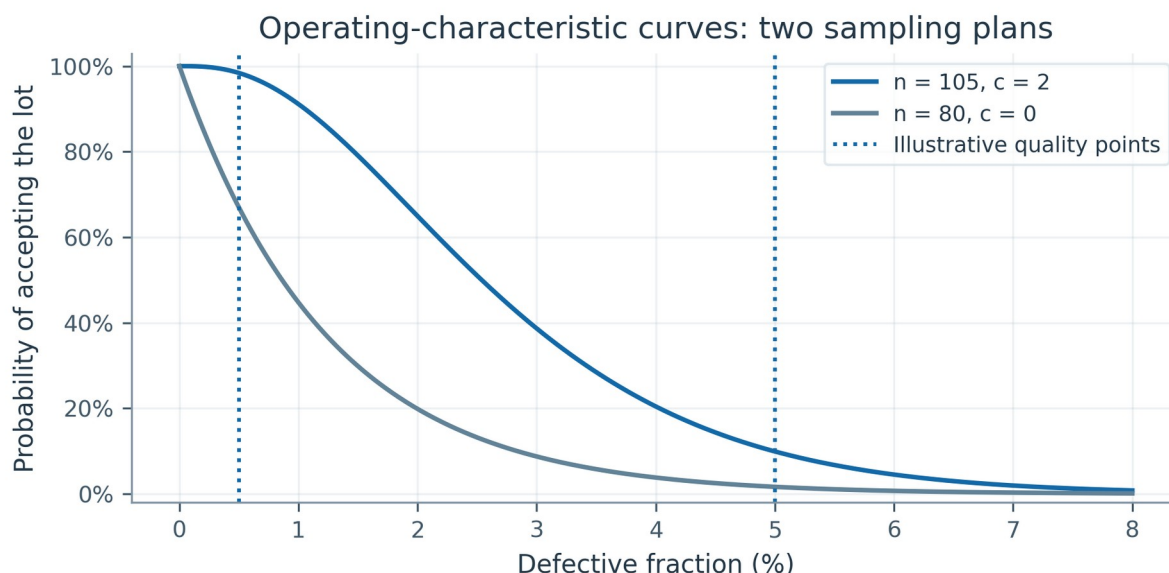


Figure I-1 — Calculated binomial operating-characteristic curves. The two plans embody different producer/consumer tradeoffs; neither is a universal aerospace acceptance plan.

I.3 Finite-lot calculation

- For a lot of $N=1,000$ containing $D=50$ defective items, sampling $n=105$ without replacement and accepting at most two gives $P_a=0.08696216$. For $D=5$, the corresponding probability is 0.99037961. The finite-lot result differs from the binomial approximation because sampling is without replacement.
- The actual number of defectives is usually unknown; the calculation describes plan behavior at hypothetical lot states. It does not reveal the true defect count in an accepted lot. Sampling should be random across the defined lot, not restricted to easily accessible or best-looking items.

$$(I-2) P_a = \sum_{k=0}^c [C(D,k) C(N-D,n-k)] / C(N,n)$$

Terms outside feasible ranges are zero. N is lot size, D is the hypothetical defective count and n is the sample size.

I.4 What zero defects in a sample means

- a) If no defects are observed in 80 independent Bernoulli observations, a one-sided 95% upper confidence bound on the defect probability is $1 - 0.05^{(1/80)} = 0.03675420$, or 3.6754%. Zero observed defects therefore does not establish a zero-defect population.
- b) This confidence calculation is a parameter-inference statement, while an OC curve characterizes a decision plan. They answer different questions and should not be interchanged. A critical defect found in the sample should trigger the required technical containment and investigation, even when a generic count rule would otherwise accept the lot.

I.5 Resubmission, switching and detection limitations

- a) Rejected lots should be segregated and dispositioned through a controlled process. Resubmission should disclose the original rejection, corrective or sorting action and the approved new inspection plan. Repeatedly drawing a fresh sample until one passes inflates acceptance probability and is not the stated plan.
- b) The model presumes the inspection correctly classifies the sampled items. False-negative inspection, clustered defects, mixed lots and unrecorded substitutions can make calculated risks misleading. Inspection capability and lot integrity should therefore be considered together with the mathematical sample size.

Annex J — Supplier qualification, surveillance and flow-down package

Normative

This annex applies when external providers affect conformity or assurance. It includes suppliers selected by customers and providers of digital services, test results or critical technical information.

J.1 Qualification and approval decision

- a) The organization shall define the supplied scope and determine criticality, technical capability, capacity, authenticity exposure and sub-tier dependencies. Qualification shall use evidence appropriate to those factors and may include document review, assessment, first article, process validation, trials or source surveillance.
- b) The approval decision shall state approved scope, status, conditions, limitations and surveillance. A certificate may be considered as one input, but its issuer, validity, site and scope shall be verified. Approval shall not extend to a new process or location without review.

Table J-1 — Supplier qualification dossier

Element	Required evidence	Decision or action
Identity and scope	Legal/site identity; ownership or relevant control; exact products, processes and services.	Establish the source actually performing the work.
Technical capability	Personnel, facilities, equipment, process qualification, current specifications and prior representative work.	Determine suitability for the assigned scope; identify required trials.
Quality and assurance	Implemented processes, records, internal audit, management review and corrective-action examples.	Assess effectiveness, not only the existence of a manual.
Product safety and criticality	Critical items, hazards, required independence and acceptance controls.	Set enhanced surveillance and release conditions where necessary.
Authenticity and traceability	Original source, chain of custody, material verification and counterfeiting controls.	Approve channels and incoming confirmation strategy.
Digital integrity	Software inventory, update controls, access, security support and evidence protection.	Resolve uncontrolled dependencies or insecure data interfaces.
Capacity and continuity	Demonstrated throughput, inspection capacity, critical dependencies and recovery arrangements.	Set volume limits, contingency plans or conditional approval.
Sub-tier controls	Identification of critical sub-tiers; flow-down; change approvals; source verification.	Confirm requirements reach the point of performance.
Ethics and obligations	Conflicts, truthful evidence, authorized access and relevant controlled-technology obligations.	Resolve unacceptable conflicts or prohibited arrangements.
Approval and surveillance	Competent review; approval scope; conditions; monitoring frequency and triggers.	Record approved, conditional, restricted, suspended or disapproved status.

J.2 Minimum contractual flow-down

- a) Purchasing information shall include the applicable elements in Table J-2. The organization shall identify the edition and effectivity of technical data and shall require the supplier to resolve ambiguity before work. Any alternative supplier proposal shall be approved before implementation.
- b) Flow-down shall be proportionate to the work but shall not omit a requirement needed to protect a critical characteristic or evidence chain. Confidentiality restrictions shall be addressed through authorized access arrangements rather than by silently removing verification rights.

Table J-2 — Purchasing and flow-down content

Topic	Required purchasing provision
Technical baseline	Part/service identity, version, drawings or model authority, specifications, quantities and applicable acceptance criteria.
Process approval	Required special processes, sources, qualification, essential-variable control and requalification triggers.
People	Required competence, task authorization and any mandatory qualifications.
Critical characteristics	Identification, control method, measurement results and required independent verification.
Change	Prior notification and approval conditions for design, process, material, source, site, software or ownership changes affecting the work.
Nonconformity	Notification, containment, disposition authority and prohibition of unauthorized repair or use-as-is.

Topic	Required purchasing provision
Authenticity	Source identity, traceability, suspect-item handling and counterfeit reporting responsibilities.
Verification	Inspection/test method, sampling if authorized, specimens, witnessing and required raw/result evidence.
Records	Required content, retention, availability, format, protection, transfer on closure and authorized disposal.
Access and sub-tiers	Applicable authorized access and flow-down to the actual lower-tier performer.
Delivery	Configuration, certificates, life status, preservation, restrictions and required accompanying information.
Ethical and safety awareness	Contribution to conformity and safety; truthful records; reporting and non-retaliation expectations.

- c) The flow-down review shall include Annex AF and Clause 27. Conditional supplier development is distinct from a positive SUB attestation; the decision and claim shall state which status applies.

J.3 Surveillance and delegated verification

- a) The organization shall monitor conformity, delivery, escape events, change discipline and corrective-action effectiveness. Thresholds and actions shall be defined according to risk. A deteriorating trend shall trigger review before a serious failure occurs.
- b) Delegated verification shall identify authorized people, methods, limits, records and oversight. The organization shall periodically compare delegated decisions with independent evidence and shall suspend authority when confidence is lost. Delegation does not transfer ultimate contractual responsibility.

J.4 Filled illustrative supplier disposition

- a) Example: supplier SUP-042 proposes a new site for a bonded assembly. Its corporate certificate remains valid, but the new site lacks demonstrated cure-process capability. The approval status is “conditional, no production release”; conditions are site-specific process qualification, operator authorization, environmental verification and first article evidence.
- b) The decision closes only when the required evidence is independently reviewed and the scope register is updated. A purchase-order deadline or a certificate covering another site does not close the conditions. This example illustrates the decision logic, not an actual supplier assessment.

Annex K — First article and production-readiness verification

Normative

This annex applies to production-process verification under 8.5.1.3. It specifies record completeness, not a proprietary form format. Equivalent digital forms are acceptable.

K.1 Planning and trigger assessment

- The organization shall define when a full or partial first article verification is required, based on new product, new process, design change, source transfer, tooling change, interruption or evidence that prior verification is no longer representative.
- The verification plan shall identify the production-representative item, route, design baseline, material, tooling, software and all applicable characteristics. A partial verification shall list the changed portion and justify the continuing validity of the remainder.

Table K-1 — Required first article record sections

Section	Minimum required content
Product accountability	Part/service identity; version; serial/lot; assembly hierarchy; production order; first article reason and full/partial status.
Production route	Actual site, line, equipment, tools, machine programs, work instructions and applicable versions.
Material and process evidence	Material identity and certificates; authenticity checks; special-process qualifications; external-source approvals.
Characteristic accountability	Unique characteristic ID; design location; requirement; units; criticality; method; actual result; uncertainty/decision rule where relevant.
Functional and software evidence	Functional requirements; software/firmware configuration; build identity; test procedure and actual results.
Nonconformities	NCR links; technical disposition; repair/rework evidence; required customer or design-authority approval.
Review and release	Completeness check; independent review where required; authorized conclusion; remaining restrictions and records index.

K.2 Characteristic completion rules

- Each applicable drawing, model, specification and interface characteristic shall be accounted for. Results shall be numeric where the criterion is numeric, or use a defined attribute evaluation with traceable evidence. "Pass" without the required actual result shall not be accepted for a variable characteristic requiring retained measurement.
- The organization shall verify that material and special-process evidence relate to the actual first article. Unverified characteristics shall remain open. A sample selected for excellent appearance shall not replace a representative production article.

Table K-2 — Filled synthetic characteristic-accountability extract

ID / characteristic	Illustrative requirement	Evidence / actual result	Disposition
K-01 / external dimension	50.000 ± 0.030 mm.	50.0040 mm; U=0.00445 mm, k=2; agreed full-interval rule.	Conformity demonstrated under the example rule.
K-02 / hole pitch	80.000 ± 0.050 mm.	80.0120 mm; U=0.0060 mm, k=2; calibrated coordinate method.	Conformity demonstrated under the example rule.
K-03 / material identity	Material specification MAT-17 rev B.	Lot ML-021; certificate MC-021; identity check IV-021.	Identity and lot linkage verified; no strength claim inferred from appearance.
K-04 / bonded process	Qualified route BOND-04 rev C.	Run BR-116; qualified operator OP-18; process record within approved window.	Process evidence complete.
K-05 / firmware identity	Firmware 2.4.1; build manifest BM-241.	Read-back identity and hash match signed release manifest.	Configuration verified; functional evidence also required.
K-06 / functional interface	Controlled interface test IF-09 rev D.	Report TR-009 records all required checks and one resolved anomaly AN-04.	Accepted only after independent retest and NCR closure.

K.3 Production-readiness conclusion

- The readiness conclusion shall consider process stability, tooling, inspection capability, operator competence, supplier readiness and closure of nonconformities, not only one conforming item. Where data are insufficient for capability inference, the limitation and compensating verification shall be recorded.
- First article acceptance shall not remove continuing process controls, surveillance or the obligation to reassess after change. The organization shall define any enhanced monitoring for initial production and objective criteria for returning to normal control.

Annex L — Special-process qualification and requalification dossier

Normative

This annex applies where the relevant output cannot be fully verified after processing. It is suitable for adaptation to heat treatment, welding, bonding, composites, surface treatment, additive manufacturing and other special processes without prescribing universal process recipes.

L.1 Qualification strategy

- The organization shall define the qualified process, scope, materials, geometries, equipment, site, personnel, essential variables and intended outputs. Qualification shall establish a technically justified operating window and the evidence needed to demonstrate repeatable performance.
- The plan shall identify representative test articles, worst-case or bounding conditions, measurement methods, acceptance criteria, sampling rationale and independent review. A supplier's generic capability statement shall not replace a scope-specific qualification.

Table L-1 — Qualification dossier contents

Topic	Required technical content	Control after approval
Scope and boundaries	Process family; materials; thickness/geometry ranges; product criticality; intended use.	Prevent application outside the demonstrated scope.
Essential variables	Parameters that can alter relevant properties; interactions; approved ranges; measurement capability.	Monitor and record actual values; define excursion response.
Facilities and equipment	Equipment identity; calibration; uniformity or performance checks; utilities; environment.	Maintain condition and reassess after relocation or major repair.
Personnel	Task competence, qualification method, authorization and supervision.	Reassess after change, inactivity or poor performance.
Consumables and inputs	Source, material condition, shelf/out-time, preparation and contamination controls.	Track lots and prevent unauthorized substitution.
Qualification samples	Representativeness, preparation, locations, destructive/NDT methods and acceptance.	Retain the relationship to the qualified process and production.
Results and uncertainty	Actual results, variability, method limitations, uncertainty and deviations.	Use valid evidence; do not hide failed or excluded trials.
Approved process	Released procedure, parameter window, inspection plan and approval authority.	Control versions and point-of-use access.
Continuing validation	Monitoring, periodic checks, witness samples or audits as justified.	Detect drift before output escapes.
Requalification	Triggers, impact assessment, full/partial basis and required approval.	No unrestricted production until necessary evidence is restored.

L.2 Excursion and production disposition

- An excursion outside the approved process window shall identify the affected population from the last demonstrated valid state. The organization shall hold affected outputs and assess the technical consequences using qualified expertise.
- Additional inspection may support disposition only when it can detect the relevant effects. If the characteristic is inherently hidden or the inspection is not capable, a favorable inspection shall not erase the excursion. Repair, concession or scrap shall follow authorized technical decisions.

L.3 Requalification triggers

- Triggers shall include relevant changes in material, source, geometry, equipment, software, location, essential parameters, preparation, consumables or inspection method, as well as adverse trends and significant interruption.
- A partial requalification shall identify which prior evidence remains valid and why. The approval shall specify effectivity and any initial-production surveillance. Qualification certificates shall not be used beyond the process scope and conditions they actually establish.

L.4 Worked administrative example

- Example: an additive-manufacturing supplier changes powder reuse policy and post-processing source. The change review identifies possible effects on porosity, chemistry and mechanical properties. Production release is held while representative builds, material checks and post-process qualification are evaluated against the approved product requirements.
- The record identifies both changes rather than attributing the result to a machine already being "qualified". The example intentionally supplies no process temperature, energy-density or material-strength recipe; those values require a qualified material and product-specific engineering basis.

Annex M — Verification, environmental testing and qualification records

Normative

This annex applies to analysis, inspection, demonstration and testing used as conformity evidence. It distinguishes a complete test-management record from a product-specific technical test specification.

M.1 Verification-method and acceptance planning

- a) The organization shall identify the requirement, method, configuration, conditions, equipment, data, uncertainty, acceptance rule and responsible reviewer for each verification activity. Acceptance and abort criteria shall be defined before execution.
- b) The test basis shall justify environmental profiles and margins using the actual duty, applicable technical requirements and limitations of the test article. This standard does not prescribe a single vibration, shock, fire, thermal-vacuum, EMC or load profile for every product.

Table M-1 — Test-plan and report data requirements

Area	Required content
Identity	Program; requirement IDs; test/report IDs; version; article serial/lot; hardware/software configuration.
Objective	Claim being evaluated; acceptance criteria; excluded claims; required confidence or coverage.
Method	Procedure; setup; sequence; conditioning; instrumentation; sampling; data processing; approved deviations.
Environment	Relevant physical conditions, profiles, tolerances, duration, interfaces and monitoring locations.
Measurement	Equipment identity, calibration, range, resolution, uncertainty, correction and decision rule.
Safety and authority	Test authorization, hazards, limits, abort criteria, emergency arrangements and responsible personnel.
Execution	Actual date/time, performer, observations, raw data, environmental records, anomalies and interruptions.
Analysis	Calculations, software/tools, assumptions, exclusions, uncertainty, comparison with criteria and limitations.
Review	Technical review, independent review when required, anomaly disposition and authorized conclusion.
Retention	Raw and processed data, configuration, photographs where useful, records location, access and retention.

Table M-2 — Qualification-domain matrix

Domain	Program-specific basis to establish	Evidence limitations to address
Mechanical / structural	Loads, dynamics, fatigue duty, attachment, shock/vibration and structural acceptance.	Boundary conditions, scaling, article representativeness and cumulative damage.
Thermal / climatic	Temperature, humidity, icing, dust, salt, altitude and cycling as applicable.	Dwell, gradients, condensation, combined environments and service duration.
Space environment	Vacuum, thermal balance/cycling, radiation, charging and contamination.	Mission equivalence, dosimetry, material behavior and inaccessible damage.
Electrical / EMC	Power quality, transients, emissions, immunity, grounding, ESD and relevant external fields.	Installation effects, cable configuration, modes, frequency coverage and failure criteria.
Fire / hazardous energy	Applicable ignition, containment, propagation, smoke or emergency requirements.	Scale, ventilation, material state, energy inventory and authorized facility capability.
Software / digital	Requirements, interfaces, timing, robustness, security and configuration.	Coverage, target equivalence, systematic defects and tool limitations.
AI / autonomy	Domain, scenario coverage, data quality, performance, fallback and intervention.	Distribution shift, rare conditions, confidence and authority boundaries.
Human-system / operations	Representative users, tasks, workload, emergency and maintenance conditions.	Participant representativeness, learning effects and simulated-environment limits.

M.2 Anomalies, retest and evidence exclusion

- a) Test anomalies shall be recorded with actual conditions and potential effects on validity. The decision to repeat, modify or exclude a result shall be technically justified and approved. All original results shall remain traceable.
- b) Retesting after a repair or software change shall identify the changed configuration and the extent of regression needed. Repeating only the previously failed check shall not be sufficient when the change can affect other requirements. A pass after uncontrolled tuning shall not be represented as the result of the original plan.

M.3 Qualification by similarity and analysis

- a)** Use of similarity shall identify the reference article, verified evidence, differences and their effects on relevant failure mechanisms. The organization shall demonstrate that the prior evidence bounds the new configuration and conditions.
- b)** Analysis-based acceptance shall record the model, assumptions, validation, uncertainty and sensitivity. An independent reviewer shall be able to reproduce material calculations from the retained inputs. Unsupported similarity statements shall remain open evidence gaps.

Annex N — Software and AI assurance cards with worked metrics

Normative requirements; informative worked example

Subclauses N.1–N.3 and Tables N-1/N-2 are normative when the relevant digital activity applies. N.4–N.6 and the numerical figures are informative synthetic examples. The distinction prevents illustrative thresholds from becoming universal acceptance limits.

N.1 Digital release card

- a) Each assured digital release shall have the fields in Table N-1 or an equivalent linked record. The card shall identify the exact evaluated configuration and the limits of the claim. Missing critical evidence shall block release rather than being masked by a summary score.
- b) The release decision shall address unresolved anomalies, security exposure, compatibility, installation, rollback, support and required independent approval. Subsequent updates shall retain lineage to the prior release.

Table N-1 — Software and programmable-hardware release card

Field group	Required content
Identity	Product; version; source version; build identity; target hardware; relevant programmable logic.
Intended function	Allocated requirements; safety/mission criticality; operating modes and domain.
Architecture	Interfaces; partitioning; timing; resources; fault containment and recovery.
Build and dependencies	Toolchain; compiler/settings; libraries; SBOM; hashes; reproducibility evidence.
Verification	Requirements coverage; test environment; structural/functional criteria; robustness; target differences.
Anomalies	Open and closed defects; severity; affected configuration; mitigations; acceptance authority.
Security	Threat-model linkage; vulnerability decisions; secure configuration; update and credential controls.
Deployment and support	Installation checks; compatibility; rollback; monitoring; maintenance and end-of-support.
Approval	Technical owner; independent reviewer where required; release authority; date and restrictions.

N.2 AI model and dataset cards

- a) An AI assurance card shall identify use case, human authority, prohibited uses, operational domain, data lineage, evaluation design, performance criteria and monitoring. Training and test-data provenance shall be sufficiently documented to evaluate representativeness and rights.
- b) The organization shall retain important subgroup and scenario results, uncertainty, known failure modes, drift triggers and fallback evidence. An aggregate accuracy figure shall not replace this evidence.

Table N-2 — AI-specific evidence card

Element	Required content
Purpose and authority	Decision supported; actions allowed; human responsibilities; prohibited uses; affected people and systems.
Domain	Environment; sensors; input ranges; relevant populations; timing; degraded and excluded conditions.
Data	Sources; rights; collection; labeling; quality checks; partitions; leakage prevention; coverage and limitations.
Model	Architecture/type; version; training configuration; preprocessing; thresholds; dependencies; reproducibility.
Evaluation	Independent test design; representative scenarios; rare/challenge cases; metrics; denominators; uncertainty.
Robustness	Invalid/missing inputs; OOD detection; foreseeable misuse; relevant adversarial conditions; fallback.
Deployment	Monitoring; drift; incident handling; rollback; controlled adaptation; update approval.
Decision	Requirement-by-requirement result; unresolved limitations; independent review; authorized operating boundary.

N.3 Acceptance and change-control rules

- a) Performance criteria shall be established before final evaluation and linked to consequences. A model shall meet each mandatory criterion for the intended domain; superior performance on one metric shall not compensate for an unacceptable critical failure rate.
- b) A change to model weights, data, preprocessing, threshold, sensor or deployment environment shall trigger an impact assessment. Safety-relevant adaptation outside the approved envelope shall require renewed assurance. The card shall be updated before the changed configuration is released.

N.4 Informative confusion-matrix example

- a) A synthetic visual-inspection model is evaluated on 1,000 independent labeled cases: 190 true positives, 15 false positives, 10 false negatives and 785 true negatives. Here “positive” means the defect class. These values are examples, not AF or supplier test results.
- b) Precision= $190/(190+15)=92.6829\%$; recall= $190/(190+10)=95.0000\%$; specificity= $785/(785+15)=98.1250\%$; accuracy= $(190+785)/1,000=97.5000\%$; F1=0.938272. The 10 missed defects remain important even when aggregate accuracy is high.

Table N-3 — Synthetic confusion matrix

Actual class	Predicted defect	Predicted non-defect	Total
Defect	190 (TP)	10 (FN)	200
Non-defect	15 (FP)	785 (TN)	800
Total	205	795	1,000

(N-1) Precision = $TP/(TP+FP)$; Recall = $TP/(TP+FN)$; F1 = $2PR/(P+R)$

P and R in the F1 expression denote precision and recall, not probability of product safety. Report undefined metrics explicitly when a denominator is zero.

N.5 Informative uncertainty and challenge-set example

- a) For the 190 successes in 200 defect cases, a two-sided exact 95% binomial interval for recall is approximately [90.997%, 97.577%]. The Wilson interval is approximately [91.042%, 97.262%]. The selected interval method and its assumptions should be reported.
- b) A separate challenge set—not a subset of the 1,000-case evaluation—contains 50 difficult defect cases, of which 38 are detected and 12 missed. Its recall is 76%, with a two-sided exact 95% lower endpoint of about 61.831%. The weak challenge result cannot be hidden by the 97.5% overall accuracy from the other dataset.
- c) An illustrative program criterion might require a lower confidence bound of at least 90% for a particular critical scenario. That hypothetical criterion would not be met by the challenge set. The actual threshold and confidence method must be derived from the program’s hazard and decision basis; this example does not prescribe either.

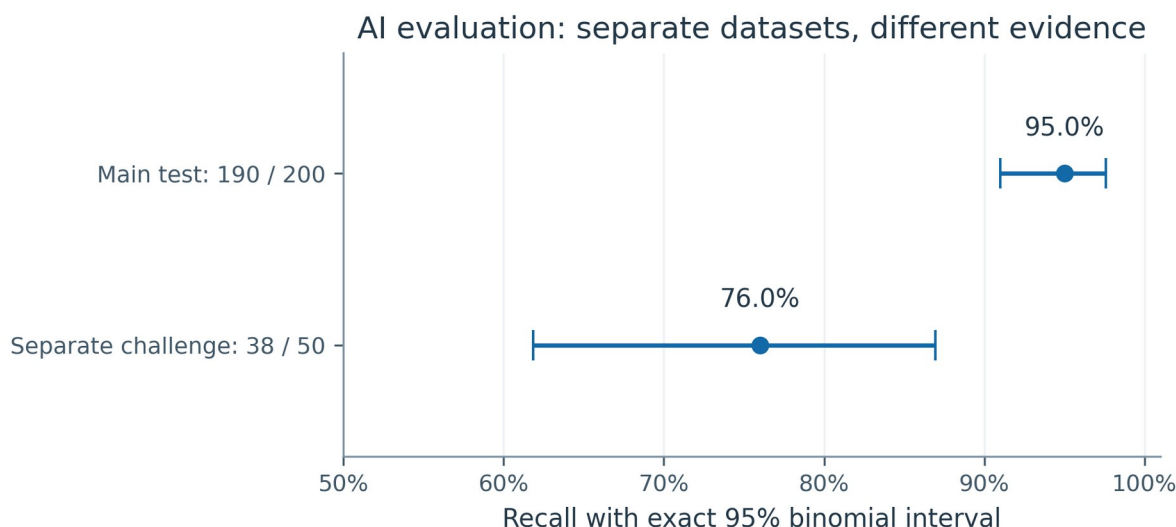


Figure N-1 — Synthetic recall estimates with exact 95% binomial intervals for two separate datasets. The challenge set is independent of, and not a subgroup within, the main example.

N.6 Informative release interpretation

- a) A reviewer should ask whether the model was tested on the actual defect mechanisms, materials, lighting, sensor condition and operating environment. The statistical interval describes sampling uncertainty under the model; it does not cover all uncertainty from bad labels, distribution shift or incomplete scenario coverage.
- b) The release could be restricted to a demonstrated domain with a validated independent inspection path for excluded conditions. Such a restriction needs operational enforcement and monitoring; merely writing a limitation in a model card is not a physical safeguard.

Annex O — Cybersecurity, update and recovery evidence pack

Normative

This annex applies to cybersecurity and integrity responsibilities in Clause 13. It specifies defensible records and decisions, not offensive testing procedures.

O.1 Security evidence baseline

- a) The organization shall maintain the records in Table O-1 for the relevant scope. Evidence shall be versioned and linked to the product, service or infrastructure configuration. Confidential security information shall have controlled access without losing authorized auditability.
- b) The security review shall identify unresolved dependencies and limitations. A security certification or penetration-test report for a different scope shall not establish assurance of the actual deployed system.

Table O-1 — Required security and integrity records

Record	Minimum content
Asset/trust model	Assets, identities, interfaces, zones, data flows, dependencies and trust assumptions.
Threat and impact assessment	Credible threats, exposure, safety/mission consequences, controls and residual decisions.
Access record	Role, identity, privileges, approver, start/end, emergency use and periodic review.
SBOM and dependencies	Components, versions, provenance, known exposure, support status and disposition.
Vulnerability record	Report source, affected versions, severity basis, exploitability context, mitigation, deadline and verification.
Update manifest	Target identity, old/new configuration, origin/integrity evidence, compatibility, authorization and rollback conditions.
Incident record	Timeline, evidence preservation, affected population, containment, communication, root cause and recovery approval.
Recovery test	RTO/RPO basis, backup identity, restoration duration, integrity checks, configuration reconciliation and result.
Crypto-agility record	Algorithms, keys/certificates, support horizon, dependencies, migration needs and verification.
Supplier interface	Access conditions, notification duties, update responsibilities, evidence rights and termination controls.

O.2 Update release checklist

- a) Before update deployment, the organization shall verify the approved build, target compatibility, cryptographic origin/integrity, regression evidence, hazard/security impact and required authorization. The deployment plan shall include interrupted installation and loss-of-power scenarios where relevant.
- b) After installation, the actual version, configuration and protective functions shall be verified. Failed or partial deployment shall remain visible in fleet or asset status. Rollback shall be evaluated for compatibility and vulnerability consequences rather than assumed always safe.

O.3 Incident-to-product linkage

- a) When an incident could affect engineering data, process programs, test records or released products, the organization shall assess the affected technical population. Cyber response and product-quality response shall share a controlled evidence trail.
- b) Return to operation shall require both operational restoration and justified integrity. The authority making that decision shall understand remaining uncertainty. Unverified records shall not be silently reclassified as authentic because the server has been restored.

O.4 Filled illustrative recovery evaluation

- a) Example recovery objectives are RTO=4 hours and RPO=1 hour for a technical-record service. An exercise restores service in 3.2 hours from a backup 45 minutes old. These two objectives are met in the example, but one configuration-link integrity check fails.
- b) The exercise outcome is therefore “service restored; assured use held pending integrity correction”. Passing time objectives does not establish trustworthy evidence. The record retains the failed check, affected records, corrective action and successful repeat verification.

Annex P — Space mission and space-purpose mobility assurance matrix

Normative

This annex applies to Clause 14, including launch/ground interfaces, satellites, exploration systems, in-space services and lunar or planetary mobility. Requirements are selected by actual mission responsibility, not by a generic “space grade” label.

P.1 Mission assurance baseline

- a) The program shall maintain an assurance matrix linking each applicable topic in Table P-1 to requirements, technical basis, evidence, owner and decision gate. Non-applicability shall be justified against the mission concept and interfaces.
- b) The matrix shall be updated for mission extensions, changed orbit or surface environment, alternate launch arrangements, payload changes, software updates and changed end-of-life assumptions. Critical resource margins shall be reconciled with the actual configuration.

Table P-1 — Space assurance evidence matrix

Topic	Required evidence and decision	Typical responsible role
Mission and responsibility	Mission concept, success criteria, system boundary, approval interfaces and responsibilities for launch, space, ground and disposal.	Program technical authority.
Requirements and interfaces	Allocated requirements, interface-control documents, timing, communication, power, mechanical and environmental compatibility.	Systems engineering.
Parts and materials	Approved parts/material list, source traceability, suitability evidence and mission-specific limitations.	Parts/materials assurance.
Radiation and charging	Relevant environment, susceptibility assessment, protection assumptions, verification and residual limitations.	Qualified environment specialist.
Thermal and vacuum	Model credibility, thermal cases, qualification/acceptance rationale and test-article representativeness.	Thermal and test authorities.
Mechanical environment	Launch/transport loads, vibration/shock basis, test configuration, margins and cumulative exposure.	Structures and test authorities.
Contamination	Particulate/molecular or biological controls as applicable, monitoring, integration discipline and excursions.	Contamination authority.
Software and command	Controlled flight/ground software, command authority, authentication, timing, recovery and anomaly response.	Software/security/operations authorities.
Energy and resources	Power/energy budgets, degradation, reserve definitions, safe modes and end-of-life resource needs.	Subsystem and mission authorities.
Reliability and hazards	Failure analysis, common causes, inaccessible repairs, redundant-function assumptions and independent safety argument.	Reliability and safety authorities.
Ground and operations	Ground baseline, telemetry interpretation, rehearsals, staffing, handovers, outages and emergency procedures.	Operations authority.
Tracking and disposal	Assigned coordination duties, disposal concept, failure cases, remaining-resource checks and verified disposition.	Mission operations and compliance.
Human systems	Life-support interfaces, habitability, workload, emergencies and required independent review for human exposure.	Human-systems and safety authorities.
Surface mobility	Terrain/environment basis, dust/thermal effects, autonomous limits, communications delay, energy and recovery.	Surface-system technical authority.
In-space servicing/manufacture	Remote inspection credibility, material/process qualification, capture/interface risks and safe abort.	Servicing/manufacturing authority.

Topic	Required evidence and decision	Typical responsible role
Long-life knowledge	Readable technical records, command history, software reconstruction, supplier exit and continuing support.	Configuration and support authorities.

P.2 Qualification, acceptance and mission readiness

- a) The program shall distinguish qualification evidence supporting the design from acceptance evidence supporting an individual flight or mission article. Differences in configuration, workmanship, environment and accumulated exposure shall be assessed.
- b) Before an irreversible mission action, the decision authority shall confirm required evidence, configuration, critical margins, ground readiness, unresolved anomalies and contingency capability. Waivers or deviations shall identify the exact obligation and authorized acceptance; they shall not erase mandatory approvals.

P.3 Space-purpose automotive and mobile systems

- a) Space-purpose vehicles shall have a requirements basis that addresses actual mission environment and support constraints. Use of automotive components shall include assessment of vacuum, thermal, radiation, dust, lubrication, material compatibility and inaccessible maintenance as relevant.
- b) The vehicle's autonomy, energy and communications shall be evaluated as a coupled mission system. A terrestrial road test may provide useful evidence for a specific mechanism but shall not be represented as complete space qualification. The evidence matrix shall state what transfers and what does not.

P.4 End-of-life and mission-extension decision record

- a) A mission-extension record shall identify current condition, remaining resources, updated environment, changed obligations, failure trends and disposal feasibility. It shall show that continued operation does not silently consume reserves required for a mandatory end-of-life action.
- b) Disposal or retirement evidence shall be retained with configuration and uncertainty. Where direct observation is unavailable, the organization shall identify the inference method and limitations rather than claiming unobserved success as verified.

Annex Q — Aviation and advanced-air-mobility assurance matrix

Normative

This annex applies to Clause 15. It defines evidence interfaces for the organization's actual responsibilities and does not grant airworthiness, maintenance or operational authorization.

Q.1 Aviation responsibility matrix

- a) The organization shall identify its role in design, production, installation, maintenance, operation or support and the relevant approval interfaces. Table Q-1 shall be completed for each applicable product or service family.
- b) Where another entity holds the approval, the organization shall identify the obligations assigned to it and the evidence to be supplied. An assumption that the customer "handles certification" shall not leave technical responsibilities unassigned.

Table Q-1 — Aviation evidence topics

Topic	Required evidence	Release or use restriction
Approval basis	Applicable authority/customer basis, role, approved scope and required submissions.	No claim beyond actual authorization.
Aircraft/equipment configuration	Design baseline, installation interfaces, software, hardware and change status.	No unreviewed mixed or substituted configuration.
Environmental qualification	Applicable temperature, vibration, electrical, electromagnetic and installation effects.	Component evidence valid only for demonstrated conditions.
System safety	Hazards, critical functions, assumptions, failure containment and independent reviews.	Unacceptable residual risk blocks the affected release.
Human interfaces	Crew/operator tasks, alerts, workload, errors, training and emergency validation.	Operational limitations shall be enforceable.
UAS system boundary	Aircraft, control station, links, supporting services, lost-link behavior and remote personnel.	Do not treat aircraft-only evidence as complete UAS evidence.
Advanced mobility energy	Battery/fuel/propulsion integration, degraded modes, ground interfaces and emergency information.	Alternative-energy qualification shall match actual architecture.
Airports and ground support	Service interfaces, equipment compatibility, access, procedures and operational changes.	Use only within verified compatibility and capability.
Maintenance capability	Current data, personnel authorization, tools, parts eligibility and independent checks.	No work outside verified capability/authorization.
Life limits and continuing support	Life consumption, field issues, service instructions, spares and configuration diversity.	Unknown life status requires controlled disposition.
Release documentation	Required authorized release, conformity evidence, restrictions and customer/operator information.	AF assessment does not replace required aviation release.
Safety communication	Notification responsibilities, recipients, acknowledgement and support for affected population.	Do not delay necessary safety information for commercial reasons.

Q.2 Installation and modification acceptance

- a) Installation acceptance shall verify the actual physical and digital configuration, affected interfaces, relevant operating modes and required documentation. Design changes shall include installation, maintenance and operator-information effects.
- b) The organization shall assess whether prior qualification remains representative. Approval for a component or a different installation shall not be carried forward without a justified applicability analysis.

Q.3 Operational and maintenance handover

- a) Handover shall identify approved operating limits, maintenance requirements, life-limited items, software status, open restrictions and emergency information. The receiving organization shall acknowledge information necessary for its assigned responsibility.
- b) Where a remote or distributed service supports flight or maintenance, loss of that service shall be included in contingency validation. The handover shall preserve the ability to identify and support the actual deployed configuration.

Annex R — Defense, maritime and mission-vehicle assurance matrix

Normative

This annex applies to Clause 16 and related support activities. Its focus is lawful industrial quality, safety, evidence integrity and through-life support; it does not specify weapon design or employment.

R.1 Defense program dossier

- a) The organization shall connect contract obligations, technical requirements, controlled-information duties and lifecycle support to named authorities and records. All relevant platform domains and interfaces shall be included.
- b) The assurance dossier shall distinguish technical acceptance, contractual acceptance, security authorization and any required operational approval. One decision shall not be represented as satisfying all four unless the responsible authorities explicitly establish that scope.

Table R-1 — Defense and mission-vehicle evidence topics

Area	Minimum program evidence	Decision focus
Contract and quality assurance	Requirements, source-inspection duties, customer access, evidence rights, release and notification obligations.	Confirm actual contractual responsibilities.
Configuration and mission integration	Platform baseline, payload/service interfaces, software, data and effectivity.	Assess system-level effects of modifications.
Land mobility	Duty cycle, loads, terrain, climate, transport, braking/steering, stability, occupant and maintenance interfaces.	Verify the modified vehicle, not only the base chassis.
Maritime systems	Environmental and operating basis, integrity boundaries, corrosion, machinery, electrical and human interfaces.	Preserve applicable marine/authority requirements.
Air and space components	Applicable aviation/space modules and approval interfaces.	Do not assume defense status removes relevant assurance.
Remote/autonomous operation	Human authority, communication loss, domain limits, safe states, intervention and configuration.	Demonstrate bounded and controllable behavior.
Energy and protection	Energy-system hazards, isolation, containment, emergency support and approved test conditions.	Ensure coupled hazards are addressed.
Manufacturing and authenticity	Qualified critical processes, material origin, sub-tier controls and counterfeit prevention.	Prevent hidden substitutions and unapproved sources.
Controlled information	Classification/handling basis, access, authorized transfer, collaboration and publication review.	Membership or commercial interest does not authorize access.
Training and non-operational states	Transport, storage, maintenance, demonstration and training configurations and safe conditions.	Assess hazards outside nominal mission operation.
Long-life support	Spares, obsolescence, software support, repair data, life status and configuration diversity.	No unsupported “as new” or life-reset claims.
Retirement and disposition	Reuse restrictions, sensitive data, hazardous inventories, disposal and retained records.	Prevent unauthorized re-entry or disclosure.

R.2 Mission-vehicle integration review

- a) For a modified automotive platform, the review shall identify changes in mass distribution, power demand, thermal behavior, structural interfaces, visibility, operator tasks and service access. Program-specific limits and validation shall be established by competent technical authorities.
- b) Any road-use approval, mission qualification and customer acceptance shall be tracked separately. A vehicle shall not be claimed suitable for every jurisdiction, terrain or mission on the basis of an AF system assessment.

R.3 Controlled evidence access and independent review

- a) Where information is restricted, the program shall appoint suitably authorized and competent reviewers and define what evidence may be released. An assessment summary shall identify limitations without disclosing protected technical details.
- b) Independence shall not be abandoned because the program is sensitive. The organization shall establish an authorized challenge path and retain the decision basis in the permitted secure environment.

R.4 Support and configuration reconciliation

- a) Field modifications, replacement parts, cannibalization, software updates and repairs shall be reconciled with the configuration record. Support decisions shall use actual life and condition history.
- b) When evidence is missing, the organization shall record uncertainty and obtain an authorized disposition. A component moved to a new platform shall not inherit an unsupported zero-life or fully qualified status.

Annex S — Heavy-industry commissioning and asset-integrity matrix

Normative

This annex applies to Clause 17. It provides management and evidence requirements for industrial systems; the applicable design and inspection codes remain program-specific controlled obligations.

5.1 Asset and code basis

- a) The organization shall identify the asset boundary, duty, design assumptions, applicable codes, inspection requirements and authorization responsibilities. Changes in intended duty shall be evaluated against the retained design and integrity basis.
- b) Where legacy evidence is incomplete, the organization shall establish a competent assessment plan rather than asserting compliance from continued operation. The plan shall address inaccessible or hidden conditions that can affect integrity.

Table S-1 — Industrial lifecycle evidence

Stage / topic	Required evidence	Gate or hold condition
Design basis	Duty, loads, environment, material basis, codes, protection concept and service life.	Unresolved binding design criteria prevent release.
Procurement	Technical scope, qualified sources, material evidence, inspection and notification requirements.	Unapproved critical source or substitution prevents use.
Fabrication	Qualified procedures/personnel, essential variables, inspections and traceability.	Hidden work not accepted without required evidence.
Installation	Foundation, alignment, anchorage, utilities, access and as-built configuration.	Unverified critical interfaces prevent energization.
Protective functions	Alarms, interlocks, isolation, emergency arrangements and bypass controls.	Failed or unverified protective function blocks affected operation.
Commissioning	Approved sequence, safety review, instrumentation, actual results and anomalies.	Test completion alone does not close failed criteria.
Operational readiness	Training, instructions, maintenance, spares, inspections and responsible operator.	No handover with unresolved blocking capability.
Asset integrity	Degradation mechanisms, inspection methods, intervals, findings and technical dispositions.	Adverse condition triggers restriction or repair assessment.
Modification	Change basis, compatibility, hazard review, requalification and documentation.	Temporary modifications require expiry and restoration control.
Retirement	Isolation, hazardous inventories, structural condition, material/data disposal and records.	Disposition must be verified and obligations assigned.

5.2 Commissioning record and punch-list controls

- a) The commissioning record shall distinguish incomplete construction, failed test criteria, deferred non-critical work and operational restrictions. Each open item shall have an owner, technical consequence, dependent activity and closure evidence.
- b) Items affecting safety, statutory acceptance or a mandatory performance criterion shall not be deferred merely by changing their priority code. Conditional handover shall state exactly what may operate and under which controls.

5.3 Integrity assessment and inspection capability

- a) Inspection methods shall be suitable for the actual degradation mechanism and access condition. Findings shall be interpreted by competent personnel against the applicable technical basis, with uncertainty and limitations stated.
- b) Condition-based maintenance shall not remove a required inspection unless the applicable approval process permits it and the alternative is justified. Monitoring systems shall be checked for sensor health, data integrity and ability to detect the relevant failure mechanism.

5.4 Filled illustrative commissioning disposition

- a) Example: a support facility completes mechanical installation and routine functional checks, but the emergency isolation test fails. The open item is classified as release-blocking for the affected equipment. Training and ordinary performance results do not compensate for that failure.
- b) Release occurs only after correction, retest, independent verification where required, updated as-built information and authorized closure. The example supplies no pressure, load or protection setpoint; those belong to the approved equipment-specific basis.

Annex T — Maintenance, distribution and authorized service-release records

Normative

This annex applies to Clause 21 and to aviation maintenance interfaces in 15.6. It defines maintenance capability, life-status control, chain of custody and authorized service release within the AF framework.

T.1 Service capability record

- a) The service organization shall define its scope, authorized tasks, facilities, people, tools, current data, required parts and release authority. New capability shall be approved only after the actual resources and methods are demonstrated.
- b) The record shall identify legal or customer authorizations separately from AF conformity. A broad corporate scope shall not imply authorization of every mechanic, location or repair method.

Table T-1 — Maintenance and repair evidence

Record	Minimum fields
Receipt and condition	Customer; item identity; configuration; reported defect; physical condition; accompanying history; missing information.
Work scope	Requested tasks; approved technical data; version; limitations; required approvals; estimate and authorization.
Life status	Time/cycles/exposure; life limits; previous repairs; applicability of service information; uncertainty.
Execution	Task sequence; performer; tools; parts removed/installed; process records; inspections; interruptions and handovers.
Independent checks	Required task; independent competent person; method; actual result; discrepancy resolution.
Nonconformity and repair	Finding; technical basis; approval; affected scope; rework/repair; verification.
Final configuration	As-maintained baseline; installed versions; restored protections; removed temporary devices.
Release	Completed requirements; authorized identity; required release document; limitations; next maintenance/life information.
Customer handover	Returned property; records; operating restrictions; acknowledgement where required.
Retention	Data location; period and basis; access; transfer on closure; secure disposal.

Table T-2 — Distribution and split-lot evidence

Stage	Required information and control
Source approval	Actual source, authorized-channel or alternative-source evidence, scope and authenticity risk.
Receipt	Manufacturer/part/lot identity, quantity, condition, certificates, life status and required verification.
Storage	Location, environment, preservation, shelf life, access and segregation of restricted stock.
Split or repack	Original lot, child lot/package identity, quantities, date, performer, certificate linkage and label accuracy.
Order fulfillment	Customer requirements, correct version/condition, required documents and preservation.
Dispatch	Quantity reconciliation, custody, carrier conditions, package identity and delivery evidence.
Recall or suspect stock	Affected original and split lots, shipped customers, remaining stock, notifications and disposition.

T.2 Unknown history and unauthorized parts

- a) Unknown service history, missing life data or unclear source shall be recorded and assessed. The organization shall not reset life or infer eligibility solely from appearance, a successful bench test or an unverifiable certificate.
- b) Suspected unapproved or counterfeit parts shall be isolated, investigated and dispositioned under controlled procedures. Removed parts shall retain identity and status so that scrap or restricted items cannot be mistaken for serviceable stock.

T.3 Filled illustrative split-lot trace

- a) Example: incoming lot L-500 contains 500 fasteners under original certificate C-500. It is split into packages L-500-A (200), L-500-B (200) and L-500-C (100). The record preserves the original manufacturer, lot, specification, certificate and storage history for all three child packages.

- b) If an authenticity concern later affects L-500, the trace identifies every shipped customer and remaining package. A copied certificate is linked to the child quantity but is not edited to imply that the distributor performed the original manufacturer's tests.

T.4 Release and continuing support

- a) Service release shall identify the exact work performed, evidence, limitations, life status and authorized person. A maintenance release shall not imply approval of unrelated systems or a complete vehicle unless that scope was actually assessed and authorized.
- b) After release, newly discovered issues affecting the service action shall be investigated and communicated to affected recipients. Records shall support population identification even when work occurred at temporary or customer locations.

Annex U — Lifecycle inventory, resource efficiency and quantitative claims

Informative

All activity data and factors in this annex are invented for a transparent arithmetic example. They are not country-specific emission factors, supplier measurements or verified environmental performance. The normative claim requirements are in 20.1–20.3.

U.1 Boundary and functional unit

- The example concerns 1,000 manufactured assemblies in one reporting period. The illustrative boundary includes purchased electricity, a fuel input, a material input and inbound transport. It excludes product use and end-of-life. Consequently the result is a partial production inventory, not a complete product lifecycle footprint.
- Before a real comparison, specify the functional unit, system boundary, time and geography, allocation, data quality and excluded activities. An aircraft, vehicle or spacecraft should not be compared with another merely per unit when their useful functions, capacity or service life differ.

Table U-1 — Synthetic inventory calculation

Input	Activity	Assumed factor	Calculated result
Electricity	120,000 kWh	0.35 kg CO ₂ e/kWh	42,000 kg CO ₂ e
Fuel	6,000 L	2.50 kg CO ₂ e/L	15,000 kg CO ₂ e
Material	20,000 kg	1.80 kg CO ₂ e/kg	36,000 kg CO ₂ e
Transport	45,000 tonne-km	0.12 kg CO ₂ e/tonne-km	5,400 kg CO ₂ e
Total for stated boundary	1,000 assemblies	No offset or avoided-emission deduction	98,400 kg CO ₂ e
Intensity for stated boundary	Per assembly	98,400 / 1,000	98.4 kg CO ₂ e per assembly

$$(U-1) E_{\text{total}} = \sum A_i EF_i; \text{ intensity} = E_{\text{total}} / \text{functional output}$$

A_i is the activity quantity and EF_i is the factor with compatible units. State whether factors include upstream effects and prevent double counting between categories.

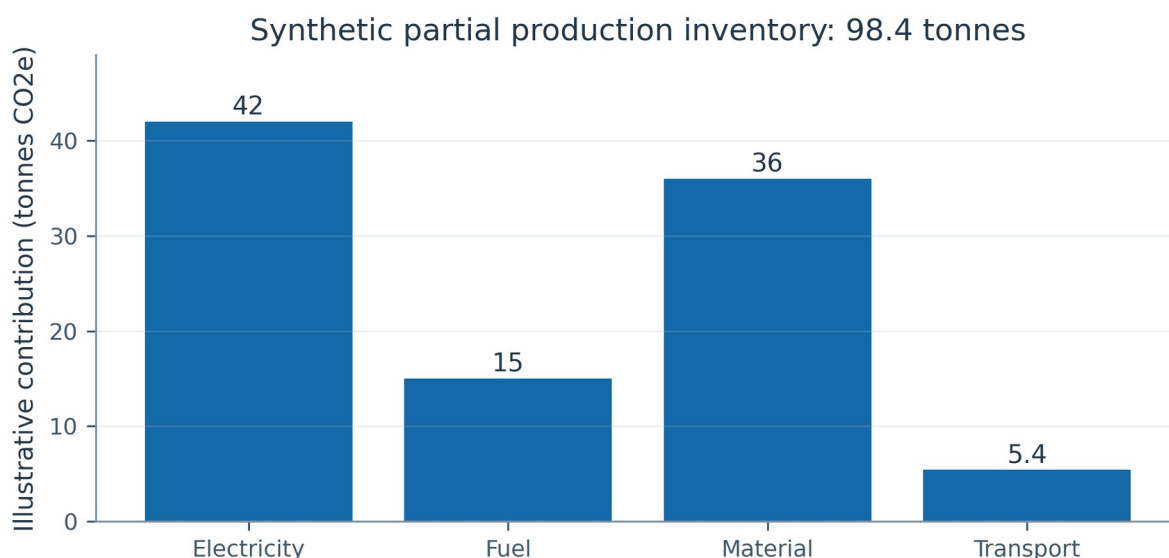


Figure U-1 — Contributions to the synthetic partial inventory. The illustrative factors and boundary do not support a real environmental claim.

U.2 Uncertainty propagation example

- Assume independent relative standard uncertainties of 10%, 8%, 20% and 15% for the four category totals. Their absolute standard uncertainties are 4,200, 1,200, 7,200 and 810 kg CO₂e. Root-sum-of-squares gives 8460.266 kg CO₂e, about 8.598% of the total.
- Under suitable distribution assumptions, an illustrative $k=2$ expanded uncertainty is about 16,920.532 kg CO₂e. Shared factors and common measurement sources could create correlation and change the result. Uncertainty does not account for an omitted major lifecycle stage; boundary incompleteness is a separate limitation.

U.3 Improvement scenario and honest comparison

- Assume electricity use falls from 120,000 to 108,000 kWh while output, boundary and all assumed factors remain unchanged. The calculated reduction is $12,000 \times 0.35 = 4,200$ kg CO₂e, or 4.2683% of the original partial inventory. New total intensity is 94.2 kg CO₂e per assembly.

- b) This scenario is an arithmetic sensitivity, not an achieved improvement. A real claim would require measured comparable activity, consideration of production mix, uncertainty, leakage outside the boundary and any effect on product quality. Offsets and avoided emissions should not be subtracted invisibly from this inventory.

U.4 Resource efficiency and circularity measures

- a) Useful measures include material yield, energy per functional output, scrap recovery, repair success and verified reuse. Definitions should state whether rework, purchased semifinished material, internal recycling and rejected output are included.
- b) An increase in recycled content should be assessed alongside qualification, contamination, service life and process energy. Circularity percentages do not establish that a safety-critical reused component has valid life or provenance. Technical suitability and environmental benefit require separate evidence.

Annex V — Assessment method and complete main-clause evidence index

Normative

This annex supports internal evaluation and the scheme routes in Annexes AA–AJ. The index covers the numbered application and requirement subclauses in Clauses 1–28. Every applicable lettered condition and normative table shall still be evaluated; a short index entry does not replace the full requirement.

V.1 Assessment planning and evidence sampling

- a) The assessor shall establish the object, scope, applicable requirements, sites, functions, products, periods and authorized evidence access. Sampling shall consider criticality, changes, poor performance, process diversity and potential systemic failure. Sample limitations shall be recorded and shall constrain the resulting claim.
- b) Assessment shall combine documented arrangements, interviews, observed work and retained results. The reviewer shall test whether records agree across the lifecycle. A completed questionnaire, certificate or policy statement alone shall not demonstrate implementation.
- c) Organizational evaluation time and coverage shall follow Annex AC. The selected object route shall additionally follow Annex AA, and the actual decision shall follow Annex AD. Confidential evidence shall remain accessible to suitably authorized reviewers; unresolved absence of necessary evidence blocks the dependent conclusion.

Required evidence: Scope and route; approved plan; sample rationale; combined evidence; actual limits and access.

V.2 Findings and requirement-level conclusions

- a) Each finding shall identify the exact requirement, objective evidence, affected scope and gap. Classification shall follow Annex AD. A technical release hold shall be applied where needed irrespective of an administrative grade. Opportunities for improvement shall not conceal nonconformities.
- b) The conclusion shall state conforming, nonconforming, not applicable with approved rationale or not yet demonstrated for each relevant requirement. Aggregate scores shall not offset missing mandatory evidence. The final decision shall identify unresolved issues and the precise scope that the evidence can support.

Required evidence: Requirement-level findings; classification; technical holds; evaluated applicability; clear conclusion.

Table V-1 — Audit and assessment record fields

Field	Minimum required content
Identity and scope	Evaluation ID, date, assessor, object route, entity/person, site, configuration, profile and period.
Requirement	Exact clause and lettered paragraph, normative table condition or profile criterion.
Sample	Records, items, people, sites and periods observed; selection method and limitations.
Evidence	Objective observations, actual results, traceable records and confidentiality controls.
Conclusion	Conforming, nonconforming, approved non-applicability or not yet demonstrated.
Finding and action	Requirement–evidence–gap, grade, extent, protection, cause, actions, owner and original deadline.
Closure and decision	Verified implementation and effectiveness; independent reviewer and decision; actual status and date.

Table V-2 — Main clause-by-clause evidence index

Clause / assessment subject	Minimum evidence to evaluate
1.1 — Organizations and value chains covered	Declared scope and implementation records demonstrating each applicable condition; technical basis and limitations.
1.2 — Products, services, processes and people	Conformity-object register; product and service families; process and personnel scope; external-provider map; selected route and technical profile.
1.3 — Scope statement and mandatory applicability decision	Approved scope; object-route selection; Annex A matrix; exclusions with evidence; interface owners; review triggers and scope-change history.
1.4 — Boundaries of conformity and authorization	Accurate claims and certificate scope; actual authorizations; mark permissions; separation of technical and statutory approvals.
1.5 — System boundaries and hazardous domains	Declared scope and implementation records demonstrating each applicable condition; technical basis and limitations.
2.1 — Self-contained AF requirement basis	Controlled edition; applicable-requirement register; application profile; evidence mapping.
2.2 — Controlled program and application profile	Approved application profile; technical rationale; criteria and methods; obligation register; change controls.
2.3 — Precedence and conflict resolution	Conflict register; affected scope; technical and contractual resolution; controlled amendments to working instructions.
2.4 — Normative annexes and evidence conventions	Annex applicability; complete evidence fields; evaluated conditions; justified non-applicability.

Clause / assessment subject	Minimum evidence to evaluate
2.5 — Edition, time and change control	Edition and amendment register; adoption record; actual decision dates and status history.
2.6 — Engineering judgment and reproducible decisions	Technical judgments; verified computations; assumptions and limitations; independent review when required.
3.1 — Interpretation and evidence convention	Consistent use of defined terms and conventions in profiles, procedures, records and public claims.
4.1 — Context, operating environment and emerging conditions	Context register; climate-relevance decision; assumptions; review minutes; resulting changes to objectives, hazards or controls.
4.2 — Interested parties and public-interest interfaces	Interested-party register; obligation classification; communication responsibilities; conflict resolutions.
4.3 — System scope, boundaries and responsibility	Scope statement and Annex A matrix; interface agreements; new-capability review; updated external claims.
4.4 — Processes and their interactions	Process architecture; process-owner definitions; operating criteria; interaction records; process metrics and improvement actions.
4.5 — Obligation and commitment register	Controlled obligation register; change assessments; authorized evidence-access arrangements.
5.1 — Executive accountability and customer focus	Executive reviews; resource decisions; commitment reviews; balanced performance measures and escalations.
5.2 — Policy and measurable commitments	Approved policy; communication records; observed application; linked objectives.
5.3 — Roles, management representative and independence	Authority matrix; management-representative appointment; independence arrangements; delegation register.
5.4 — Ethical behavior and quality culture	Behavior code; reporting channels; investigation records; incentive review; culture evaluation and actions.
5.5 — Stop-work and release protection	Stop-work instruction; hold records; restart criteria and authorized decisions.
5.6 — Governance of claims and external relationships	Claim-approval process; supporting evidence; conflict disclosures; correction records.
6.1 — Risk planning and acceptance	Risk register; hazard analyses; acceptance criteria; control verification; residual-risk decisions and triggers.
6.2 — Opportunity planning as a distinct activity	Opportunity register; selected initiatives; benefit evaluations; associated risk assessments.
6.3 — Objectives and execution plans	Objective plans; metric definitions; baseline data; progress reviews and decisions.
6.4 — Management-system and operational changes	Change requests; impact assessments; approvals; training; implementation and post-change verification.
6.5 — Resilience and continuity planning	Business-impact analysis; continuity plans; exercise results; approved recovery and restart evidence.
6.6 — Technology maturity and future readiness	Technology evidence dossier; experiment approvals; readiness gap list; transition-gate decisions.
7.1 — Resource and capacity assurance	Capacity reviews; staffing and equipment plans; constraint decisions; lifecycle-support commitments.
7.2 — Competence, qualification and authorization	Role competence criteria; assessments; qualifications; task-authorization register; reassessment records.
7.3 — Awareness and human-performance conditions	Awareness evaluation; human-factor assessments; shift handover and error-prevention controls.
7.4 — Infrastructure, utilities and facility integrity	Infrastructure register; maintenance and commissioning records; utility limits; facility change reviews.
7.5 — Work environment, cleanliness and contamination	Environmental specifications; monitoring logs; excursion investigations; cleanliness verification.
7.6 — Measuring equipment and metrological traceability	Equipment register; calibration chain; recall system; uncertainty suitability; impact and disposition records.
7.7 — Measurement methods, uncertainty and decision rules	Method-validation records; uncertainty budgets; decision rules; automated inspection challenge results.
7.8 — Organizational knowledge and technical continuity	Knowledge map; succession and transfer records; lessons database; reuse applicability reviews.
7.9 — Communication and controlled information exchange	Communication matrix; notification and acknowledgement logs; approved information-sharing arrangements.
7.10 — Document creation, approval and distribution	Document master list; approval workflow; distribution controls; point-of-use verification.

Clause / assessment subject	Minimum evidence to evaluate
7.11 — Record integrity, retention and long-life readability	Retention schedule; signature controls; audit trails; migration and restore tests; authorized disposal records.
7.12 — Technical software, spreadsheets and decision tools	Tool inventory; validation plan and known-answer tests; version records; review and revalidation triggers.
8.1 — Integrated operational planning	Program assurance plan; work packages; control plans; integrated schedule; baseline consistency review.
8.1.1 — Operational risk management	Program risk register; mitigation verification; residual-risk acceptance; changes based on new evidence.
8.1.2 — Configuration management	Configuration plan; item hierarchy; baselines; change board decisions; status accounting; configuration audits.
8.1.3 — Product safety and mission-critical controls	Hazard log; safety-control traceability; independent reviews; safety communications; in-service event assessments.
8.1.4 — Counterfeit and unapproved-item prevention	Authenticity-risk assessment; approved sources; incoming verification; suspect-item records and disposition.
8.1.5 — Temporary and permanent work transfer	Transfer plan; receiving-site readiness; qualification evidence; initial-output monitoring and closure.
8.2 — Requirements for products and services	Requirement lifecycle; agreed baseline; review and change records.
8.2.1 — Customer and user communication	Communication arrangements; technical clarifications; complaints; user-information distribution.
8.2.2 — Requirement determination and completeness	Requirements register; assumptions; applicable obligations; acceptance definitions; identified special requirements.
8.2.3 — Contract and commitment review	Multifunctional contract review; feasibility evidence; resolutions; approved deviations from the proposed offer.
8.2.4 — Changes to requirements	Requirement-change record; impact analysis; baseline update; implementation and acknowledgement evidence.
8.3 — Design and development	Design scope and responsibility; controlled inputs; review, verification, validation and changes.
8.3.1 — Design and development governance	Design process; responsibility allocation; design-data acceptance; escalation of ambiguities.
8.3.2 — Design planning and lifecycle controls	Design plan; interface agreements; review schedule; V&V strategy; required independence.
8.3.3 — Design inputs and derived requirements	Approved input baseline; derivation rationale; assumption register; conflict resolutions.
8.3.4 — Design review, verification and validation	Review records; requirements-to-evidence matrix; approved test plans; raw data; model credibility; anomaly dispositions.
8.3.5 — Design outputs and release	Released design package; critical-characteristic list; approval; downstream usability review.
8.3.6 — Design changes and continued validity	Change request; impact analysis; requalification decision; approvals; affected-item and implementation records.
8.4 — Externally provided products, processes and services	External-provider scope; approval, verification and flow-down evidence.
8.4.1 — External-provider selection and approval	Supplier evaluations; approval register; performance reviews; conditional approvals; sub-tier dependency map.
8.4.2 — Verification of externally provided outputs	Incoming verification plans; report checks; delegated inspection controls; restricted-release and recall records.
8.4.3 — Purchasing information and flow-down	Purchase-order clauses; technical-data issue record; sub-tier acknowledgement; flow-down verification.
8.5 — Production and service execution	Controlled work routes; actual execution; identity, preservation, support and change records.
8.5.1 — Controlled production and service execution	Controlled route or work package; process records; in-process verification; quantity reconciliation; FOD and utility controls.
8.5.1.1 — Equipment, tooling and production software	Tool and software qualification; controlled programs; maintenance; storage checks; revalidation records.
8.5.1.2 — Special-process validation and control	Special-process qualification dossier; approved parameter ranges; operator qualifications; run records; requalification decisions.
8.5.1.3 — Production-process and first article verification	First article record; characteristic accountability; material/process evidence; differences and repeat-verification rationale.
8.5.2 — Identification, status and traceability	Identity scheme; genealogy records; status controls; signature register; forward and reverse trace exercises.
8.5.3 — Customer and external-provider property	Property register; receipt checks; access controls; condition and incident records.

Clause / assessment subject	Minimum evidence to evaluate
8.5.4 — Preservation, packaging and transport	Preservation specifications; packaging qualification; environmental history; shelf-life controls; excursion dispositions.
8.5.5 — Post-delivery support and field feedback	Support plan; service information; field reliability data; notifications; off-site work controls.
8.5.6 — Production and service changes	Process-change record; technical impact; approvals; temporary controls; changed-output verification.
8.6 — Acceptance and authorized release	Release checklist; acceptance results; closed or authorized issues; delivery dossier; release authorization.
8.7 — Nonconforming outputs and escape control	NCR; material review decisions; population trace; notifications; repair/rework verification; scrap control.
9.1 — Monitoring strategy and data credibility	Monitoring plan; metric dictionary; source reconciliations; data-quality checks; action records.
9.2 — Customer satisfaction and external feedback	Feedback records; segment analysis; improvement plans; effectiveness evaluations.
9.3 — Internal audit program	Risk-based audit program; competence and independence; plans; evidence trails; findings; closure verification.
9.4 — Management review inputs	Review agenda and input pack; trend analyses; independent assurance concerns; status of prior actions.
9.5 — Management review decisions and follow-through	Recorded decisions; action ownership; resource commitments; follow-up and effectiveness evidence.
9.6 — Independent assurance and systemic challenge	Independent-review plan; challenge records; dissent resolution; release recommendations.
10.1 — Response to nonconformity and containment	Response record; containment scope; trace results; effectiveness checks; preserved evidence.
10.2 — Cause analysis and corrective action	Evidence-based cause analysis; occurrence and escape controls; action plan; systemic extent; effectiveness results.
10.3 — Continual improvement and preventive learning	Improvement portfolio; baseline and outcome evaluation; change assurance; retained learning.
10.4 — Learning across the lifecycle and network	Indexed lessons; applicability reviews; supplier communication; recurrence and uptake assessment.
11.1 — Mission and concept definition	Mission concept; scenario catalogue; boundary assumptions; success and safe-state criteria.
11.2 — Requirements decomposition and interface control	Requirement allocation; interface-control documents; integration assumptions; cross-interface verification.
11.3 — Assurance planning and lifecycle gates	Gate plan; review packages; decision records; conditions and verified closure.
11.4 — Reliability, availability and maintainability	RAM plan; models and assumptions; test plan; field exposure; repair-time and downtime definitions.
11.5 — Hazard analysis and assurance case	Assurance case; hazard log; analysis rationale; evidence index; limitations and independent challenge.
11.6 — Verification strategy and model credibility	Verification matrix; method-selection rationale; model-credibility dossier; approved extrapolations.
11.7 — Technical budgets and margin management	Budget register; margin definitions; allocation history; uncertainty and change assessments.
11.8 — Integrated readiness and handover	Integrated readiness review; handover dossier; receiving acknowledgement; long-life support arrangements.
12.1 — Digital lifecycle and architectural assurance	Digital lifecycle plan; allocated requirements; architecture; fault-containment and timing analyses.
12.2 — Implementation, review and build control	Source and review records; build manifest; dependency inventory; reproducibility and artifact identity checks.
12.3 — Verification, test coverage and independence	Verification plan; traceable tests; coverage analysis; anomaly disposition; target-representativeness assessment.
12.4 — AI and machine-learning use-case governance	AI use-case inventory; intended-use statement; alternatives assessment; authority limits; oversight validation.
12.5 — Dataset quality, lineage and evaluation design	Dataset manifest; labeling assurance; partition controls; scenario coverage; stratified evaluation and uncertainty.
12.6 — Model release, drift and bounded adaptation	Model release card; drift thresholds and rationale; fallback tests; update approvals; monitoring records.
12.7 — Generative AI and engineering evidence	Approved use cases; data-access rules; review records; verified calculations and references.

Clause / assessment subject	Minimum evidence to evaluate
12.8 — Digital twins, MBSE and model-based acceptance	Model authority map; twin identity and update controls; validation; model-based acceptance rationale.
12.9 — Long-term digital maintainability and obsolescence	Digital support plan; escrow or access arrangements where needed; migration tests; obsolescence decisions.
13.1 — Security scope and integrated risk assessment	Asset and trust-boundary inventory; threat assessment; safety-security interface decisions.
13.2 — Identity, access and privileged actions	Access matrix; privileged approvals; identity lifecycle; emergency-access reviews.
13.3 — Secure development and supply-chain integrity	Secure-development plan; SBOM; dependency reviews; vulnerability decisions and mitigations.
13.4 — OT and connected-production safeguards	OT architecture; authorized connections; patch assessments; compensating controls; restoration tests.
13.5 — Secure updates, rollback and cryptographic agility	Update architecture; signed release manifest; interruption and rollback tests; cryptographic inventory and migration plan.
13.6 — Security testing and vulnerability handling	Authorized test plans; results; vulnerability register; remediation verification; customer communication.
13.7 — Incident response and recovery assurance	Incident plan; exercise records; RTO/RPO basis; integrity verification; return-to-service decision.
14.1 — Space program and mission-product assurance	Space assurance plan; mission interface allocation; environmental and lifecycle assumptions; gate evidence.
14.2 — Space environment and qualification rationale	Environmental specification; qualification matrix; test-article differences; margin and exposure rationale.
14.3 — Components, materials and contamination control	Parts and materials lists; environmental suitability; contamination plan; applicable protection-control evidence.
14.4 — Ground segment, command and mission operations	Ground-segment baseline; command-authority rules; rehearsals; anomaly procedures; telemetry interpretation limits.
14.5 — Orbital responsibility and end-of-life planning	Responsibility allocation; disposal concept; resource budgets; failure cases; end-of-life decision and verification records.
14.6 — Human spaceflight and habitation interfaces	Human-system requirements; life-support interface assurance; emergency scenarios; independent review; integrated validation.
14.7 — Surface mobility, in-space servicing and manufacturing	Surface or servicing concept; environment-specific qualification; remote acceptance strategy; safe-state and evidence limitations.
15.1 — Airworthiness and operational approval interfaces	Approval-interface matrix; assigned obligations; change and repair approvals; supporting evidence.
15.2 — Aircraft and equipment integration	Installation assessment; integration verification; affected-system analysis; updated support data.
15.3 — Unmanned and remotely operated systems	System-level UAS assessment; domain definition; link-loss tests; workload and contingency validation.
15.4 — Electric, hybrid and hydrogen aviation	Integrated energy-hazard assessment; architecture qualification; degradation limits; ground-support and emergency information.
15.5 — Airports, ground support and air-navigation services	Service assurance plan; interface compatibility; change assessments; maintenance and operational verification.
15.6 — Continuing airworthiness and aviation maintenance	Capability list; approved maintenance data; personnel authorization; life-status records; maintenance release evidence.
16.1 — Defense program assurance and contractual obligations	Defense assurance plan; contractual obligation matrix; access arrangements; approval responsibilities.
16.2 — Multi-domain platforms and interfaces	Cross-domain interface baseline; integration tests; safe-state definition; authorized test controls.
16.3 — Defense-purpose road and off-road vehicles	Vehicle duty profile; integration impact assessment; configuration-specific qualification; maintenance and transport limits.
16.4 — Maritime platforms and underwater systems	Maritime requirement basis; critical-boundary records; process and inspection evidence; deterioration-management plan.
16.5 — Autonomy, remote systems and human authority	Authority model; domain constraints; intervention validation; simulation limits; change and release records.
16.6 — Controlled technology, ethics and supply integrity	Controlled-technology review; authorized access; due diligence; ethical escalation and disposition.
16.7 — Long-life support and obsolescence	Support and obsolescence plan; substitution approvals; field configuration; life and refurbishment records.
17.1 — Industrial system boundary and lifecycle integrity	Asset design basis; boundary drawings; applicable-code register; lifecycle responsibility allocation.

Clause / assessment subject	Minimum evidence to evaluate
17.2 — Mechanical integrity and essential services	Integrity-management plan; equipment dossiers; degradation assessments; override and temporary-repair controls.
17.3 — Fabrication, installation and construction interfaces	Fabrication and installation records; hidden-work inspections; alignment and interface checks; as-built configuration.
17.4 — Commissioning and operational readiness	Commissioning plan; test records; protective-function verification; open-item disposition; handover acceptance.
17.5 — Asset inspection and condition-based maintenance	Inspection strategy; condition data; detection capability; remaining-life or repair decisions; interval review.
17.6 — Industrial modernization and decommissioning	Modernization assessment; verified legacy baseline; decommissioning plan; disposition and transfer records.
18.1 — Material and process specification control	Material specifications; batch certificates and verification; substitution approvals; storage and life records.
18.2 — Metals, castings, forgings and heat treatment	Process qualification; batch and thermal records; representative test evidence; repair approvals.
18.3 — Composites, polymers, adhesives and bonded structures	Composite or bond qualification; constituent genealogy; process history; inspection capability; change review.
18.4 — Additive and digitally driven manufacturing	Build qualification; feedstock history; signed build package; monitoring validation; post-process and acceptance records.
18.5 — Electronics, semiconductors and interconnections	Component assurance plan; approved parts list; assembly qualification; configuration and screening evidence.
18.6 — NDT, inspection capability and probability of detection	NDT procedure qualification; personnel authorization; reference-artifact control; detection capability and limitations.
18.7 — Surface engineering, cleanliness and contamination-sensitive products	Surface-process qualification; bath or chemical controls; test results; cleanliness criteria and records.
19.1 — Energy-system boundary and coupled hazards	Energy-system architecture; integrated hazard analysis; lifecycle controls; specialist approvals.
19.2 — Electrical storage and battery systems	Battery configuration; qualification basis; life and condition data; protection verification; reuse assessment.
19.3 — Hydrogen, fuels and chemical-energy systems	Compatibility assessment; containment and protection evidence; supply controls; authorized procedures.
19.4 — Propulsion and rotating-machinery assurance	Operating-envelope basis; critical-part genealogy; qualification and acceptance; life-management records.
19.5 — Hazardous tests and emergency preparedness	Test safety review; readiness approval; abort rules; anomaly evidence; restart and reuse decisions.
20.1 — Lifecycle environmental responsibilities	Lifecycle aspect register; obligations; action plans; integrated change assessments.
20.2 — Quantification and credible environmental claims	Inventory model; data sources; factors and editions; uncertainty; claim review and verification status.
20.3 — Circularity, repair and responsible material recovery	Repair and recovery strategy; life-status controls; qualification of reused inputs; secure disposition records.
20.4 — Human-system integration and ergonomics	Human-system requirements; representative evaluations; workload and error analyses; design decisions.
20.5 — Worker competence, health and safe work interfaces	Work-risk interfaces; competence and contractor controls; incident learning; emergency arrangements.
20.6 — Responsible innovation and future-technology review	Responsible-innovation review; evidence gap assessment; bounded-deployment plan; claim approval.
21.1 — Service scope and new-capability approval	Service capability list; new-capability review; applicable authorizations; activity-based scope.
21.2 — Maintenance planning and execution	Maintenance package; current-data verification; handovers; parts traceability; post-maintenance verification.
21.3 — Repair, overhaul and remanufacture	Repair basis; condition assessment; process records; remaining-life decisions; release limitations.
21.4 — Distribution, stock splitting and chain of custody	Source verification; split-lot records; stock status; certificate linkage; customer delivery evidence.
21.5 — Logistics, storage and remote support	Logistics plan; custody records; excursion assessments; remote-support authorization and advice records.
21.6 — Retirement, disposal and record handover	Retirement plan; material and data disposition; record-transfer arrangements; disposal verification.
22.1 — Conformity evidence dossier	Object-specific dossier; applicable requirement set; evidence index; configuration and population coverage; limitations.

Clause / assessment subject	Minimum evidence to evaluate
22.2 — Evaluation, review and decision separation	Assignment matrix; competence and conflict checks; evaluation record; independent review and decision identities.
22.3 — Criteria, sampling and findings	Evaluation plan; sample rationale; objective evidence; requirement-linked findings; assessed limitations.
22.4 — Decision conditions and release blockers	Requirement-by-requirement conclusion; finding closure; blocker check; reasoned and dated decision.
22.5 — Statements, certificates and mark use	Approved claim text; certificate data; mark permission; actual recognition scope where claimed.
22.6 — Continuing validity and changes	Change notifications; surveillance findings; renewal evidence; current and historical status records.
22.7 — Complaints, appeals and corrective communication	Case records; independent reviewer appointment; reasoned outcomes; affected-population action and communication.
22.8 — Scheme operation and competence attestations	Operator authority; body competence evaluation; written scope; independent decision; accurate accreditation and authorization claims.
23.1 — Product identity, families and intended application	Product definition; configuration baseline; family matrix; variant-difference and representativeness analyses.
23.2 — Product application profile and acceptance plan	Approved product profile; characteristic-to-method matrix; qualification and acceptance distinction; unresolved-input decisions.
23.3 — Design qualification and integration evidence	Qualification dossier; test-article differences; system-interface verification; validated support assumptions.
23.4 — Production, unit and lot acceptance	Unit or lot dossier; critical characteristics; sampling decision; controlled departures; final release record.
23.5 — Changes, family extensions and digital updates	Change-impact record; evidence reuse rationale; repeated qualification; instance effectivity; updated scope.
23.6 — Product statements, labeling and user information	Approved claim and label master; mark authorization; traceable labeling records; user-information delivery.
23.7 — In-service evidence, corrective campaigns and retirement	Field data and exposure; affected-population analysis; campaign records; verified completion; retirement and reuse decisions.
24.1 — Service catalog, boundary and responsibility	Service catalog; service profile; dependency and responsibility map; controlled exclusions.
24.2 — Service design and measurable outcomes	Requirements and metrics; capacity assumptions; validated service design; customer-interface results.
24.3 — Delivery planning and competent execution	Service work package; competence and readiness checks; current inputs; handovers and escalation records.
24.4 — Service acceptance and performance decisions	Actual outcome records; acceptance decision; metric calculations and exclusions; critical-event review.
24.5 — Digital services, data and external platforms	Digital service architecture; data and access agreements; supplier controls; recovery and integrity verification.
24.6 — Continuity, disruption and customer protection	Continuity plan; exercised recovery; qualified alternatives; affected-output analysis; customer notifications.
24.7 — Service change, completion and exit	Change and transition approvals; revised scope; service completion dossier; property/data handover and access closure.
25.1 — Process identity, scope and essential variables	Process definition; essential-variable register; qualified family rationale; interface controls.
25.2 — Qualification strategy and demonstration	Qualification plan; representative results; method suitability; failed-run disposition; approved process window.
25.3 — Capability, stability and statistical interpretation	Study design; data and model assumptions; stability review; capability calculation; justified alternative evidence.
25.4 — Operating approval and release for use	Process approval record; released instructions; authorization and limitations; ongoing acceptance controls.
25.5 — Monitoring, drift and excursions	Monitoring records; reaction plan; affected-population trace; technically justified disposition and restart.
25.6 — Changes, transfer and requalification	Requalification trigger review; transfer readiness; retained-evidence rationale; actual receiving-site results.
25.7 — Process records, traceability and retirement	Traceable process history; automated-data verification; withdrawn approval controls; preserved lifecycle evidence.
26.1 — Role analysis and competence criteria	Job/task analysis; role profile; required competences; relevant prerequisites and assessment methods.
26.2 — Development and verified competence	Gap assessment; development activities; observed demonstration; competent assessor conclusion.

Clause / assessment subject	Minimum evidence to evaluate
26.3 — Personnel certification and fair assessment	Published role profile; candidate information; validated assessment; fair-access arrangements; decision rationale.
26.4 — Employer task authorization and supervision	Task-authorization register; scope and limitations; competence and license checks; supervision arrangements.
26.5 — Continued competence and reassessment	Practice and development record; performance review; reassessment; renewal and inactivity decisions.
26.6 — Restriction, suspension and restoration	Protective action; affected-work review; reassessment; reasoned restoration or withdrawal; status updates.
26.7 — Personnel records and responsible use of credentials	Protected competence dossier; current credential status; accurate claims; controlled access and retention.
27.1 — Retained accountability and actual performers	Performer and sub-tier map; responsibility matrix; documented delegations and retained decisions.
27.2 — Qualification, risk and source status	Scope-specific supplier dossier; risk assessment; source-status conditions; verified closure and approval.
27.3 — Contractual flow-down and acknowledgement	Reviewed purchase scope; flow-down matrix; performer acknowledgement; resolved ambiguities.
27.4 — Ongoing oversight and delegated verification	Surveillance plan; performance trends; witnessed and verification records; delegation reviews and affected-output checks.
27.5 — Changes and further subcontracting	Change notices; approved sub-tier use; emergency restrictions; receiving capability and requalification.
27.6 — Escapes, continuity and controlled exit	Population trace; notifications; joint corrective action; continuity and termination record; preserved evidence.
28.1 — Legal responsibility, resources and impartiality	Legal and governance records; resource and liability arrangements; impartiality analysis; conflict decisions.
28.2 — Competence by function and technical scope	Competence criteria; witnessed assessments; role and technical-scope authorizations; performance monitoring.
28.3 — Valid methods, equipment and technical evidence	Method and equipment records; validity checks; raw and processed results; subcontracted-evidence evaluation.
28.4 — Independent review and final decision	Independent review; conflict-free decision authorization; recorded rationale; actual decision date.
28.5 — Outsourced evaluators and supporting services	External-personnel agreements; verified competence; technical review of external evidence; retained responsibility.
28.6 — Information, complaints and continuity	Protected records; status controls; complaint and appeal outcomes; provider continuity and closure arrangements.
28.7 — CAB competence route and limits of accreditation	CAB evaluation and witnessing; independent decision; exact authorized scope; accurate accreditation and recognition claims.

Table V-3 — Normative annex coverage register

Annex	Assessment coverage
A	Scope and activity-based applicability matrix
B	Criticality classification and assurance tailoring
C	Lifecycle-gate evidence and transition decisions
D	Requirements, configuration and digital evidence data model
J	Supplier qualification, surveillance and flow-down package
K	First article and production-readiness verification
L	Special-process qualification and requalification dossier
M	Verification, environmental testing and qualification records
N	Software and AI assurance cards with worked metrics
O	Cybersecurity, update and recovery evidence pack
P	Space mission and space-purpose mobility assurance matrix
Q	Aviation and advanced-air-mobility assurance matrix
R	Defense, maritime and mission-vehicle assurance matrix
S	Heavy-industry commissioning and asset-integrity matrix
T	Maintenance, distribution and authorized service-release records
V	Assessment method and main-clause evidence
W	Nonconformity and corrective-action record with completed example
Y	AF interpretation, amendment and publication control
AA	Assessment scheme architecture and object-specific conformity routes

Annex	Assessment coverage
AB	Auditor, technical expert, reviewer and decision-maker competence
AC	Audit planning, audit time, multisite coverage and remote methods
AD	Conformity decision rules, findings and release controls
AE	Personnel assessment, examinations and task authorization
AF	Subcontracting, outsourced work and flow-down control package
AG	Surveillance, renewal, status and mandatory time limits
AH	Assessment-body, laboratory and competence-attestation controls
AI	Complaints, appeals, impartial review and case administration
AJ	Controlled forms, record dictionary and consistency matrix

For Annex N, only N.1–N.3 and their required record tables are normative; the numerical worked examples are informative. For Annex AJ, required record fields and controls are normative, while filled sample values are informative.

V.3 Integrated audit trail and sample expansion

- a) An assessor may select a delivered serial, service event or task authorization and trace it backward through release, requirements, configuration, process, competent performer, measurement and external source. The assessor shall then trace relevant changes, field issues or complaints forward through population identification and corrective action.
- b) When records disagree, the assessor shall expand the trail according to the potential extent and consequence. One successfully traced item does not verify the whole population. An apparent completeness score shall not conceal absent actual measurements, unverified qualifications or unresolved configuration changes.

Required evidence: Complete backward/forward trail; consistency checks; expanded samples; evaluated population limitations.

Annex W — Nonconformity and corrective-action record with completed example

Normative

The required process and record fields are normative. The completed case is illustrative and does not describe an actual organization or product.

W.1 Required corrective-action sequence

- a) The organization shall record the detected issue, protect affected outputs, determine the extent, preserve evidence, establish causes, implement actions and verify effectiveness. The response shall address both the occurrence of the defect and the failure of controls to prevent escape.
- b) Closure shall not be based solely on training attendance, a revised procedure or the action owner's statement. The organization shall define evidence showing that causes were addressed and controls remain effective under representative conditions.

Table W-1 — Complete NCR/CAPA record requirements

Stage	Required record content
Identification	NCR ID, date, reporter, requirement, item/process, configuration, actual evidence and initial consequence.
Containment	Affected population, immediate controls, stock/delivery status, responsible person, notifications and effectiveness.
Extent	Related lots/serials/sites/suppliers/configurations; trace method; uncertainty and expanded search.
Disposition	Correction, rework, repair, return, concession or scrap; design/customer/authority approvals as applicable.
Cause	Evidence-supported occurrence and escape causes; tested hypotheses; human/system factors; rejected explanations.
Actions	Action tied to each cause, owner, due date, resources, affected documents/tools/suppliers and change approval.
Verification	Implementation evidence, pre-defined effectiveness criterion, sample/exposure, results and adverse side effects.
Systemic learning	Risk updates, similar processes, supplier flow-down, knowledge transfer and recurrence monitoring.
Closure	Independent review where necessary, residual limitations, final authority and reopened conditions.

W.2 Completed synthetic case — measurement offset

- a) Case NCR-026 concerns a dimensional characteristic measured using an automated fixture. A periodic independent check identifies a 0.012 mm offset after fixture maintenance. The applicable procedure required a reference check after maintenance, but the work-order system did not trigger it. The issue is not closed by recalibrating the fixture.
- b) Containment holds 240 items measured since maintenance; 90 remain on site and 150 are traceable to two customers. The responsible team preserves raw measurements, fixture settings and maintenance records and notifies recipients according to the assessed consequence and applicable obligations. No assumption is made that all 240 items are defective.

Table W-2 — Filled corrective-action case

Step	Recorded result
Requirement and evidence	Post-maintenance reference check required by WI-MET-08 rev D; no check record for event M-114; independent comparison shows 0.012 mm offset.
Containment	Hold 90 on-site items; notify two recipients of 150 shipped items; identify exact serial range and related jobs.
Extent assessment	Trace confirms 240 potentially affected items. Independent remeasurement finds 8 outside the actual product limit; remaining results are assessed under the approved decision rule.
Occurrence cause	Fixture datum was reset incorrectly during maintenance; the setup allowed an undetected offset.
Escape cause	Maintenance event classification did not generate the mandatory metrology hold; production release checked only calendar calibration status.
Correction/disposition	Restore and verify fixture datum; disposition 8 nonconforming items through authorized technical review; record customer actions and remeasurement evidence.
Corrective action 1	Interlocked reference verification required after the relevant maintenance event before measurement results can support release.

Step	Recorded result
Corrective action 2	Maintenance classifications and release checks revised; challenge test confirms that a missing check blocks release.
Corrective action 3	Review similar fixtures and maintenance workflows; extend controls to two additional affected process families.
Effectiveness plan	Independently observe the next 10 relevant maintenance events and 100 post-maintenance measurements; verify hold behavior and measurement validity.
Example effectiveness outcome	All 10 events generated the required hold and valid reference check; 100 independent comparisons met the pre-approved method criterion; no bypass observed.
Closure and limitation	Technical and quality reviewers approve closure; continued trend monitoring remains active. The sample does not prove recurrence is impossible.

W.3 Recurrence and ineffective action

- a) Recurrence or failure of an effectiveness check shall reopen the analysis and trigger review of related assumptions, resource decisions and management controls. A new due date alone shall not be treated as corrective action.
- b) The organization shall identify whether earlier closures relied on inadequate evidence, narrow population scope or untested human-factor assumptions. Lessons shall be incorporated into new-program and change reviews.

Annex X — Implementation, transition and continual-assurance roadmap

Informative

This annex provides an implementation approach for this edition. The phases are guidance, not mandatory elapsed durations, promises of certification or claims that a particular organization has already adopted the standard.

X.1 Scope-led implementation

- Begin with actual products, services, processes, people, sites and responsibilities. Select the object routes and technical modules, establish criticality and create a controlled applicability matrix. Reuse effective existing controls when they satisfy the actual AF requirements; do not replace sound practice solely to change terminology.
- A mature organization may focus on gaps in digital evidence, technical profiles, competence, object boundaries and independent decisions. A new organization may first need operational capacity, current work instructions, valid measurement and verified personnel. Implementation should reflect actual evidence rather than a uniform template schedule.

Table X-1 — Implementation work packages

Phase	Work to complete	Evidence of completion
Scope and gap assessment	Select routes, sites, responsibilities, criticality, modules and profiles; compare actual practice with applicable requirements.	Approved scope and evidence-based gap register.
Governance and capability	Assign responsibilities, independence, resources, competence, data and change controls.	Working authorizations, current instructions and demonstrated capability.
Operational connection	Link requirements, design, sources, processes, people, verification and release.	A traceable actual product or service dossier with functioning hold controls.
Technical profiles	Define and approve product, service, process, personnel and provider criteria and methods.	Technically justified profiles with measurable criteria and no unresolved essential definitions.
Object-specific evaluation	Implement product qualification, service validation, process demonstration and personnel assessment as applicable.	Representative results, corrected failures and explicit limitations.
Internal evaluation	Complete risk-based internal audits and management review; verify corrective effectiveness.	Closed gaps supported by actual implementation evidence.
Independent assessment	Confirm operator competence and scope; evaluate and independently decide the requested route.	A bounded decision, not an assumed approval from preparation or attendance.
Continuing assurance	Monitor performance, changes, practice, suppliers and field effects; complete surveillance and renewal.	Current evidence, valid status, truthful history and sustained learning.

X.2 Representative deployment and feedback

- Implementation trials should represent the actual operating environments, workforce, supply tiers and critical interfaces. Useful cases include build-to-print manufacture, spacecraft subsystems, maintenance, distribution, mission-vehicle integration, industrial equipment, digital services and personnel authorization.
- Trials should test requirement clarity, operational burden, missing hazards, inconsistent decisions, retrieval of evidence and effectiveness of protective controls. A trial is not certification. Unfavorable findings should lead to corrected implementation and, where necessary, a formal interpretation request under Annex Y.

X.3 Transition without loss of control

- An organization should identify the adoption date for each contract or internal scope, the responsibilities for transition and the work already in progress. Existing technical acceptance, safety, confidentiality and customer obligations remain active throughout transition.
- Changes to forms, terminology and software should preserve traceability to earlier records. An older authorization should not be silently relabeled as a new AF decision. Where additional evaluation is required, the actual scope and date of that evaluation should be recorded.

X.4 Readiness measures without score substitution

- Useful measures include verified requirements, closure of critical gaps, retrieval success, current personnel authorization, source flow-down and completed lifecycle decisions. Each measure should define its denominator and evidence. Counting documents or hyperlinks alone does not demonstrate effective implementation.
- A readiness dashboard can support planning, but a 95% completion result is not a conformity pass when the missing portion contains a required safety control, failed competence step or unsupported technical claim. The applicable decision rules remain requirement-based.

Annex Y — AF interpretation, amendment and publication control

Normative

This annex governs the identity and maintenance of the AF publication and prevents uncontrolled interpretation from changing the requirement basis. It does not attest that an organization, product or person has been evaluated or that an external authority recognizes an AF claim.

Y.1 Publication identity and controlled edition

- a) The publication identifier shall be AF 9100:2026 and the edition label First Edition. The publication date is 29 September 2026. The publisher designation shall be Aerospace Federation. The full identifier shall be used in conformity statements so that the AF publication cannot be confused with an unrelated document.
- b) AF is an AF publication-series designation. It shall not be interpreted as adoption by a regional standards system or a claim of regulatory endorsement. Any separate recognition arrangement shall identify its actual parties, scope, date and conditions without altering the meaning of this publication.
- c) Controlled distribution shall preserve the approved text, tables, equations, figures, annex status and edition metadata. Uncontrolled extracts shall be identified as extracts and shall not be presented as the complete requirement set.

Required evidence: Publication master; edition metadata; controlled copies; accurate extracts and recognition statements.

Y.2 Interpretation requests and technical resolution

- a) A request for interpretation shall identify the exact provision, application context, ambiguity, conflicting readings, proposed consequence and relevant evidence. AF shall assign competent reviewers and check conflicts before issuing a controlled response.
- b) An interpretation may explain an existing requirement but shall not silently create a new obligation, relax a minimum or validate previously missing technical evidence. A material requirement change shall use the amendment process. Where a safe interpretation cannot be established, the affected dependent decision shall remain held or bounded by a lawful technical restriction.
- c) Issued interpretations shall have unique identifiers, dates, applicable clauses, rationale and approval records. Parties using the standard shall assess their effect on current profiles, procedures and claims and preserve the resulting decisions.

Required evidence: Interpretation request; technical review; controlled response; implementation-impact record.

Y.3 Corrections and amendments

- a) An editorial correction shall identify its exact location and show that it does not change technical intent. Changes to requirements, decision rules, thresholds, scope, validity or essential competence shall be treated as technical amendments, not hidden editorial corrections.
- b) A technical amendment shall include a change rationale, affected clauses and annexes, cross-clause consistency review, relevant technical and mathematical checks, implementation impact and defined effectivity. Substantive changes shall undergo at least 60 calendar days of public comment before final adoption. Comments and dissent shall receive recorded dispositions.
- c) Urgent safety information may communicate a protective concern and necessary interim measures, but shall be identified separately and shall not silently rewrite this edition. The subsequent amendment shall follow the controlled technical process.

Required evidence: Correction/amendment record; technical and consistency reviews; comment log and dispositions; actual adoption and effectivity.

Y.4 Numbering, translations and technical fidelity

- a) AF shall maintain unique clause, table, figure, equation and form identifiers. Renumbering shall preserve a traceable correspondence and shall not invalidate historical evidence references. Cross-references shall resolve to actual provisions and shall identify whether the cited content is normative or informative.
- b) An authorized translation shall preserve technical meaning, normative verbs, mathematical notation, units, definitions and decision logic. Ambiguities shall be escalated rather than resolved through unrecorded local interpretation. The English text is the reference edition for this publication; any authorized translation shall state its relationship and issue identity.
- c) Reformatted accessible copies may be issued where the complete content and relationships are preserved. Layout changes shall not alter tables, mathematical signs, figure labels or the association between a requirement and its exceptions.

Required evidence: Numbering and correspondence register; translation review; technical layout verification; controlled accessible copies.

Y.5 Rights, marks and honest publication claims

- a) Rights and permissions for reproduction, licensed use and AF marks shall be administered by the responsible rights holder through explicit terms. A copy of the standard shall not itself confer authority to certify, accredit, represent AF or use its marks.

- b) Publication status shall be distinguished from independent technical validation, regulatory approval and recognition by another party. Claims about completed evaluation or recognition shall require actual supporting records. Adoption of the document by an organization shall not be described as adoption by the whole sector.
- c) The publisher and scheme operators shall correct misleading publication or recognition statements when identified and shall preserve the record of the correction. No external endorsement shall be inferred from the similarity of a publication number, a technical term or the use of familiar assurance methods.

| **Required evidence:** Actual permissions; mark controls; evidenced recognition claims; corrected misleading statements.

Y.6 Periodic review and maintenance record

- a) AF shall review the continued suitability of the edition at least every three years and sooner where significant safety evidence, technology, feedback or implementation inconsistency warrants. A review shall consider technical coverage, decision consistency, proportionality and effectiveness of the scheme.
- b) The maintenance record shall distinguish proposals, approved changes, editorial corrections, interpretations and superseded content. A future proposal does not modify the current edition before its actual approved effectivity. Holders shall retain the basis used for each historical decision.

| **Required evidence:** Review program; technical feedback; controlled maintenance log; actual effective versions.

Annex Z — Metric dictionary, engineering budgets and integrated worked case

Informative

This annex provides original synthetic calculations to support controlled decision making. None of its numbers is a mandatory AF target, a qualified design value or actual organizational performance.

Z.1 Metric definitions and numerical examples

- Each measure should have an owner, purpose, denominator, data source, reporting window, inclusion/exclusion rule and action threshold. Targets should be set before reporting. A favorable operational metric does not compensate for a mandatory conformity failure.
- The following examples are independent unless a shared dataset is explicitly stated. They should not be combined into a single invented organization's performance score.

Table Z-1 — Calculated quality and delivery metrics

Metric	Definition and synthetic inputs	Calculated result / limit
First-pass yield	940 units accepted without rework out of 1,000 entering the defined process.	940/1,000 = 94.0000%.
Rolled throughput yield	Three sequential stage yields 0.98, 0.97 and 0.99, using compatible conditional stage definitions.	0.98×0.97×0.99 = 94.1094%; not the arithmetic average.
On-time delivery	92 of 100 orders due in the period delivered in full by the agreed date; cancellation/partial rules fixed.	92.0000%; denominator is due orders, not only shipped orders.
Defective units per million	7 nonconforming units out of 20,000 inspected units; each unit counted once.	350 ppm; do not confuse units with number of individual defects.
Cost of poor quality	Scrap 18,000 + rework 12,000 + returns 9,000 + failure investigation 6,000 monetary units.	45,000; 3.0000% of an illustrative 1,500,000 revenue base.
Overall equipment effectiveness	Availability 0.90 × performance 0.95 × quality 0.98 under defined time and ideal-rate boundaries.	83.7900%; does not establish safe or conforming operation.
Earned-value cost index	Earned value 180,000 / actual cost 200,000.	CPI = 0.9000; financial progress is not technical readiness.
Earned-value schedule index	Earned value 180,000 / planned value 225,000.	SPI = 0.8000; does not measure calendar delay directly.
Evidence completion	Verified applicable requirement records / all applicable requirement records.	Report critical missing records separately; no aggregate conformity pass.
Corrective-action effectiveness	Actions meeting their pre-defined effectiveness test / actions evaluated.	State evaluation exposure; "closed on time" is a different measure.

Z.2 Margin definitions and reserve double counting

- Assume an available power capacity of 5.0 kW and a predicted demand of 4.0 kW for a stated condition. Margin relative to demand is $(5.0-4.0)/4.0=25\%$. Unused fraction of available capacity is $(5.0-4.0)/5.0=20\%$. Both calculations are correct but use different denominators.
- The budget should define which convention is used and whether uncertainty, degradation, contingency and reserve have already been included. Allocating the same reserve independently to multiple subsystems can overstate system margin. Simultaneous peak and transient conditions may require a separate assessment.

$$(Z-1) \text{ Margin_relative_to_demand} = (\text{capacity} - \text{demand}) / \text{demand}$$

Use the same physical quantity and compatible units. A nominal positive margin is not sufficient when the prediction uncertainty or unmodeled transients can consume it.

Z.3 Mission-support energy example

- Assume a non-flight mobile support unit has nominal stored energy 6.0 kWh. A predefined usable fraction of 0.80 already includes the chosen state-of-charge reserve; a condition factor of 0.85 and conversion efficiency of 0.90 are also assumed. Usable delivered energy is $6.0 \times 0.80 \times 0.85 \times 0.90 = 3.672$ kWh.
- If average loads are 0.72 kW propulsion, 0.18 kW computing and 0.10 kW auxiliaries, total average demand is 1.00 kW and the simplified endurance estimate is 3.672 hours. This does not demonstrate peak-power capability, thermal safety, terrain performance or battery life. The reserve shall not be deducted a second time without explaining the changed convention.

$$(Z-2) t_{\text{est}} = E_{\text{nominal}} \times f_{\text{usable}} \times f_{\text{condition}} \times \eta / P_{\text{average}}$$

Energy in kWh divided by power in kW gives hours. The factors are assumptions for a simplified budget and require validation for a real mission.

Z.4 Generic structural-margin arithmetic

- a) For a purely illustrative uniaxial calculation, assume a nominal stress demand of 80 MPa, a separately justified load factor of 1.5 and an applicable allowable of 150 MPa. Factored demand is 120 MPa and the arithmetic margin is $150/120 - 1 = 0.25$.
- b) These assumed numbers are not material properties or approved factors. The example does not address multiaxial stress, fatigue, buckling, joints, defects, temperature, scatter or load-path validity. A real structural decision requires the applicable design basis and competent analysis; this calculation only demonstrates an explicit margin convention.

$$(Z-3) MS = \text{allowable} / \text{factored_demand} - 1$$

Allowable and demand must refer to the same failure mode, units and condition. Avoid applying the same safety factor twice or omitting it through inconsistent definitions.

Z.5 Integrated ground-support case and release decision

- a) The synthetic ground-support cart used in Annexes B, D and W illustrates an end-to-end evidence chain. The organization defines the handling task and exposure, classifies the motion-control function, allocates requirements, approves suppliers, qualifies the process and verifies the actual hardware/software configuration.
- b) Before release, it checks dimensional acceptance using a pre-agreed decision rule, verifies the stop and control functions against the program-specific safety basis, assesses energy assumptions, closes the fixture-offset corrective action and validates operator handover. An AI inspection aid is restricted when its separate challenge-set performance is inadequate.
- c) The final release decision is requirement-based. Good OEE, a positive energy budget or a high aggregate inspection accuracy cannot compensate for missing safety verification, an unresolved configuration mismatch or an unapproved critical characteristic. The released dossier states the exact operating boundary and remaining support obligations.

Table Z-2 — Integrated case decision chain

Decision	Evidence used	What is not inferred
Define scope and category	Annex A activity matrix; Annex B hazard-based category.	No automatic equivalence to an external safety-integrity level.
Control design and configuration	Requirements and interface records; Annex D trace chain.	No assumption that a model matches the physical item without reconciliation.
Establish production capability	Annexes J–L supplier, first article and special-process evidence.	One conforming first article does not guarantee every later unit.
Evaluate numerical evidence	Annexes F–I calculations and valid actual program tests.	Synthetic examples are not test results for the cart.
Control digital functions	Annexes N–O release cards, model limits and security/update evidence.	High accuracy or a secure update alone does not prove system safety.
Resolve a detected defect	Annex W occurrence/escape causes and effectiveness evidence.	Recalibration alone does not resolve earlier product impact.
Authorize release	Clause 8.6 and Annex V requirement-based evidence review.	No score-based compensation and no invented statutory approval.

Z.6 Calculation reproducibility and verification limits

- a) The accompanying calculation package contains deterministic synthetic data, formula implementations, computed results and figure-generation code. Arithmetic assertions check selected identities, confidence/sample-size behavior and consistency of results. This is computational verification, not independent engineering validation.
- b) Before using a method operationally, the organization should verify the implementation, software environment, input provenance, units, numerical precision and applicability assumptions. Successful arithmetic checks do not replace competent review of applicability, assumptions and operational use.

Annex AA — Assessment scheme architecture and object-specific conformity routes

Normative

This annex establishes the AF scheme rules for defined conformity objects. The route codes, minima and administrative arrangements in Annexes AA–AJ are AF requirements within this scheme; they are not presented as universal rules of another certification system. Use of an AF-authorized mark or accreditation claim additionally requires actual written authorization.

AA.1 Object selection and the scope tuple

- Before accepting an application, the scheme operator shall select one or more routes from Table AA-1. Each route shall have a separate evaluation boundary and conclusion. A combined assessment may share relevant evidence, but shall not merge different conformity objects into an ambiguous certificate.
- The scope tuple shall identify object type; applicant and responsible legal entity; product, service, process, person or provider identity; sites and remote functions; configuration or role version; lifecycle responsibilities; criticality; technical modules; application profile; evaluated period; and exclusions or restrictions. Empty fields shall be justified rather than omitted silently.

Required evidence: Application review; selected routes; completed scope tuple; responsibility and applicability matrix.

Table AA-1 — AF conformity objects and decision boundaries

Route / object	Applicable evaluation basis	Permitted conclusion and boundary
ORG — Organization	Clauses 1–10 and 22; triggered 11–21 and 23–28; organizational implementation and outcomes.	Defined management and assurance system. Does not approve every product or certify every employee.
PRD — Product / system	Clause 23; product profile; relevant technical, qualification and acceptance requirements; controlled production where ongoing.	Identified product, configuration, family, lot or serial against stated criteria. No implied statutory approval.
SVC — Service	Clause 24; defined outcomes, delivery boundary, period, interfaces, competence and continuity.	Specified service or service event, not an unrestricted approval of the provider's other services.
PRC — Process	Clause 25; relevant Annex L; essential variables, qualification, scope, monitoring and output relationship.	Process capability within the qualified conditions. Not automatic acceptance of all output.
PER — Person	Clause 26 and Annex AE; approved job profile; Annex AB for assessment-role credentials.	Demonstrated competence for a defined role. Employer task authorization and required licenses remain separate.
SUB — External provider	Clause 27; Annexes J and AF; actual site, supplied work and sub-tier controls.	Qualification for a defined supply scope. Conditional development status is not a conformity certificate.
CAB — Assessment provider	Clause 28 and Annex AH; role-specific competence, methods, witnessing, impartiality and independent decisions.	Defined assessment capability under actual AF authorization. ORG certification is not accreditation.

AA.2 Application profile requirements

- The profile shall define the evaluated object, version, intended use, operating or task domain, characteristics or competences, acceptance criteria, methods, samples, uncertainty or scoring rules, required evidence, critical failures, surveillance and change triggers. The technical profile owner shall be identified and competent to approve those criteria.
- A PRD profile shall state relevant performance, environmental, safety, interface and life criteria. A SVC profile shall state delivery outcomes and observation windows. A PRC profile shall state essential variables and qualified ranges. A PER profile shall state tasks, prerequisites, knowledge and practical demonstration. SUB and CAB profiles shall state the actual work or assessment capability.
- The profile shall be approved before evaluation. It may add requirements but shall not waive AF minima or mandatory obligations. Where methods or limits are missing, the application shall be held until competent technical definition is available; broad references to “good quality” or “all aerospace uses” are not adequate criteria.

Required evidence: Approved profile with technical criteria; method and decision matrix; critical-failure list; profile change history.

Table AA-2 — Minimum profile fields

Field group	Required information
Identity and ownership	Profile ID, version, route, owner, technical approver, issue date and affected claims.
Object and domain	Exact object/configuration, sites, relevant users, operating or task conditions and exclusions.
Obligations and criteria	Requirement IDs, quantitative limits or defined attributes, legal and customer constraints, essential controls.

Field group	Required information
Evaluation design	Methods, test conditions, samples, representativeness, uncertainty, validity checks, required independence.
Decision	Pre-agreed passing rules, critical failures, treatment of unavailable evidence and nonconformities, decision authority.
Continuing basis	Surveillance, expiry or instance boundary, change triggers, renewal and retained support obligations.
Records and claims	Required reports, retention, authorized public statement, privacy and mark restrictions.

AA.3 Evaluation sequence and admission controls

- The operator shall review eligibility, scope, competence resources, impartiality, evidence access and evaluation feasibility before contracting. It shall agree the profile and explain fees independently of outcome. An application shall not be accepted for a scope the operator cannot competently assess.
- The evaluation shall establish readiness, verify implementation or technical performance, record findings, verify correction and submit the complete evidence for independent review. ORG evaluation shall include readiness and implementation stages. Other routes shall use object-appropriate stages without imposing an organizational audit on an individual candidate.
- For an initial ORG assessment, the applicant shall have completed an internal audit covering the applicable scope and a management review, with sufficient implemented records to show operation. A new organization may be assessed when adequate actual evidence exists; artificial backdated records or a fixed unsubstantiated history shall not be requested or accepted.

Required evidence: Admission decision; contract; approved evaluation plan; readiness evidence; evaluation results and independent review.

AA.4 Evaluation evidence by route

- For PRD, evaluation shall verify product identity, representative qualification and applicable unit or lot evidence. For an ongoing family claim it shall also verify that manufacturing and change controls maintain the evaluated properties. A one-time sample test shall not support indefinite production claims.
- For SVC and PRC, evaluation shall include actual delivery or witnessed execution under representative conditions. For PER, it shall include verified identity, prerequisites and the required knowledge and practical assessments. For SUB, it shall examine the actual performer and supplied scope, not merely a purchasing intermediary.
- For CAB, evaluation shall cover the technical methods and decisions the body intends to perform, including representative witnessed activities. A general quality audit without technical witnessing and competence evidence shall not be treated as a completed CAB route.

Required evidence: Route-specific results; representative work; witnessed evidence; limits of reused or sample evidence.

AA.5 Independent review, decision and permitted outcomes

- The independent reviewer shall confirm scope completeness, criteria validity, evaluator competence, method suitability, adequate evidence, findings and closure. A reviewer shall return an incomplete dossier rather than infer missing results. Technical disagreements shall be recorded and resolved through competent authority.
- The authorized decision shall grant, refuse, maintain, restrict, suspend, restore, renew or withdraw a defined attestation. Initial grant, renewal and extension require closure of all nonconformities in the granted scope under Annex AD. A refusal shall identify the relevant unmet conditions without implying that unrelated scopes were evaluated.
- An applicant may correct deficiencies and reapply with actual evidence. The operator shall control repeat evaluations and configuration changes so that rejected results are not discarded. Payment, membership or seniority shall not determine the outcome.

Required evidence: Independent review checklist; reasoned decision; finding closure; precise scope and actual decision date.

AA.6 Attestation content and separate claims

- An attestation shall contain a unique identifier, issuer, applicant or holder identity, full publication identifier, First Edition, route, application-profile ID and version, evaluated scope and sites, configuration or role, decision and issue dates, applicable expiry or instance boundary, restrictions, status-verification method and authorized signatory.
- Multiple routes may be presented in one document only where the separate route, criteria, evaluation, decision and status are clear for each object. Suspension of one route shall not be concealed by the continued validity of another. Product markings shall be controlled separately from organizational publicity.
- A supplier's own declaration shall be labeled as a self-declaration. A customer's assessment shall be labeled as such. Neither shall be represented as an independent AF-authorized attestation unless that independent process and authorization actually exist.

Required evidence: Issued statement; separate route conclusions; mark permission; status record; accurate self-declaration labeling.

AA.7 Scheme ownership, authorization and changes

- a) AF shall control the published AF rule set and written permissions to operate its scheme or use its marks. The operator shall retain responsibility for its evaluations and decisions within the granted scope. The applicant shall retain responsibility for its products, services and representations.
- b) A scheme operator shall not expand its authorized sector, object or technical scope without the required competence evaluation and written approval. Scheme changes shall follow Annex Y; changes to individual attestations shall follow Annex AG. An AF designation does not establish governmental delegation or recognition in another scheme.

| **Required evidence:** Scheme governance; actual written operator authorization; authorized scope; controlled changes.

AA.8 Illustrative combined-scope example

- a) Illustrative example: an organization manufactures ground-support carts, provides maintenance and employs inspectors. ORG evaluates its management and assurance system. PRD evaluates a stated cart configuration and technical profile. SVC evaluates the maintenance service. PER evaluates an inspector's defined competence. Employer task authorization permits that inspector to work on the specified cart family.
- b) A positive ORG decision cannot close missing cart braking evidence, failed service recovery tests or a failed practical inspector assessment. Each route retains its own evidence, decision, status and limitations. The example describes scheme logic, not an actual AF approval.

Annex AB — Auditor, technical expert, reviewer and decision-maker competence

Normative

This annex sets AF competence and authorization minima for assessment roles. The quantitative entry and maintenance criteria below are scheme rules, not assertions about another system's qualifications. Documented experience supports, but never replaces, demonstrated competence.

AB.1 Role definition and competence domains

- The provider shall define competence separately for auditor, lead auditor, technical expert, application reviewer, technical reviewer, decision maker and appeal reviewer. Authorization shall state the routes, sectors, methods, criticality limits, languages and any supervision requirements. One role shall not automatically confer the others.
- Required competence shall include interpreting AF requirements and application profiles; process and lifecycle understanding; evidence integrity; sampling; measurement and statistical limitations; configuration and traceability; risk and criticality; human factors; ethics; interview and observation; reporting; finding classification; and recognition of work beyond personal competence.
- Domain-specific competence shall cover the hazards, materials, technologies, operational conditions and approval interfaces relevant to the assignment. For C2 or C3 work, the team shall include a verified technical specialist with relevant recent practice or demonstrated equivalent current competence. Merely adding a specialist's name to the plan shall not satisfy actual participation.

Required evidence: Role competence profiles; sector and method criteria; authorization limits; assigned technical coverage.

Table AB-1 — Minimum entry evidence for assessment roles

Role	AF entry and demonstration requirements	Authorization limitation
Internal auditor	Task-relevant experience; at least 16 hours of AF/process-audit learning; one complete witnessed internal audit; satisfactory evidence-based reporting.	May audit internally within demonstrated competence; shall not independently audit their own work.
Third-party auditor	At least three years of relevant professional experience, including two years in quality, assurance or the intended technical domain; at least 40 hours of AF audit training; knowledge and practical assessment under AB.2; four mentored complete audits totaling at least 20 auditor-days.	Independent assignments only after witnessed approval and defined route/sector authorization.
Lead auditor	Qualified third-party auditor; additionally three complete audits led under supervision totaling at least 10 auditor-days; demonstrated planning, team direction, conflict handling and integrated reporting.	May lead only within authorized scope; technical gaps require participating specialists.
Technical expert	At least three years of relevant technical practice, normally including two years within the preceding five; verified task demonstration and sufficient AF scheme orientation.	Provides technical conclusions; not automatically an auditor or independent decision maker.
Technical reviewer	Demonstrated AF interpretation and evidence-review competence; technical coverage for the assigned scope; five satisfactorily mentored complete file reviews.	Shall not independently review an evaluation they performed. May combine review and decision if separately authorized.
Decision maker	Verified knowledge of routes, scope, decision rules, impartiality, status and appeals; five satisfactorily mentored complete conformity decisions; access to required technical expertise.	Shall not have performed the evaluation being decided or supplied the relevant consultancy.
Application / appeal reviewer	Demonstrated competence for scope determination and resource review / fair case analysis, AF requirements and independence; observed satisfactory performance.	Appeal reviewer shall be independent of the original evaluation and decision.

AB.2 Knowledge examination and practical evaluation

- A third-party auditor shall achieve at least 80% in a controlled written examination covering AF interpretation, evidence, scope, findings and decisions, and at least 85% in the practical assessment. Every predefined essential safety, integrity and independence step shall be passed. A high total shall not compensate for falsified evidence, unsupported critical acceptance or failure to escalate an essential hold.
- The practical assessment shall include planning, interviews, observation, sampling, tracing actual or controlled simulated evidence, writing findings and presenting a reasoned conclusion. Competence evaluators shall record observed strengths, deficiencies and authorization limits. Assessment shall be independently reviewed before authorization.
- Assessment questions and case criteria shall be mapped to the competence profile, technically reviewed, secured and periodically evaluated for validity. Reassessment following failure shall use corrected competence and an equivalent controlled assessment, not memorized answers to an unchanged disclosed case.

Required evidence: Examination blueprint; secured questions; scores; essential-step results; practical observations; authorization decision.

AB.3 Experience equivalence and initial assessor development

- a) An experience-equivalence route may recognize comparable prior professional audit or technical practice where identity, scope, dates, duration, role and performance are verified. It shall not waive the AF knowledge assessment, witnessed practical demonstration, impartiality or essential competence requirements.
- b) For the initial development of an AF assessor population, a panel of at least two independent competent professionals shall evaluate each candidate against this annex. Their own relevant technical and assessment competence shall be documented. Reciprocal self-approval, honorary appointments and automatic recognition based on membership shall not be accepted.
- c) The equivalence record shall identify each criterion satisfied by prior evidence, each remaining gap, the evaluated scope and the reason for the final decision. Unknown or unverifiable audit logs shall not be counted toward the required mentored experience.

Required evidence: Verified experience log; equivalence matrix; independent panel competence; witnessed demonstration; remaining restrictions.

AB.4 Assignment and technical coverage

- a) Before each assignment, the provider shall verify role authorization, current competence, sector and criticality coverage, language, methods, physical or remote access and independence. The team shall be able to evaluate each relevant critical process and technical interface; no individual is presumed competent in all sectors covered by this standard.
- b) A technical expert shall work within a defined assignment and communicate evidence and limitations to the auditor and reviewer. The lead auditor shall integrate the result without overruling a specialist on a technical matter outside the lead auditor's competence. Unresolved disagreement shall be escalated and recorded.
- c) Classified or otherwise controlled work shall be assigned only to appropriately authorized personnel. Lack of permitted access or competence shall lead to resourcing changes, scope restriction or refusal, not acceptance on the strength of an unsupported management statement.

Required evidence: Assignment review; team coverage matrix; specialist work record; access and conflict checks; disagreement resolution.

AB.5 Impartiality and incompatible activities

- a) For third-party evaluation, review and decision, personnel shall not be assigned to a client for which they provided relevant consultancy or held employment within the preceding 24 months. The provider shall also evaluate ownership, financial dependence, family or close relationships and other conflicts that may remain after that period.
- b) The 24-month rule is not an internal-audit ban on employees. Internal auditors shall instead be independent of the work they evaluate, with suitable reassignment or external support where separation is not feasible. A product release reviewer may be internal, subject to the technical independence required by Annex B.
- c) An evaluator shall not promise a favorable decision, design the corrective action they will independently certify, accept outcome-linked compensation or suppress evidence at the applicant's request. General explanation of a requirement is permitted; client-specific system design that undermines independence is not.

Required evidence: Conflict declarations; prior-work screening; compensation controls; reassignment decisions; internal independence arrangements.

AB.6 Continuing authorization and observed performance

- a) All authorized assessment-role personnel shall complete at least 16 hours of relevant continuing professional development in each 12-month period. Independent auditors shall additionally perform at least four auditor-days across at least two assignments in that period. A lead auditor shall lead at least two complete assignments in each 24-month period.
- b) Reviewers and decision makers shall complete at least three substantive file reviews or decisions in each 12-month period. Technical experts shall demonstrate current relevant practice and review changes affecting their technical scope. Providers shall assess performance using witnessed work, report quality, decisions, complaints and recurrence of errors.
- c) An independent auditor shall undergo a witnessed performance review at least once every 24 months. More frequent observation shall be required for a new sector, C2/C3 expansion, significant adverse evidence or deficient performance. Training hours shall not substitute for the required observed competence.

Required evidence: Development and activity logs; witnessed reviews; report-quality checks; ongoing role authorizations.

AB.7 Inactivity, restriction and reactivation

- a) When the applicable activity minimum is not met, independent authorization for that role shall be suspended until a competence review and supervised reactivation demonstrate current capability. After more than 12 months without relevant audit practice, an auditor shall complete updated AF learning and a satisfactory witnessed assignment before independent work resumes.

- b) A serious competence or integrity concern shall trigger immediate assessment of the authorization and earlier affected work. Reinstatement shall require evidence proportionate to the cause, including reassessment where necessary. The original authorization expiry shall not be extended merely by restoration.
- c) Changes to the standard, sector technology, methods or legal access shall trigger targeted updates. An assessor shall decline tasks outside their authorization and request appropriate technical support. Automated tools may support work but shall not replace the accountable human evaluator or decision maker.

Required evidence: Restriction and inactivity records; reactivation plan; witnessed results; prior-work assessment; restored scope.

AB.8 Competence dossier and approval record

- a) The provider shall retain the role profile, verified experience, training, examination and practical results, mentored assignments, competence decisions, technical scope, witnessed performance, development, conflicts and status history. The record shall identify who evaluated, reviewed and authorized each role.
- b) Certificates or authorization letters shall disclose limitations and shall not imply that a person can audit every AF sector. Evidence of technical competence may be confidential, but the provider shall retain sufficient authorized access to substantiate assignments and respond to complaints.

Required evidence: Complete competence dossier; role and scope register; approval identity; current and historical restrictions.

Annex AC — Audit planning, audit time, multisite coverage and remote methods

Normative

This annex defines AF planning minima for organizational assessments. The time model is an AF resource floor, not an empirical guarantee that every system can be evaluated in that time. The provider shall allocate additional time whenever complexity, access, evidence or risk requires it. Product tests and personnel examinations follow their approved profiles rather than this organizational formula.

AC.1 Planning inputs and effective personnel

- The plan shall identify sites, shifts, functions, product and service families, technical modules, criticality, languages, external work, past performance, changes and access conditions. The provider shall review scope before determining time, rather than deriving scope from a fee quotation.
- Effective personnel N shall include employees and externally provided people whose work falls within the assessed organizational scope, including relevant temporary and seasonal staff. Part-time work may be converted using documented full-time-equivalent hours; each unique critical role shall nevertheless count as at least one person. Peak relevant staffing and actual shift diversity shall be considered. After the FTE calculation, N shall be rounded upward to the next whole person, with a minimum of one, before selecting the Table AC-1 band.
- Personnel shall not be excluded solely because they work remotely, are employed by an agency or support production indirectly. The provider shall document any consolidation of equivalent roles and shall avoid counting the same shared-service staff more than once.

Required evidence: Scope and staffing basis; FTE calculation; sites and shifts; critical-role coverage; planning rationale.

Table AC-1 — Base initial organizational evaluation time

Effective personnel N	Base B(N), auditor-days	Application
1–10	2.0	Readiness and implementation evaluation combined, before modifiers.
11–25	3.0	Same scope and time definition.
26–75	4.0	Same scope and time definition.
76–150	5.0	Same scope and time definition.
151–300	7.0	Same scope and time definition.
301–600	9.0	Same scope and time definition.
Above 600	$9 + \text{ceil}((N - 600)/300)$	Add one base auditor-day for each additional block of up to 300 effective personnel.

AC.2 Criticality, complexity and site modifiers

- The multiplier K shall use the highest relevant criticality in the assessed scope: C0 = 1.00; C1 = 1.15; C2 = 1.35; C3 = 1.60. Where genuinely separate technical scopes are evaluated independently, their separate time allocations shall be recorded; a critical function shall not be diluted by averaging personnel across lower-criticality work.
- The additive complexity factor f shall include 0.15 for special-process qualification in scope, 0.15 for assured software/AI or digitally controlled acceptance, and 0.15 for materially novel technology without representative operating history. These are distinct triggers; a trigger shall be counted once. Other complexity requiring more time shall be added through a documented plan adjustment.
- Let S_v be the number of physical sites to be visited, with a minimum value of one for calculation. Let H be the number of additional materially different operating shifts requiring separate observation beyond the primary shift. The site/shift addition is $0.5(S_v - 1) + 0.5H$ auditor-days. This addition does not remove the coverage floor in AC.3.

Required evidence: Criticality selection; triggered complexity factors; site and shift additions; additional-resource decisions.

$$(AC-1) \quad T_{\text{calc}} = \text{ceil}(2 \times [B(N) \times K \times (1 + f) + 0.5(S_v - 1) + 0.5H]) / 2$$

ceil means rounding upward to the next integer. T_{calc} is rounded upward to a half auditor-day. One auditor-day is eight hours of actual evaluation; time is additive across competent evaluators, not merely elapsed calendar days.

AC.3 Total time, stages and exclusions

- Initial evaluation time T shall be at least T_{calc} and at least one auditor-day per visited physical site, with additional time for the central function and remote activities where needed. For a wholly digital single-location organization, the physical-site floor shall be treated as one evaluation location, not an obligation to invent a physical visit.
- Readiness-stage time T1 shall be at least 0.5 auditor-day and the upward half-day rounding of 25% of T. Implementation-stage time T2 shall be the remainder and at least 1.5 auditor-days. If these minima cannot both be met, total time shall be increased. Readiness shall verify scope, documents, internal evaluation, implemented evidence and readiness for technical examination.

- c) Travel, meal breaks, commercial administration, final report production, interpretation delays, independent review and decision time shall not count as evaluation time. Trainees and observers shall not be counted as fully productive auditors. Separate technical expert time shall be counted only for the actual evaluation task and not double-counted against simultaneous auditor activity on the same task.

Required evidence: Time calculation; stage allocation; site/shift schedule; productive-time records; separate review and decision resources.

$$(AC-2) \quad T1 = \max[0.5, \text{ceil}(2 \times 0.25T)/2]; \quad T2 = T - T1 \geq 1.5$$

The equation gives the minimum readiness allocation. Increase total time where the readiness or implementation evidence requires more time.

AC.4 Surveillance and renewal time

- a) For the current scope, the operator shall recalculate the initial time T when material scope or risk changes. Each surveillance evaluation shall use at least half of T, rounded upward to a half-day, and at least one auditor-day. Renewal shall use at least three quarters of T, rounded upward to a half-day, and at least two auditor-days.
- b) The site coverage and critical-control requirements remain additional floors. The provider shall increase time where these percentages cannot cover required sites, shifts, technical processes or unresolved concerns. No reduction shall be granted merely for AF membership, another certificate, a low fee or long customer history.
- c) Frequency is governed by Annex AG. Time allocated to one surveillance visit shall not be borrowed from a future visit to cover a missed required activity. Extra follow-up to verify nonconformity closure shall be planned according to the nature of the issue.

Required evidence: Current T calculation; surveillance and renewal schedules; required-site coverage; added follow-up time.

AC.5 Multisite coverage and controlled sampling

- a) Every physical site included in an initial or renewal ORG scope shall be evaluated. The central management function, shared critical activities and remote functions shall also be covered. Site selection shall consider actual processes rather than addresses alone; a legal address with no operational activity shall not be represented as a production site.
- b) For surveillance only, homogeneous C0/C1 sites under one centrally controlled system may be sampled when equivalent activities, methods and controls are demonstrated. From S eligible sites, at least $m = \max(\text{ceil}(\text{sqrt}(S)), \text{ceil}(S/2))$ shall be evaluated at each annual surveillance. Selection shall rotate to cover all eligible sites within 24 months. At least one quarter of selected sites, rounded upward, shall be chosen randomly; the remainder shall be risk-selected.
- c) C2/C3 sites, unique activities, materially different processes, sites with significant unresolved issues and newly added sites shall not enter that reduced homogeneous pool. Relevant C2/C3 critical-control sites shall be evaluated at each required surveillance interval. The central function shall be evaluated at every surveillance. These selections are coverage rules, not statistical confidence claims.
- d) A systemic finding at one site shall trigger review of all potentially affected sites and expansion of the sample. Removing the failing site from the certificate shall not be accepted as correction where the central system or remaining sites share the deficiency.

Required evidence: Eligibility analysis; site pool; random and risk selection; rotation history; expanded sampling and systemic review.

$$(AC-3) \quad m = \max[\text{ceil}(\text{sqrt}(S)), \text{ceil}(S/2)]$$

Applies only to the eligible homogeneous C0/C1 surveillance pool. Mandatory central, critical and otherwise ineligible sites are added separately.

AC.6 Remote evaluation and access limitations

- a) Remote methods may be used when identity, confidentiality, live observation, configuration, provenance and access provide evidence equivalent for the stated purpose. The provider shall document the suitability decision and limitations. Remote record review alone shall not replace necessary observation of a physical special process or safety-critical activity.
- b) Where reliable physical evidence cannot be obtained remotely, on-site evaluation or an appropriately controlled witnessed method shall be used. Restricted access shall be resolved through authorized arrangements. If necessary evidence remains unavailable, the corresponding conformity conclusion shall not be granted.
- c) Recording, screen capture and transfer of sensitive data shall be authorized. Live feeds shall be protected against selective or prerecorded presentation. Network failure or incomplete observation shall be recorded and the affected activity repeated or supplemented rather than marked complete.

Required evidence: Remote-method suitability review; authorized access; witnessed records; limitations and completed supplementary work.

AC.7 Audit execution, sample expansion and reporting

- a) The audit shall include an opening review of scope and access, examination of actual process interactions, vertical traceability through selected outputs, observation of critical controls and a closing review of evidence-based findings. The sample shall include unfavorable results, changes, rework, complaints and unsuccessful tests where relevant.

- b) Samples shall identify populations, selections and limitations. Judgmental sampling shall not be described as a statistical assurance level. An inconsistency or suspected systemic issue shall trigger an expanded trail proportionate to consequence. The final report shall be issued within 14 calendar days after the evaluation closes, unless a documented exceptional delay is communicated without postponing protective action.
- c) The report shall identify actual evaluation time, participants, scope, criteria, methods, locations, sample, findings, unresolved limitations and the evaluator's recommendation. The independent decision shall remain distinct from that recommendation.

Required evidence: Audit plan; time log; evidence and sample trails; expanded checks; final report and separate decision.

AC.8 Worked time and sampling examples — illustrative

- a) For $N = 80$, one physical site, one observed shift, C2 criticality and two complexity triggers, $B = 5$, $K = 1.35$ and $f = 0.30$. The calculation gives $5 \times 1.35 \times 1.30 = 8.775$ auditor-days, rounded upward to $T = 9.0$. The minimum readiness stage is 2.5 days and implementation is 6.5 days. Surveillance is at least 4.5 days; renewal is at least 7.0 days. Independent review and decision require additional time.
- b) For nine eligible homogeneous C0/C1 sites, $m = \max(3, 5) = 5$ sites at annual surveillance, plus the central function and any separately mandatory locations. The selection rotates to cover every eligible site within 24 months. At least two of the five selected sites are random. This does not mean the unvisited sites are known to conform.
- c) For an optional statistical detection study, independent random observations with a true issue rate $p = 0.10$ need $n = \text{ceil}(\ln(0.05)/\ln(0.90)) = 29$ to have at least 95% probability of observing one or more issues. This model does not validate judgmental audit sampling, dependent records or a claim that the whole system is 95% conforming.

$$(AC-4) \ n_{\text{detect}} = \text{ceil}[\ln(1 - C)/\ln(1 - p)]$$

C is the desired probability of detecting at least one issue when independent observations each have issue probability p . This is a detection-planning model, not a universal audit sample requirement.

Annex AD — Conformity decision rules, findings and release controls

Normative

This annex governs acceptance and attestation decisions. It separates a measured result, conformity to a criterion, technical permission to use an output, and authority to issue or maintain a certificate. These are related but different decisions. Annex H supplies informative measurement examples; this annex supplies the mandatory governance.

AD.1 Decision basis and non-compensable conditions

- a) Before evaluation, the responsible authority shall define the object, applicable requirements, criterion for each characteristic or competence, evidence needed, uncertainty treatment, required independence and permitted outcomes. Criteria shall not be selected retrospectively to obtain a favorable result.
- b) Every applicable mandatory criterion shall be fulfilled for a positive initial conformity attestation. No aggregate score, favorable delivery performance, commercial benefit or passing result in an unrelated area shall compensate for an unmet mandatory requirement, missing critical evidence or unresolved unacceptable risk.
- c) A technical release may include a lawful, explicitly approved concession for a bounded departure where the underlying technical and contractual framework permits it. The record shall identify that departure; it shall not falsely state that the original requirement was fulfilled. A concession cannot waive a mandatory legal approval or alter the AF requirements for an attestation.

Required evidence: Pre-agreed decision basis; complete criterion register; blocker review; concession and release distinctions.

AD.2 Measurement decision preparation

- a) The measurement decision shall use the corrected result, applicable specification, validated method, justified uncertainty model and pre-agreed rule. Known significant systematic effects shall be corrected or otherwise treated through an approved model; an uncertainty allowance shall not conceal an ignored known bias.
- b) The record shall distinguish specification limits, control limits, resolution, uncertainty and acceptance limits. Units, significant figures, confidence or coverage interpretation and treatment of correlation shall be stated. The uncertainty shall be appropriate to the actual result and conditions, not copied from an unrelated calibration capability.
- c) Decisions shall use sufficient unrounded precision. Rounding is applied to reported values after the decision and shall not turn a failing or indeterminate result into a pass. When both lower and upper limits apply, both shall be evaluated; one favorable characteristic shall not substitute for another.

Required evidence: Measurement model; corrections; uncertainty budget; specification and acceptance limits; recorded rule and precision.

AD.3 DR-A — Full-interval decision rule

- a) For a two-sided numerical specification $[L, H]$, DR-A shall conclude “conformity demonstrated” only when the entire stated uncertainty interval lies within the inclusive specification limits. It shall conclude “nonconformity demonstrated under DR-A” when the entire interval lies outside one specification limit. All other results are indeterminate and shall be held from acceptance pending valid disposition.
- b) For C2 or C3 acceptance characteristics whose uncertainty can materially change the decision, DR-A shall be the default unless a documented alternative is approved under AD.5 by the metrology and relevant independent technical authorities. Applicable binding rules take precedence where they mandate another lawful rule.
- c) A one-sided specification shall use the corresponding single bound. For asymmetric uncertainty, the actual lower and upper coverage endpoints shall replace $y - U$ and $y + U$. The interpretation remains conditional on the stated measurement model and coverage; it is not an absolute guarantee of physical truth.

Required evidence: Declared DR-A application; actual result and coverage endpoints; criterion-by-criterion disposition; independent alternative approval where used.

(AD-1) Conform: $y - U \geq L$ and $y + U \leq H$. Nonconform: $y + U < L$ or $y - U > H$. Otherwise: indeterminate.

y is the corrected result and U the justified expanded uncertainty for the symmetric case. Equality at a specification boundary is inside the limit. An interval overlapping a limit is not automatically a proven physical defect, but conformity has not been demonstrated by this rule.

AD.4 DR-B — Simple acceptance with disclosed decision risk

- a) Simple acceptance compares the corrected result directly with the specification limits. It may be used for C0 or C1 characteristics only where the rule is agreed before evaluation, the method is suitable, uncertainty and decision risk have been reviewed, and no binding obligation requires a more protective rule.
- b) The report shall disclose that acceptance does not use a guard band and that uncertainty can create false acceptance or false rejection near a limit. The operator shall not describe simple acceptance as zero risk. C2 or C3 use requires the independent alternative-rule approval in AD.5; it shall not be selected solely to accept a result that failed DR-A.

Required evidence: Prior agreement; uncertainty and risk review; scope and criticality; clearly disclosed acceptance rule.

AD.5 DR-C — Risk-targeted or other justified alternative

- An alternative rule shall define the decision objective, allowable risks, statistical or physical model, prior information where used, distribution, dependence, measurement uncertainty, acceptance region and validation. Consumer and producer risks shall be distinguished. Approval shall occur before results are evaluated.
- A posterior probability of nonconformity conditional on a result shall be reported only when the underlying prior and likelihood are specified and justified. A coverage interval shall not automatically be reinterpreted as that posterior probability. Likewise, a sampling plan's operating characteristic shall not be interpreted as the probability that an accepted particular lot is conforming.
- For a C2/C3 alternative, the independent technical reviewer shall evaluate consequences, model limitations, sensitivity and whether the rule provides the required protection. The metrology authority, relevant safety or mission authority and contractual authority where required shall approve its exact scope. The rule shall be reviewed after a material model or process change.

Required evidence: Alternative-rule model; risk constraints; validation and sensitivity; independent approvals; application limits.

AD.6 Indeterminate results, repeat testing and multiple criteria

- An indeterminate result shall remain held until a validated improved measurement, relevant additional evidence or a lawful technical disposition resolves it. Repeating observations until a favorable reading appears is prohibited. A repeat or pooled-result method shall be specified in advance or independently justified with the original results retained.
- Where a guard band leaves an empty acceptance region, the method cannot demonstrate conformity under that rule. The response shall improve the method or obtain an approved technically justified alternative, not quietly widen the product specification. Known nonconforming material shall remain controlled under Clause 8.7.
- For many characteristics or repeated decisions, the plan shall consider cumulative false-decision risk, dependence and the consequences of multiple comparisons. A nominal interval for each characteristic shall not be represented as the same confidence for all characteristics jointly without a justified analysis.

Required evidence: Hold and disposition record; repeat-test plan; retained original results; cumulative-risk review.

Table AD-1 — Illustrative DR-A outcomes for the Annex H example

Corrected result y, mm	Expanded uncertainty U, mm	Outcome under the stated example rule
50.0240	0.00444522	Conformity demonstrated: the full interval is inside [49.970, 50.030] mm.
50.0280	0.00444522	Indeterminate: nominal result is inside the specification, but the interval overlaps the upper limit. Hold acceptance.
50.0360	0.00444522	Nonconformity demonstrated under DR-A: the full interval is above the upper limit.
50.02555478	0.00444522	Upper interval endpoint equals 50.03000000 mm: inside the inclusive limit using these stated numbers. Actual decisions use unrounded inputs.

AD.7 Finding classification and immediate action

- A finding shall identify the exact requirement, objective evidence, affected scope and gap. The evaluator shall classify the finding using Table AD-2 and separately decide whether an immediate technical hold or protective action is necessary. Administrative classification shall never delay protection.
- Related localized findings shall be reviewed together for evidence of systemic breakdown. An opportunity for improvement shall not replace a nonconformity where a requirement is unmet. A mere preference for a different method, where the actual requirement is fulfilled, shall not be raised as a nonconformity.

Required evidence: Requirement–evidence–gap statement; classification rationale; systemic extent; immediate technical action.

Table AD-2 — Finding categories and minimum consequences

Class	Decision definition	Required consequence
Critical	Evidence of an uncontrolled unacceptable safety/mission risk, deliberate material falsification, serious compromise of essential evidence, or another condition requiring immediate protection.	Stop or contain the affected activity immediately. Block grant/renewal. For an existing affected attestation, suspend or impose an effective evaluated restriction without delay; apply Annex AG notifications.
Major	Absence or breakdown of a required control, or a group of deficiencies, materially undermining the ability to fulfill requirements; not necessarily an immediate hazard.	Block initial grant/renewal/extension until verified closure. Assess existing scope promptly; suspend when continuing conformity cannot be demonstrated.
Minor	Localized failure to fulfill a requirement where evidence does not show a material system breakdown or loss of essential control.	Correct and address cause. No open minor at initial grant, renewal or extension. Existing status may continue only under the bounded AD.8 decision.

Class	Decision definition	Required consequence
Observation / improvement	No demonstrated failure of an applicable requirement; a documented possibility to improve effectiveness.	May support improvement. Shall not be used to conceal nonconformity or require uncontracted consultancy.

AD.8 Attestation decisions and open findings

- a) Initial grant, renewal and extension shall require all nonconformities in the granted scope to be closed, adequate evidence for all mandatory criteria and independent review. A restricted scope may be granted only where its boundary is real, independently evaluated and unaffected by unresolved systemic deficiencies; it shall not conceal the failed scope.
- b) An existing attestation may be maintained with a localized minor finding only when immediate correction or containment is adequate, cause and extent are reviewed, a corrective plan is accepted within the Annex AG time limit, and no essential control or mandatory output criterion is compromised. The decision maker shall record why continued status is justified and verify closure within the required period.
- c) An existing major finding shall trigger an immediate assessment of continuing conformity. Where the underlying ability to meet requirements is not demonstrated, the affected status shall be suspended. Limited continuation is permitted only for a specifically evidenced unaffected scope, through a documented restriction decision. A planned future correction alone is not evidence of current conformity.
- d) A conditional lifecycle gate or conditional supplier-development approval may permit bounded non-dependent work. Neither is a conditional conformity certificate. Annex AG controls closure, suspension and restoration deadlines; an expired deadline shall not be reset by reissuing the same finding.

Required evidence: Independent grant or continuation decision; closed findings; real scope boundaries; verified corrections and corrective action.

(AD-2) Grant = scope valid AND all applicable criteria fulfilled AND evidence adequate AND findings closed AND independent decision authorized

This is a logical conjunction, not a weighted score. "Findings closed" refers to nonconformities in the scope being granted; observations do not create a mandatory failure.

AD.9 Decision record and challenge

- a) The record shall identify the applicant and object, route, profile, evidence package, evaluator and reviewer, findings and closure, independence, limitations, decision, reasons, actual date and signatory. Automated workflow may enforce checks, but an accountable authorized person shall approve the conformity decision.
- b) Technical dissent shall remain in the record with its resolution. An appeal shall follow Annex AI. A revised decision shall preserve the earlier decision and explain the new evidence or corrected interpretation. No record shall be backdated or altered to make the earlier basis appear stronger than it was.

Required evidence: Complete decision record; documented dissent; accountable signatory; preserved history and appeal disposition.

Annex AE — Personnel assessment, examinations and task authorization

Normative

This annex governs the PER route and the organizational authorization of people for actual work. A credential confirms a bounded competence assessment; it does not grant an unrelated occupational license or authorize work on every product. Numerical examination and renewal requirements are AF scheme minima.

AE.1 Job and task profile

- The scheme operator shall approve a job/task profile defining role purpose, tasks, decisions, hazards, technical knowledge, practical skills, ethical behavior, communication, relevant prerequisites, equipment and permitted scope. The analysis shall involve persons competent in the actual work and be reviewed when technology or responsibility changes.
- Profiles may cover engineers, technicians, inspectors, test personnel, special-process operators, maintainers, digital specialists and assurance professionals. A profile shall not certify a protected or licensed professional activity beyond the operator's lawful authority. Auditors and assessment-role personnel shall additionally meet Annex AB.
- The profile shall identify essential practical steps whose failure would compromise safety, evidence integrity or the validity of the technical conclusion. These steps shall be designated before examination and shall not be removed after a candidate fails them.

Required evidence: Approved job/task analysis; competence profile; technical and legal boundaries; essential-step list.

AE.2 Eligibility, identity and candidate information

- The operator shall verify identity, prerequisites and relevant experience through traceable evidence. The candidate shall receive the profile, methods, passing rules, fees, expected conduct, renewal duties, permitted claims and appeal process before enrollment.
- Eligibility requirements shall be related to competence. Reasonable accommodations shall preserve the competence being assessed and any essential task conditions. Medical or physical criteria shall be required only where law or a justified task need makes them necessary, with confidential handling of the relevant information.
- A supplier of training shall not guarantee certification. The candidate shall not be required to buy a particular course where equivalent verified preparation meets the profile, unless a specific training element is itself technically necessary and transparently justified.

Required evidence: Identity and eligibility verification; candidate information; fair-access review; justified prerequisites.

AE.3 Assessment blueprint and validity

- The blueprint shall map every required competence to a suitable examination, interview, practical task or verified experience method. Critical practical skills shall be demonstrated, not assessed solely through multiple-choice answers. Technical reviewers shall confirm content validity and representative task coverage.
- Written examinations shall contain at least 40 scored items or an equivalently rigorous, independently approved constructed-response assessment. Item difficulty, scoring consistency, security and relevance shall be reviewed using performance evidence. An examination shall not be considered valid solely because its total scores are statistically consistent.
- The practical assessment shall use representative equipment, conditions and anomalies within a safe controlled environment. Simulation may be used where it validly demonstrates the skill; the profile shall state limitations and any supervised workplace demonstration still required.

Required evidence: Blueprint; controlled examination; item and scoring review; practical task design; simulation validity.

Table AE-1 — Illustrative profile blueprint — weights are not universal technical criteria

Competence group	Illustrative knowledge weight	Practical evidence to define in the actual profile
AF scope and work controls	20%	Identify the applicable instruction, current version, task boundary and authorization.
Role-specific technical competence	30%	Perform the actual task and interpret representative results within the role.
Safety and critical limits	20%	Recognize a critical condition, protect the work and escalate appropriately.
Evidence and configuration	15%	Preserve identity, record actual results and trace the configuration.
Ethics and impartial conduct	10%	Refuse falsification or an unsupported approval; disclose conflicts.
Learning and corrective response	5%	Analyze an error, apply correction and recognize the need for reassessment.

AE.4 Passing rules and essential practical controls

- a) A PER candidate shall achieve at least 80% in the knowledge assessment and at least 85% in the practical assessment, and shall pass every essential practical step. The profile may set more demanding requirements where justified. Scores for separate mandatory components shall not be averaged to offset a failed component.
- b) A candidate who falsifies material evidence, bypasses an essential safety control or approves a result known to lack required evidence shall fail the affected assessment and undergo an integrity or competence review. The assessment shall be stopped where continuation creates an unacceptable hazard.
- c) Scoring rubrics shall define observable behavior and tolerances before examination. Borderline cases shall receive an independent review of the actual evidence, not a discretionary pass based on fees, reputation, seniority or workforce shortage.

Required evidence: Component scores; all essential-step results; independent borderline review; reasoned pass or fail.

AE.5 Examiner competence, independence and security

- a) Examiners shall demonstrate the technical competence and assessment skill required by the profile. They shall use controlled criteria and record actual observations. A trainer may contribute technical evidence but shall not be the sole practical examiner, reviewer and decision maker for their own candidate or cohort.
- b) Independent personnel decisions shall be made by a competent person who did not perform the candidate's examination. Conflicts, coaching during assessment, answer disclosure and unauthorized assistance shall be controlled. Identity checks, secure question handling and attributable scoring shall apply to remote and on-site examinations.
- c) Automated scoring shall be validated for the stated questions and rules. AI-generated assessments, translations or scoring recommendations shall receive competent review. No automated model shall be the sole authority for a competence decision involving an essential practical skill.

Required evidence: Examiner competence; independent decision; secure examination records; conflict and scoring validation.

AE.6 Failure, remediation and reassessment

- a) The candidate shall receive an understandable outcome and the competence areas needing improvement, without compromising secured examination content. A remediation plan shall address the demonstrated deficiency before reassessment. Repeat assessment shall use equivalent difficulty and representative tasks.
- b) A failed essential practical step shall be reassessed through direct demonstration; passing an unrelated written test shall not close that deficiency. All earlier attempts shall remain traceable. Administrative re-registration shall not erase an integrity investigation or an existing protective restriction.
- c) The operator shall define fair reassessment access and controls against repeated guessing. A fixed waiting period is not substituted for evidence of improved competence. Where additional supervised experience is necessary, the required activities and completion evidence shall be specified.

Required evidence: Candidate feedback; remediation evidence; equivalent reassessment; preserved attempt history.

AE.7 Credential scope and employer authorization

- a) A personnel credential shall state identity, unique ID, profile and version, assessed role and technical scope, limitations, decision date, expiry, issuer and verification method. Its maximum ongoing validity shall be 24 months under Annex AG, subject to continued competence and truthful use.
- b) Employer task authorization shall separately identify the actual task, product or process, site or equipment, competence basis, supervision and validity. Its review interval shall not exceed 12 months and shall be shortened where risk warrants. A credential alone shall not confer employer release authority or required statutory privileges.
- c) Where the employer changes, the credential may remain valid within its assessed scope, but the new employer shall verify task suitability and issue its own authorization. Significant changes to tools, technical data or task hazards shall trigger review before independent work.

Required evidence: Credential; employer task authorization; role and scope limits; change and transfer verification.

AE.8 Continued practice, inactivity and renewal

- a) The credential holder shall complete at least 16 hours of relevant continuing development in each 12-month period and maintain evidence of relevant practice. The profile shall define the minimum practical frequency or supervised demonstration necessary for that role. The operator shall assess actual competence, not training hours alone.
- b) For C2/C3 tasks, more than six months without relevant practice shall require an observed competence demonstration before independent task authorization resumes. For C0/C1 tasks, the corresponding trigger is more than 12 months. Earlier reassessment shall follow significant change or adverse evidence. Auditor activity rules in Annex AB also apply; the stricter triggered requirement controls.
- c) Renewal shall review current scope, practice, development, conduct, complaints, changes and performance. It shall include a practical demonstration of essential skills within the preceding six months and a knowledge update covering material changes. New or expanded scope shall receive the necessary initial assessment rather than automatic renewal.

- d) The operator shall complete PER continuing-scope surveillance at the interval in Annex AG applicable to the assessed role criticality. Surveillance may use verified practice, development and observed performance as specified in the profile; renewal still requires the practical and knowledge evidence stated above.

Required evidence: Practice and development log; inactivity decision; observed essential-skill demonstration; knowledge update; renewal decision.

AE.9 Restriction, records and public verification

- a) A competence or integrity concern shall trigger protection of affected work, investigation and a reasoned restriction, suspension or withdrawal decision. Restoration shall require correction and reassessment proportionate to the cause. Employer authorizations and personnel credential status shall be reviewed separately and communicated to authorized recipients.
- b) Records shall preserve eligibility, examination and practical evidence, scores, attempts, decisions, development and status history. Personal data shall be minimized and protected. Public verification shall disclose only credential identity, scope, issuer, validity and relevant status, not examination answers or sensitive personal records.

Required evidence: Protected dossier; restriction and restoration evidence; current status; permitted verification information.

AE.10 Completed illustrative personnel case

- a) Candidate PER-EX-017 is assessed for a defined dimensional-inspection role. The knowledge score is 86%, the practical score is 92%, but the candidate releases a C2 item after a result is indeterminate under the pre-agreed rule. "Hold an unresolved critical acceptance result" was an essential practical step. The decision is refusal of the requested credential despite the high aggregate scores.
- b) After supervised remediation, an equivalent practical assessment demonstrates correct holding, escalation, uncertainty interpretation and traceable reporting. An independent reviewer verifies all required components and the decision maker grants only the assessed inspection scope. The employer must still issue the actual task authorization. These are fictional case records, not credentials issued to a real person.

Annex AF — Subcontracting, outsourced work and flow-down control package

Normative

This annex applies to every external performer whose work affects an assured output. It supplements, rather than replaces, Annex J's supplier dossier. It covers external personnel, design services, digital providers, laboratories, inspection, manufacture, maintenance and lower-tier subcontracting.

AF.1 Work-package and responsibility definition

- a) The commissioning organization shall define the outsourced work package, outputs, technical baseline, acceptance criteria, interfaces, criticality, actual performer and retained decisions. A scope shall identify whether the source performs the work itself or uses further providers.
- b) The responsible buyer and technical authority shall verify completeness before order placement. Commercial terms shall not silently contradict technical quality requirements. Where the performer cannot access necessary controlled data, an authorized information arrangement shall be established before work starts.

Required evidence: Approved work package; performer identity; technical baseline; retained decision authority; resolved commercial/technical conflicts.

Table AF-1 — Contractual flow-down review — apply each relevant topic

Topic	Required contractual or controlled work-package content
1. Identity and location	Legal and actual performer, approved site, contact, supplied product/service/process and permitted further subcontracting.
2. Technical baseline	Drawing/model/data identity, edition, configuration, quantities, units and effectivity.
3. Intended use and criticality	Relevant operational environment, critical characteristics and consequences that affect the supplied work.
4. Required management controls	Applicable organizational, configuration, evidence-integrity and corrective-action requirements.
5. Design responsibility	Design authority, inputs, derived requirements, review and approval boundaries.
6. Process qualification	Required process scope, essential variables, equipment, source, validation and requalification triggers.
7. People	Required competence, task authorization, supervision, continuity and reassessment.
8. Materials and components	Approved sources, material condition, lot/serial identity, authenticity and substitution restrictions.
9. Digital configuration	Software/build/model versions, dependencies, data provenance and secure update responsibilities.
10. Acceptance	Characteristics, methods, uncertainty and decision rules, sampling where permitted, hold points and actual-result records.
11. Source witnessing	Planned source inspection or witnessed testing, notification, safe access and protection of controlled information.
12. Delegated verification	Named roles, scope, methods, records, oversight and withdrawal of delegation.
13. Nonconformity	Containment, prompt reporting, population trace, disposition authority and prohibition of unauthorized repair or use-as-is.
14. Change	Prior notification and approval for relevant changes to design, material, process, software, site, source or critical sub-tier.
15. Traceability	Genealogy through splitting, merging, packaging, rework, installation and release.
16. Records	Required content, raw data where necessary, retention basis, integrity, retrieval and transfer after closure.
17. Information security	Access, confidentiality, personal or controlled data, authorized transfer and incident response.
18. Capacity and continuity	Verified capacity, critical dependencies, alternate sources, recovery and controlled restart.
19. Packaging and delivery	Preservation, environment, life status, markings, configuration and accompanying evidence.
20. Further tiers	Applicable requirements reaching the point of performance, critical-source visibility and acknowledgement.
21. Ethics	Truthful records, counterfeit prevention, conflict disclosure and good-faith reporting without retaliation.
22. Exit and responsibility	Tooling and data return, support continuity, remaining obligations and preservation of unresolved issues.

AF.2 Approval status and release restrictions

- a) Supplier status shall identify the precise approved scope. Conditional development or trial use shall specify the work permitted, technical conditions, output segregation, approver and closure evidence. It shall not permit unrestricted delivery or be represented as a conformity certificate.

- b) When a source's certificate or approval is used as supporting evidence, the organization shall verify its authenticity, scope, actual site and current status. The organization shall retain responsibility for its assigned acceptance decision and any required independent verification.

Required evidence: Source status; conditional-work restrictions; verified certificates; completed technical approval.

AF.3 Sub-tier visibility and change control

- a) Critical sub-tier sources shall be identified to the degree needed for traceability, capability and risk control. The organization shall verify that essential instructions and change restrictions reach the performer. An intermediary's assurance that requirements were passed on shall be tested through representative evidence.
- b) A change affecting qualification, technical characteristics, capacity, security or evidence validity shall be reviewed before implementation. Planned changes shall be notified early enough for the required evaluation; where timing is inadequate, work shall remain restricted. Further subcontracting shall not be used to avoid a disapproved source.

Required evidence: Critical sub-tier map; flow-down acknowledgement; representative checks; prior change decisions.

AF.4 External personnel and knowledge services

- a) Personnel agencies and professional service providers shall supply verified competence, relevant experience, authorization and supervision information. The commissioning organization shall verify suitability for the actual task and communicate current instructions, hazards, confidentiality and reporting duties.
- b) Outsourced engineering, inspection conclusions, AI-generated analyses and advisory reports shall be reviewed by competent personnel before they become controlled evidence. Contractual allocation shall identify the technical reviewer, approval authority, data rights and responsibility to correct errors.

Required evidence: Personnel suitability; task induction and authorization; reviewed technical service outputs; correction obligations.

AF.5 External laboratories, inspection and digital providers

- a) Technical providers shall be evaluated for the actual method, range, uncertainty where relevant, personnel, equipment, sample integrity and reporting scope. Accreditation or another competence statement may support selection only for its verified actual scope; it shall not replace assessment of fitness for the requested work.
- b) Digital and cloud providers shall have defined data location and access arrangements where relevant, configuration and update control, recovery, incident communication and exit support. A service subscription shall not remove the need to preserve long-life engineering evidence or maintain an approved deployed configuration.

Required evidence: Technical provider review; method and range suitability; sample/data chain; digital continuity and exit agreements.

AF.6 Incident, escape and corrective-action integration

- a) A supplier shall report a known or credible issue affecting supplied output through agreed channels, preserving data and identifying the affected population. AF-attestation-related notifications shall meet Annex AG; earlier legal or contractual duties shall prevail. The commissioning organization shall promptly assess downstream consequences.
- b) Corrective action shall address both occurrence at the source and escape through the commissioning organization's controls. Closing the supplier's action request shall not automatically close the receiving organization's affected-product disposition or its own oversight deficiency.

Required evidence: Notification and acknowledgement; downstream trace; joint cause analysis; separate product and system closure.

AF.7 Continuity, source exit and completed trace example

- a) Exit plans shall identify records, tools, intellectual property, outstanding orders, service-life support and unresolved findings. The receiving source shall demonstrate capability before transfer. Confidentiality and data rights shall be respected while preserving necessary evidence for existing users.
- b) Illustrative chain: a prime contracts a bonded bracket to supplier S-10, which uses approved surface-treatment source S-10A and test laboratory L-07. The lot record connects input material M-31, treatment record ST-88, bonding run BR-116, laboratory result TR-41 and bracket serials B-001 to B-040. A treatment excursion shall trace through all 40 serials, including delivered assemblies; a valid laboratory report for another lot cannot close the issue.

Required evidence: Exit and transfer plan; complete source-to-output trace; verified receiving capability; controlled unresolved issues.

Annex AG — Surveillance, renewal, status and mandatory time limits

Normative

This annex is the controlling timetable for the AF assessment scheme. Its periods are AF administrative and assurance rules; they do not alter statutory approvals, contractual notification duties or the service life of a product. Earlier applicable protective or reporting duties take precedence.

AG.1 Time interpretation and recorded dates

- a) Unless explicitly stated otherwise, “days” means calendar days. A period starts when the holder or responsible operator is first formally informed of the relevant finding, decision or event; final report production shall not postpone an already communicated finding. A deadline measured in months falls on the corresponding calendar date, or the last day of that month if no corresponding date exists.
- b) A validity record shall specify its time basis and exact expiry date. Certificate issue date and conformity decision date shall be recorded separately when they differ. No document shall be backdated to conceal an expired, suspended or unassessed period. A later correction shall preserve the actual history.

Required evidence: Time basis; notification timestamps; decision, issue and expiry dates; preserved amendments.

Table AG-1 — Controlling AF scheme intervals and deadlines

Activity / status	Maximum interval or deadline	Decision condition
Ongoing ORG, PRD-family, SVC, PRC, SUB or CAB attestation	24 months from the conformity decision	Renewal decision completed before expiry; no automatic extension. Route-specific instance limits remain separate.
PER credential	24 months from the conformity decision	Continued competence and renewal under Annex AE.
Employer task authorization review	12 months	Earlier reassessment after change, inactivity or adverse evidence; not a statutory license period.
C0/C1 ongoing surveillance	12 months between decision/last surveillance and next completed surveillance	First surveillance completed no later than 12 months after initial decision.
C2/C3 ongoing surveillance	6 months between decision/last surveillance and next completed surveillance	First surveillance completed no later than six months after initial decision; relevant critical-control sites included.
Corrective-action plan for a nonconformity	30 days after finding notification	Immediate protection is separate; initial grant and renewal still require actual closure.
Major nonconformity verified closure	60 days after finding notification	No presumption of continued status during correction; AD.8 controls suspension or evaluated restriction.
Minor nonconformity verified closure	90 days after finding notification	Bounded continuation only for an existing attestation under AD.8.
Critical concern: protective action	Immediately upon recognition	Stop/contain the affected work; do not wait for an administrative deadline.
Holder notification to its scheme operator of a critical attestation-related concern	Within 24 hours after awareness	Earlier legal/customer notification duties still apply; continue updates as scope becomes known.
Operator action on a substantiated critical concern	Suspend or impose an effective evaluated restriction within 24 hours	The decision cannot wait for root-cause completion. Notify AF where AF authorization is involved.
Registry update after a status decision	Within two days	Holder informed immediately; public record accurately identifies affected scope.
Suspension duration	90 days from suspension decision	Restore on verified evidence, formally restrict to a demonstrably unaffected scope, or withdraw; no rolling reset.
Final evaluation report	14 days after evaluation close	Exceptional delay communicated under AC.7; protection and finding clocks unaffected.
Complaint/appeal acknowledgement	Five days after receipt	Assign case and provide process information.
Appeal submission	30 days after notification of the contested decision	A justified exceptional late submission may be admitted under AI.3.
Ordinary complaint/appeal determination	60 days after receipt	Necessary exceptional extensions require reasons and progress communication at least every 30 days.

AG.2 Ongoing versus instance attestations

- a) An ongoing attestation remains valid only while required surveillance, criteria and conditions are fulfilled. A holder with mixed criticality shall follow the shortest interval triggered by the attested scope unless genuinely separate scopes and records justify different surveillance arrangements.
- b) A lot, serial, one-time test, service-event or other instance attestation shall identify the exact evaluated instance and conditions. It does not authorize future production or continuing services. Its historical result does not acquire a universal 24-month technical validity; later evidence that invalidates the result shall nevertheless trigger correction or withdrawal of the claim.
- c) A process qualification or personnel task authorization may lose validity before its scheduled review because conditions or competence have changed. A certificate period shall not extend an equipment life limit, calibration validity, operator license or qualified process window.

Required evidence: Ongoing/instance classification; appropriate expiry or event boundary; monitored conditions; linked technical limits.

AG.3 Surveillance planning and completed coverage

- a) The operator shall plan surveillance using current scope, criticality, changes, performance, complaints, prior findings and technical dependencies. Annex AC sets organizational time and site-coverage minima. Other routes shall use the profile's appropriate tests, observation or competence checks within the intervals in Table AG-1.
- b) Completed surveillance shall verify that the attestation basis remains valid, not merely that documents have not changed. Missed surveillance by the applicable deadline shall trigger suspension of the affected ongoing attestation. Scheduling an audit, paying an invoice or issuing a reminder shall not count as completion.
- c) A serious event or material change shall trigger special evaluation before the routine due date where necessary. Recovery from an interruption shall verify actual competence, configuration and controls before the affected status is restored.

Required evidence: Risk-based surveillance plan; completed evidence; missed-deadline decisions; special evaluations and restoration checks.

AG.4 Finding closure and overdue action

- a) The finding owner shall implement immediate correction or containment, determine extent and cause, implement corrective action and provide evidence of effectiveness. The operator shall verify closure by a method appropriate to the finding; a revised procedure alone is insufficient for an implementation failure.
- b) If a major or minor closure deadline is missed, the operator shall suspend or further restrict the affected ongoing scope unless it is already suspended or withdrawn. A new finding number or revised action plan shall not restart the original deadline. The deadline for a critical finding shall be set by the necessary protective action and relevant technical basis, not by the minor or major timetable.
- c) For initial grant, renewal and extension, no open nonconformity may remain within the requested scope at the decision. Corrective-action periods are time allowed to remedy deficiencies, not a permission to issue a certificate before those deficiencies are closed.

Required evidence: Correction and cause evidence; verified effectiveness; original due dates; overdue status decisions.

AG.5 Suspension, restriction, restoration and withdrawal

- a) Suspension shall state the affected object, scope, reason, prohibited claims, required action and final resolution deadline. The holder shall cease the affected claim and mark use immediately. Product or service containment obligations remain separate and shall be implemented where the technical issue requires them.
- b) Restoration shall require verification that the cause is resolved, affected outputs have been addressed and the attestation basis is again valid. The original expiry shall remain unchanged unless a complete renewal decision is also made. Restoration shall not retrospectively validate the suspended interval.
- c) Restriction shall be allowed only where the remaining scope is independently demonstrated to be unaffected and adequately controlled. At the end of 90 days of suspension, the operator shall restore, formally restrict to such a scope or withdraw. Suspension shall not be prolonged by repeated administrative resets.

Required evidence: Reasoned status decisions; required action; verified restoration; unaffected-scope analysis; complete history.

AG.6 Renewal and continuity of claims

- a) The operator and holder shall plan renewal sufficiently before expiry to complete evaluation, corrective action, independent review and decision. Initiating the process at least 90 days before expiry is recommended; it does not guarantee completion or extend validity.
- b) Renewal shall evaluate the complete current basis, performance over the preceding period, changes, complaints, competence and surveillance effectiveness. The operator shall not rely solely on the prior certificate. All nonconformities in the renewed scope shall be closed before the new decision.
- c) If the decision is completed after expiry, the new attestation shall begin no earlier than its actual decision date. The gap shall remain visible. The holder shall not use the expired claim while waiting for a decision.

Required evidence: Renewal plan; complete evaluation; closed findings; actual decision dates; disclosed gaps.

AG.7 Scope change, transfer and provider closure

- a) Expansion to new products, services, roles, technical methods, critical processes or sites shall require competence, profile and evidence review before the expanded claim is used. Legal identity, ownership and key resource changes shall be assessed for their effect on responsibility and continuing control.
- b) Transfer to another operator shall not be automatic. The receiving operator shall verify authenticity, actual scope, decision history, open findings, surveillance and competence evidence and perform additional evaluation where necessary. A suspended or unsupported claim shall not be made valid by transfer.
- c) If an operator ceases operation, the owner and authorized parties shall preserve records, status and outstanding cases, and arrange any lawful transfer. Holders shall be informed of effects on surveillance and claims. Record transfer alone does not transfer accreditation or AF operating authority.

| **Required evidence:** Scope-change evaluation; transfer review; unresolved findings; provider closure and holder notification.

AG.8 Status register, records and historical integrity

- a) The scheme operator shall maintain a current register identifying attestation ID, holder, route, scope, profile, issue and decision dates, expiry or instance boundary, status and restrictions. Public verification shall disclose sufficient information to prevent misleading use while protecting personal and controlled technical data.
- b) Assessment and decision records shall be retained for at least seven years after the last relevant decision, or longer where applicable obligations, product life or investigations require. Sensitive personnel information shall be minimized, access controlled and lawfully disposed of when retention is no longer justified. Legal constraints requiring a different handling arrangement shall be documented without falsifying or concealing the decision basis.
- c) Corrections, restrictions, suspension, expiry and withdrawal shall preserve historical dates. A record may be archived but shall not be deleted to imply that an adverse status never existed. The operator shall test retrieval and continuity of status information.

| **Required evidence:** Current and historical register; privacy controls; justified retention; tested retrieval and continuity.

Annex AH — Assessment-body, laboratory and competence-attestation controls

Normative

This annex defines the operational and technical controls of assessment providers and the CAB competence route. It distinguishes a quality-management conclusion from a competence attestation for testing, calibration, inspection, certification or personnel assessment. Any use of accreditation terminology requires the actual authorized decision and its exact scope.

AH.1 Provider identity, governance and responsible operation

- a) The provider shall identify its legal responsibility, owners, governing authority, authorized activities, organization, decision authority, resources and arrangements for liabilities. Its scope shall distinguish testing, calibration, inspection, organizational certification, product/service/process certification, personnel assessment and competence assessment of other bodies.
- b) The provider shall maintain sufficient qualified personnel, technical resources and financial continuity to perform contracted work, corrective follow-up and required surveillance. Liability, insurance or equivalent arrangements shall be appropriate to the work and applicable obligations. Funding shall not purchase a favorable technical conclusion.
- c) Terms of service shall state the object, criteria, confidentiality, access, responsibilities, fees, complaints, appeals and restrictions on claims. The provider shall not imply authorization beyond its actual written scope or guarantee that a public authority will accept its reports.

Required evidence: Legal and governance records; declared activity scope; resources; liability arrangements; accurate service terms.

AH.2 Impartiality oversight and structural separation

- a) The provider shall maintain a live analysis of impartiality risks, including common ownership, consultancy, product design, manufacture, financial dependence, shared staff, referral fees and outcome-linked compensation. Interested-party input shall be obtained through a balanced oversight mechanism whose members can challenge management without commercial retaliation.
- b) A body shall not independently certify work it designed or provide consultancy that compromises its subsequent independent decision. Related activities shall be identified and controlled through adequate structural and functional separation. Where effective independence cannot be demonstrated, the affected evaluation shall be refused or performed through a genuinely independent authorized arrangement.
- c) An internal inspection or test function may generate technical evidence if its relationship is declared and its competence is valid. It shall not falsely present that evidence as independent third-party certification. The required independence level shall reflect the stated claim and technical consequence.

Required evidence: Impartiality-risk register; oversight decisions; related-activity controls; declared relationships and assignment refusals.

AH.3 Technical scope and competence authorization

- a) Each authorized technical scope shall identify object families, methods, ranges or conditions, equipment, personnel and relevant limitations. Calibration scopes shall additionally identify quantities, ranges and demonstrated uncertainty capability. A broad sector label shall not substitute for this technical definition.
- b) Competence shall be evaluated for application review, method approval, sampling, evaluation, technical sign-off, independent review and final decision. Annex AB applies to audit and decision personnel; Annex AE applies where personnel credentials are issued. The provider shall verify external personnel to the same applicable requirements.
- c) Changes to methods, equipment, key personnel, sites or decision activities shall undergo a competence and authorization review before use. A flexible internal method scope may permit controlled changes only within demonstrated competence and documented authorization boundaries.

Required evidence: Detailed scope schedule; function-specific competence; technical authorizations; change evaluation.

AH.4 Test and calibration method validity

- a) The laboratory shall select methods suitable for the actual measurand, item, range, environment and decision. A new or materially modified method shall be validated; an established method shall be verified for the laboratory's actual implementation. Performance characteristics shall address bias, precision, selectivity, range, detection capability and robustness where relevant.
- b) Measurement traceability shall use an appropriate documented chain of calibrations, reference materials or other justified references with their uncertainty contributions. Equipment shall be identified, maintained and verified after relevant change. An expired calibration or unsuitable range shall trigger assessment of affected previous results, not only a new calibration.
- c) Uncertainty shall be evaluated to the extent needed for the report and intended decision. Sampling contributions shall be addressed when sampling belongs to the laboratory's responsibility. Tests reporting qualitative outcomes shall still evaluate the relevant capability to distinguish conditions and avoid false conclusions.

Required evidence: Method validation/verification; measurement traceability; equipment status; uncertainty and detection capability; previous-result impact reviews.

AH.5 Samples, execution and continuing validity of results

- a) The provider shall control sample receipt, unique identity, condition, requested work, storage, preparation, chain of custody, consumption and disposal. Deviations from requested conditions shall be resolved before using results for a claim. Raw data shall identify the item, method, equipment, personnel and actual conditions.
- b) Continuing validity shall be monitored using suitable reference checks, control samples, repeated or blind tests, interlaboratory comparison, proficiency activities or technically justified alternatives. The program shall cover significant technical scopes at justified intervals and respond to adverse results. Participation alone shall not establish competence when performance is unsatisfactory.
- c) Data-processing software and calculation tools shall be verified. Manual transcription, unit conversion, automated interfaces and electronic signatures shall be controlled. A report shall be amended when a material error is identified, preserving the earlier version and notifying affected users.

Required evidence: Sample and custody records; raw data; validity-monitoring program; comparison results; verified data processing; corrected reports.

AH.6 Inspection and certification method controls

- a) Inspection shall use qualified procedures and personnel appropriate to the material, configuration, access and defect mechanisms. Limitations of visual access, non-destructive examination or remote evidence shall be recorded. A report shall not imply that inaccessible characteristics were directly verified.
- b) Certification shall evaluate the actual object against its approved profile, apply independent review and decision, and maintain surveillance where the claim is ongoing. Product inspection, a laboratory test report, personnel examination and management-system audit shall not be substituted for one another without a justified route-specific evidence decision.
- c) Outsourced evaluations shall have verified scope, methods, competence and confidentiality. The certification provider shall retain its final decision responsibility. An applicant shall not be permitted to choose favorable results while concealing relevant failures from the evaluator or reviewer.

Required evidence: Inspection and certification methods; stated limitations; outsourced-work review; independent decisions; complete result population.

AH.7 CAB application and competence evaluation

- a) A CAB applicant shall submit its legal and governance information, impartiality analysis, requested detailed technical scope, methods, facilities, competence records, sample reports, internal evaluation, management review, complaints and corrective-action evidence. Requested activities not yet demonstrated shall be identified rather than described as established capability.
- b) The authorized competence-assessment team shall review documentation and evaluate the relevant operating sites, technical resources, methods, personnel, records and decisions. It shall witness representative activities for every distinct method family or assessment route, including the highest consequence and material scope limitations. Grouping shall be justified by actual technical similarity.
- c) The evaluation shall include at least one complete trace from application and contract review through technical execution, reporting, independent decision where applicable and subsequent control. It shall challenge unsuccessful work, amended reports, complaints and changes. Outstanding nonconformities in the requested scope shall be closed before grant.

Required evidence: CAB application dossier; detailed scope; on-site and witnessed evaluation; complete case trails; verified closure.

Table AH-1 — Minimum CAB witnessing coverage

Provider activity	Witnessed evidence	Competence conclusion shall identify
Testing / calibration	Actual representative method, sample preparation, equipment, data, uncertainty where relevant and authorized report.	Methods, quantities or properties, ranges/conditions, sites and demonstrated limitations.
Inspection	Actual inspection or a controlled representative task with the relevant configuration, access and acceptance criteria.	Inspection object, method, required independence and detection/access limitations.
ORG certification	Complete representative audit trail, team competence, scope, time, findings, review and decision.	Authorized organizational scopes, technical sectors and criticality coverage.
PRD / SVC / PRC certification	Actual profile review, technical evaluation, representative witnessing, independent decision and continuing controls.	Object families, profiles, technical evaluation methods and restrictions.
PER certification	Eligibility, examination security, practical evaluation, scoring, independent decision and credential control.	Role profiles, technical scope, examination methods and continued competence controls.

AH.8 Independent competence decision and accreditation boundaries

- a) The competence-assessment decision shall be made by authorized personnel independent of the applicant and the evaluation they are deciding. AF shall identify the responsible scheme authority and preserve documented technical independence where related AF activities have a commercial or operational interest.
- b) A body shall not accredit itself or issue an accreditation claim from its own ORG conformity statement. Use of the AF accreditation or CAB competence claim shall require an actual written authorization, a completed scope-specific competence evaluation and a controlled independent decision. The decision shall state exactly which activities are covered.
- c) Acceptance by another authority, customer or recognition arrangement shall be described only to its actual evidenced scope. This annex creates no governmental delegation or automatic cross-border recognition. A competence attestation shall not be used to imply that every report produced by the body is correct.

Required evidence: Independent decision authority; completed evaluation; exact written CAB scope; accurate accreditation and recognition statements.

AH.9 Surveillance, corrective learning and operational closure

- a) CAB surveillance and renewal shall follow Annex AG and address technical witnessing, competence, method validity, impartiality, decisions, complaints and significant changes. Adverse proficiency or comparison results shall trigger technical action and review of affected earlier reports.
- b) The provider shall correct inaccurate reports and claims, notify appropriate recipients and assess systemic extent. Closure or loss of authorization shall preserve technical records, outstanding cases and accurate status information. Any transfer shall maintain confidentiality and the actual history of competence decisions.

Required evidence: Technical surveillance; witnessed competence; adverse-result action; report corrections; closure and record-transfer arrangements.

Annex AI — Complaints, appeals, impartial review and case administration

Normative

This annex applies to complaints about assessments, reports, credentials or scheme operation and appeals against conformity decisions. Technical protection and lawful reporting remain active while a case is being considered.

AI.1 Accessible intake and case separation

- a) The operator shall provide an accessible route for complaints and appeals, with clear instructions, confidentiality arrangements and responsible contacts. A complaint expresses dissatisfaction requiring investigation; an appeal requests reconsideration of a specified decision. A case may contain both, and each issue shall receive appropriate handling.
- b) Good-faith safety, integrity or competence concerns shall be accepted without an application fee or retaliation. Anonymous concerns shall be evaluated on available evidence. The operator shall not reject a material allegation solely because the reporter is not a paying customer or certificate holder.

Required evidence: Published intake procedure; case identity; issue classification; confidentiality and non-retaliation controls.

AI.2 Acknowledgement, triage and protection

- a) The operator shall acknowledge receipt within five calendar days and identify the case owner, scope and expected process. Triage shall determine whether immediate protection, report correction, status action or notification is needed. Time-critical protection shall not wait for acknowledgement or a full investigation.
- b) The operator shall preserve relevant original records and prevent inappropriate modification or destruction. A conflict check shall be performed before appointing investigators or reviewers. The reporter's identity shall be disclosed only as necessary and lawful for fair handling and protection.

Required evidence: Acknowledgement; triage; protective actions; evidence preservation; conflict and privacy review.

AI.3 Appeal admissibility and independent reviewers

- a) An appeal should identify the contested decision, grounds and relevant evidence and shall normally be submitted within 30 calendar days after decision notification. The operator may admit a later appeal where justified by new material evidence, access barriers or other documented good cause, applying the policy consistently.
- b) The appeal decision shall be made by competent persons who did not perform the original evaluation, review or decision and have no material conflict. At least one reviewer shall understand the relevant technical or competence scope; specialist advice shall be obtained where needed.
- c) An internal review may resolve a clear administrative error promptly, but a substantive contested decision shall still receive independent consideration. The original decision maker may explain the record, but shall not vote on the appeal outcome.

Required evidence: Admissibility decision; independent appointment; technical competence; conflicts; participation boundaries.

AI.4 Evidence, fairness and technical investigation

- a) The case review shall examine the applicable requirements, profile, actual evidence, method, scoring or decision rule, independence, original reasoning and new material information. Both supporting and contrary evidence shall be evaluated. Missing records shall be identified as a limitation, not reconstructed as if they had existed.
- b) Affected parties shall have a fair opportunity to present relevant information and respond to material issues, subject to lawful confidentiality and safety limits. The review may request repeat testing, re-examination, additional audit or specialist analysis where necessary and technically justified.
- c) The investigation shall distinguish a valid original decision from new circumstances arising later. Where the scope or configuration has changed, the operator may require a new application rather than falsely treating later evidence as proof of conformity at the original date.

Required evidence: Investigation plan; complete evidence record; party submissions; independent technical analysis; distinction of original and later facts.

AI.5 Determination, communication and exceptional delay

- a) An ordinary case shall be determined within 60 calendar days after receipt. Where complexity, authorized evidence access or necessary technical testing requires longer, the operator shall document the reason, inform the parties and provide progress at least every 30 days. An extension shall not postpone necessary protective action or revive an expired claim.
- b) The decision shall state whether the original conclusion is upheld, corrected, replaced, returned for further evaluation or withdrawn. Reasons shall identify the applicable requirements and material evidence. The authorized scope and effective date of any status change shall be explicit.

- c) The outcome shall be communicated to the relevant parties with available further review routes. A successful appeal shall not be conditioned on purchasing consultancy or additional membership. Costs for genuinely necessary new technical evaluation shall be transparent and not punitive.

Required evidence: Reasoned determination; documented extensions; timely progress; communicated status and review route.

AI.6 Status during appeal and corrective effects

- a) Filing an appeal shall not automatically suspend a protective measure, reinstate a credential or extend validity. The independent authority may revise an interim measure only where actual evidence supports equivalent protection and the decision is lawful.
- b) A substantiated complaint shall trigger review of affected reports, attestations, applicants or earlier outputs, not only the individual case. Corrective actions shall address method, competence, impartiality or system deficiencies and their demonstrated effectiveness.
- c) Where public correction is necessary to prevent misleading use or harm, the operator shall issue a proportionate authorized notice. Confidentiality shall not be used as a blanket reason to leave a materially false public conformity claim uncorrected.

Required evidence: Interim status decisions; affected-population analysis; systemic corrective action; accurate public correction.

AI.7 Case records, oversight and completed example

- a) The case record shall include identity, dates, issue, contested object and decision, submissions, evidence, conflicts, reviewers, technical analysis, interim measures, outcome, communication and corrective action. Records shall follow Annex AG retention and appropriate privacy controls. Trend review shall identify repeated bias, method failure or delayed handling.
- b) Illustrative case: an applicant appeals rejection of a dimensional result because the nominal value is within specification. The independent reviewer confirms that DR-A was agreed before testing and that the uncertainty interval overlapped the limit. The original indeterminate decision is upheld. The applicant may submit a validated improved measurement; such later evidence supports a new acceptance decision and does not make the original record incorrect.

Required evidence: Complete case dossier; trend and impartiality oversight; preserved original and revised decision history.

Annex AJ — Controlled forms, record dictionary and consistency matrix

Normative record requirements; informative filled examples

This annex defines complete minimum record content for the integrated AF scheme. Electronic implementations and combined forms are permitted when all fields, relationships, signatures and controls are preserved. Filled examples are fictional and are not actual certifications, personnel credentials or product approvals.

AJ.1 Form control and common data fields

- a) Each operational record shall have a unique ID, form type and version, object or applicant identity, applicable scope and profile, creation and decision dates as relevant, authors, reviewers, approvers, status, evidence references, access class and retention basis. Corrections shall preserve the previous record and the reason for change.
- b) An electronic signature shall identify the responsible individual and the approved action. Shared credentials shall not mask accountability. A form's completion status shall not itself establish technical conformity. Required relationships shall remain resolvable after document export or database migration.

Required evidence: Controlled form register; attributable approvals; version and status history; accessible evidence relationships.

Table AJ-1 — Operational form set and mandatory payload

Form ID / purpose	Required form-specific fields beyond AJ.1	Approval and control
F01 — Application and scope	Route; legal/holder identity; sites and remote functions; product/service/process/role identity; lifecycle responsibility; criticality; exclusions; actual operator authorization; evaluation access.	Applicant acknowledgement and independent application review before evaluation.
F02 — Application profile	Intended use/domain; requirements and limits; essential controls; methods; conditions; samples; uncertainty/scoring; acceptance rule; failure criteria; surveillance; changes; technical owners.	Competent technical approval before evaluating results.
F03 — Competence and assignment	Role; verified prerequisites; experience; training; examination/practical results; essential steps; witnessed work; authorized scope; conflicts; development; expiry and restrictions.	Competence approval separate from mere training delivery; assignment check before each job.
F04 — Audit or evaluation plan	Objectives; route; scope; criteria; sites/shifts; methods; team coverage; time calculation; sample design; access/security; meetings; reporting; technical witnessing.	Authorized plan review; actual departures and resulting coverage recorded.
F05 — Technical result and decision rule	Object/configuration; characteristic; specification; method; equipment; corrections; raw result; uncertainty/coverage; selected rule; result; limitations; technical disposition.	Competent technical sign-off; independent review for triggered criticality.
F06 — Nonconformity and corrective action	Exact requirement; evidence and gap; grade; affected population; protection; notification; occurrence/escape causes; actions; owners; original due dates; effectiveness; verified closure.	Finding classification, technical disposition and final closure separately attributable.
F07 — Review and attestation decision	Complete scope/profile; evaluation package; competence and independence; findings/closure; evidence limitations; decision and rationale; dates; issuer; required scope restrictions.	Independent reviewer/decision maker; no evaluator deciding own third-party evaluation.
F08 — Surveillance and status	Attestation ID; current scope; criticality; due dates; completed activities; findings; change triggers; status; restrictions; restoration/withdrawal; registry update.	Actual decision dates; no hidden gaps or deadline resets.
F09 — Supplier flow-down and transfer	Actual performer and sub-tiers; work package; essential instructions; acknowledgements; source approval; change notice; verification; custody; escape response; records and exit.	Commissioning organization retains acceptance and oversight accountability.
F10 — Personnel credential and task authority	Person; profile; knowledge/practical/essential results; independent decision; credential limits; employer task; site/equipment; supervision; practice; reassessment; expiry.	Separate credential and employer authorization decisions and status.
F11 — Complaint or appeal	Reporter/party; object; issue/grounds; dates; admissibility; conflicts; independent reviewer; submissions; evidence; interim measures; outcome; communication; corrective effects.	Independent outcome; protective action remains effective during review.
F12 — CAB competence scope	Legal provider; activity; method families; ranges/conditions; uncertainty capability where relevant; sites; competence; witnessing; findings; independent authority; exact authorized claim.	Actual competence decision; no self-accreditation or automatic equivalence.

AJ.2 Requirement and evidence-status dictionary

- a) Evidence status shall distinguish planned, collected, technically reviewed, accepted for the stated purpose, rejected, superseded and unavailable. "Accepted evidence" means adequate for the identified decision use, not unconditional truth or indefinite validity. A planned test shall not appear as completed evidence.
- b) Requirement status shall distinguish conforming, nonconforming, not applicable with approved rationale and not yet demonstrated. An indeterminate measurement shall remain not demonstrated for acceptance until valid disposition; it shall not be silently converted into "not applicable". The status record shall identify the person and basis of change.

Required evidence: Controlled status dictionary; evidence-purpose linkage; approved applicability; attributable state changes.

Table AJ-2 — Cross-object record relationships

Relationship	Required consistency check
F01 scope → F02 profile	Every claimed object and site is covered by a valid profile and applicable requirements; excluded responsibility is justified.
F03 competence → F04 plan	Assigned evaluators cover routes, sector, criticality, methods and language; conflicts are cleared.
F04 plan → F05 results	Actual objects, sites, methods, samples and configurations match the plan or an approved recorded deviation.
F05 result → F06 finding	Failed or indeterminate criteria are correctly reflected; no favorable score suppresses a critical gap.
F06 closure → F07 decision	Initial/renewal/extension decisions contain no open nonconformity in their scope; effectiveness is verified.
F07 decision → F08 status	The exact scope, dates, restrictions and ongoing/instance basis agree; no claim is broader than its decision.
F09 outsourced work → product/service dossier	Actual performer, source changes, lot identity and evidence reach the final delivered object.
F10 credential → employer task	Credential competence supports, but does not replace, the specific employer authorization.
F11 case → F07/F08 versions	Appeal or complaint effects change only supported decisions/status and preserve their original history.
F12 body scope → issued reports	Each claimed accredited/authorized activity remains within the actual assessed technical scope.

AJ.3 Completed illustrative profile record

- a) The example below concerns a fictional ground-support dimensional inspection service. Its numerical limits demonstrate record structure; they are not prescribed design criteria. The actual technical owner must establish the real application profile before use.

Table AJ-3 — F02 profile example — AP-GSI-01, version 1

Field	Filled illustrative record
Route and object	SVC; dimensional inspection service for identified support-equipment parts; one evaluated site and controlled measuring station.
Domain and responsibility	Room-temperature dimensional inspection; no claim for destructive tests, complete vehicle safety or statutory approval.
Criterion	Characteristic EX-D01: 50.000 ± 0.030 mm for the fictional demonstration part; traceable actual-result report required.
Method and evidence	Approved procedure MP-01; corrected result; instrument identity; valid calibration; environmental record; uncertainty budget; actual raw observations.
Criticality and rule	C2 for this demonstration use; DR-A full-interval rule; uncertainty factor and basis recorded.
Release and failure	A competent authorized person signs the result. Missing configuration or an indeterminate critical result holds acceptance.
Continuing controls	C2 ongoing service surveillance no later than six months; method/site/critical equipment changes trigger review.
Claim limit	Only the described inspection service and method; no automatic product approval or laboratory accreditation.

AJ.4 Completed illustrative assessment and decision record

- a) This example combines F04–F08 fields to show a traceable decision. The object is an ongoing ORG scope; it is not the same conformity object as the SVC example above. Shared identifiers identify related business activity without merging conclusions.

Table AJ-4 — F04–F08 combined example — EVAL-EX-026

Record stage	Filled illustrative record
Application	ORG; fictional support-equipment manufacturer; 80 effective personnel; one site; C2; special processes and assured digital acceptance.
Plan	B = 5; K = 1.35; f = 0.30; T = 9.0 auditor-days; readiness 2.5 and implementation 6.5; qualified specialists assigned; independent review separate.
Observed finding	NCR-EX-11: post-maintenance reference verification not enforced. Requirement 7.6/7.7; actual affected work and evidence recorded. Major classification based on control breakdown.
Protection	Affected measurements held; relevant earlier output traced; safe disposition and required notifications completed.
Correction and cause	Reference verified; occurrence and escape causes demonstrated; workflow amended and challenged under representative conditions.
Closure	Competent reviewer verifies implementation and effectiveness. No open nonconformity remains in the proposed ORG scope.
Decision	Independent decision maker grants only the evaluated ORG scope on the actual recorded decision date. Product and personnel routes not included.
Continuing status	Maximum ongoing validity 24 months; first C2 surveillance no later than six months; exact dates calculated from actual decision and recorded.

AJ.5 Completed illustrative personnel and supplier records

- a) The examples retain the distinction between demonstrated competence, employer task permission and supplier work approval. They deliberately contain no real personal data, signature or purported live certificate number.

Table AJ-5 — F09–F10 bounded records

Record	Filled illustrative content and decision
PER-EX-017 competence	Knowledge 86%; practical 92%; failed essential hold step. Initial decision refused. After successful documented remediation and equivalent practical reassessment, independent decision limited to the assessed dimensional-inspection role.
Employer task authorization TA-EX-17	Applies only after competence is demonstrated; approved measuring station and stated part family; current method and supervision limits; review no later than 12 months; C2 inactivity over six months requires observed demonstration.
Supplier approval SUP-EX-042	New bonded-assembly site proposed; existing corporate documentation does not prove site capability. Conditional development status permits controlled qualification trials only; production release held.
Source closure	Site-specific process qualification, operator authorization, environmental controls and representative first article verified. Approval record updated only for the demonstrated site and process window.
Sub-tier trace	Surface source S-10A and test laboratory L-07 approved for actual work; their evidence connects material M-31 and run BR-116 to the delivered bracket serial population.

AJ.6 Cross-clause consistency and interpretation controls

- a) The organization and scheme operator shall check that profiles, contracts, internal procedures, calculations, electronic states and public statements agree with the controlling clauses in Table AJ-6. A locally invented workflow shall not change a requirement simply because it is convenient to automate.
- b) Detected contradictions shall be recorded with affected objects and versions, evaluated for technical and status impact, and corrected through authorized change. Where a safe resolution is not yet available, dependent acceptance or attestation shall be held. Historical records shall remain truthful.

Required evidence: Consistency review; identified conflicts; impact assessment; approved corrections; preserved historical decisions.

Table AJ-6 — Controlling rules and common misinterpretations

Subject	Controlling provisions	Required interpretation
Scope and object	1.3; 2.2; Annexes A and AA	Activity triggers and retained responsibility determine requirements. PER applicants do not inherit corporate QMS obligations.
Criticality and independence	Annex B; 5.3; 9.6; Annex AB	Criticality drives technical assurance. Third-party decision independence is additional, not replaced by low criticality.
Measurement decisions	7.7; Annex AD; informative Annex H	The pre-agreed normative decision rule controls; example numbers are not universal limits.
Product / service / process release	8.6; 23–25; Annexes C, K–M and AD	Qualification, routine release and independent certification are separate. Conditional progression is not conditional certification.
Auditor and personnel competence	7.2; 26; Annexes AB and AE	Knowledge scores, practical scores and all essential steps are separate pass conditions. Employer authorization remains distinct.

Subject	Controlling provisions	Required interpretation
Subcontracted work	8.4; 27; Annexes J and AF	Requirements reach the actual performer; outsourcing does not remove retained accountability.
Audit time and frequency	Annexes AC and AG	AC controls resource floors and coverage; AG controls intervals. A smaller fee does not justify less evidence.
Findings and status	22; Annexes AD and AG	No open nonconformity at initial grant/renewal/extension. Existing minor continuation is bounded and documented.
Provider competence / accreditation	28; Annex AH	Organizational conformity is not accreditation; actual independent technical competence and authorization are required.
Appeals and protection	22.7; Annex AI	Fair independent review does not automatically suspend protective action or extend validity.
Edition and amendment	2.5; Annex Y	First Edition identifies the document. Amendments and recognition arrangements require their own actual controlled decisions.
Examples and calculations	0.5; Annexes E–I, U and Z	Synthetic values support methods; they do not establish the performance of an actual product or operation.

AJ.7 Digital implementation and record export

- a) A digital workflow shall implement required state transitions, approvals and access controls and shall be tested against permitted and prohibited cases. Tests shall include open critical findings, expired competence, unavailable evidence, mismatched configurations, suspended status and an attempted unauthorized approval.
- b) An export shall preserve readable decisions, identities, configurations, requirements, actual results and relationships to supporting evidence. A summary PDF without the necessary source evidence shall not be described as a complete transferable dossier. Migration and restoration shall verify records and relationships, not merely file counts.

Required evidence: Workflow validation; prohibited-case tests; attributable approvals; complete exports; relationship and recovery verification.

ANNEX AK / NORMATIVE

Integrated applicability and atomic acceptance architecture

This annex supplements Clauses 1–3 and 22 and Annexes A, AA, AD and AJ. It defines a reproducible decision unit. It does not replace the engineering judgement needed to establish a valid application profile. The underlying engineering uncertainty shall remain visible even when the administrative outcome is explicit.

Linked provisions: 1.2–1.5; 2.1–2.6; 3.1; 22; A; AA; AD; AJ

This annex forms part of the approved edition. Requirements apply within its stated scope. Numerical examples and explanatory diagrams remain informative.

AK.1 Requirement atom and complete decision record

- a)** The profile owner shall decompose each applicable compound provision into separately testable conditions without changing the source obligation. Each condition shall have a stable atom identifier linked to the full originating paragraph, table row or profile requirement. A summary question shall not delete an exception, an interface duty or a required independent approval.
- b)** Before evaluation, each atom shall identify the object and configuration, applicability trigger, responsible role, observable characteristic, criterion, units or attribute vocabulary, method, observation conditions, population or sample, evidence requirement, uncertainty treatment, decision rule and approval authority. The record shall also identify the consequence of missing or failed evidence and the event that invalidates a previous conclusion.
- c)** An essential field shall not be left blank, assigned an unexplained dash or completed with an undefined expression such as acceptable, adequate or aerospace grade. Where a technical value is not yet available, the atom shall remain not yet demonstrated and shall block dependent acceptance. This rule requires completion of the real engineering basis; it does not authorize use of example values as defaults.

Table AK-1 — Requirement atom and complete decision record

Field	Required definition
Identity	Atom ID; complete parent provision; object; configuration; accountable owner.
Criterion	Quantity and units or defined attribute; lower/upper or categorical limits; inclusivity.
Method	Procedure and version; conditions; instruments; raw data; competence and sample basis.
Decision	Uncertainty rule; prohibited outcomes; review independence; actual conclusion and rationale.
Continuity	Validity context; change triggers; related release, hold, finding and status records.

Required evidence / record: Atomic requirement register; parent links; approved criteria and methods; unresolved-input holds.

Decision control: PASS requires all applicable conditions of the source provision to pass; an atom list is not complete merely because every existing row is filled.

AK.2 Activity, responsibility and boundary closure

- a)** The applicability review shall evaluate direct work, retained outsourced responsibility and interfaces capable of affecting an assured outcome. For each lifecycle phase it shall identify what is performed, what is supplied by another party, what is explicitly excluded and who retains each acceptance decision. A commercial contract label shall not override the actual activity.
- b)** The review shall test boundary closure in both directions: every claimed object shall resolve to criteria and evidence, and every safety- or mission-significant interface shall resolve to an accountable owner. An excluded service that supplies an essential input shall still appear as a controlled dependency. An unlisted technology shall enter the same consequence-led review.
- c)** Approved non-applicability shall state the absent activity and absent retained responsibility, supporting evidence, effect on neighbouring requirements, approving role and review trigger. Missing evidence, inaccessible premises, lack of personnel or a failed result shall not be represented as non-applicability.

Required evidence / record: Object-by-phase matrix; performer/dependency map; approved non-applicability records; boundary-closure review.

Decision control: An unowned essential interface or unjustified exclusion blocks the affected claim.

AK.3 Four requirement states and separate evidence states

- a)** Requirement status shall use PASS for conformity demonstrated, FAIL for an applicable requirement demonstrably unmet, HOLD for not yet demonstrated, and approved N/A for valid non-applicability. These are display aliases for the source status dictionary, not new certificate classes. Every state change shall identify the actor, time, prior state, new evidence and decision basis.
- b)** Evidence status shall independently identify planned, collected, technically reviewed, accepted for a specified purpose, rejected, superseded or unavailable. Accepted evidence shall state the purpose and conditions for which it is adequate. Receipt, signature, payment or successful file upload shall not automatically move evidence to accepted.
- c)** An indeterminate measurement under DR-A shall remain HOLD for acceptance; it is not automatically a proven physical defect. Invalid test execution may demonstrate failure of a process-control requirement while leaving the tested product characteristic HOLD. The record shall preserve both conclusions rather than merge them into one colour or score.

Required evidence / record: State dictionary; evidence-purpose links; actor-attributable history; separate method and product findings.

Decision control: A positive grant may not be inferred from a dashboard with unresolved FAIL or HOLD atoms in the granted scope.

AK.4 Acceptance algorithm and non-compensable gates

- a)** The decision engine or manual review shall first verify authority, object identity, profile completeness, applicable obligations, competence, independence and evidence validity. It shall next evaluate every applicable mandatory atom using the pre-agreed criterion. It shall then verify finding closure and the exact boundaries of the proposed claim.
- b)** For an initial grant, renewal or extension, every in-scope nonconformity shall be closed and each required acceptance condition shall be fulfilled. A weighted total, majority vote, maturity level, customer preference or favourable commercial outcome shall not compensate for a failed gate. Restriction is permissible only for a real independently evaluated scope that is not affected by a systemic deficiency.
- c)** A technical concession shall identify a permitted bounded departure and the actual authority accepting that departure. It shall not change a failed original requirement into PASS or relax the source attestation

rules. Conditional progression may authorize only non-dependent work within its recorded limits. Neither concession nor conditional progression is a conditional conformity certificate.

Required evidence / record: Gate-by-gate record; atom results; independent review; closed findings; distinct concession and progression records.

Decision control: Grant = valid scope AND complete criteria AND valid evidence AND all mandatory conditions fulfilled AND in-scope findings closed AND independent authorized decision.

AK.5 Numeric boundaries, precision and invalid inputs

a) The criterion shall state whether each numerical boundary is inclusive or exclusive and whether the uncertainty interval is symmetric or asymmetric. One-sided and two-sided requirements shall be identified before result review. Decisions shall use unrounded values with sufficient precision; presentation rounding follows the decision.

b) The evaluator shall reject incompatible units, missing required inputs, invalid time bases, negative standard uncertainty, undefined denominators and non-finite outputs as invalid calculation states. Such states shall create HOLD rather than a numeric zero, an empty-cell pass or a false non-applicability. Exact-integer criteria and calendar rules shall not be evaluated with inappropriate floating-point tolerances.

c) Comparison tolerances in software shall be justified from representation error and the calculation model. They shall not silently widen a physical specification. Where the specified uncertainty interval produces an empty acceptance region, the method is incapable of demonstrating conformity under that rule; the method or authorized decision basis shall be improved before acceptance.

Required evidence / record: Boundary convention; units and precision record; known-answer tests; invalid-input and empty-region challenges.

Decision control: No rounding, missing-cell default or software tolerance may create a physical acceptance that the approved rule does not permit.

AK.6 Conflict resolution, interpretive consistency and escalation

a) The organization shall maintain a conflict register when a profile, instruction, contract, numerical tool or form disagrees with a controlling provision. It shall identify every affected object, prior decision and dependent activity. Compatible obligations accumulate; incompatible obligations require the lawful resolution in Clause 2.3.

b) Competent reviewers shall determine whether a proposed clarification merely explains an existing obligation or changes its technical intent. An example, checklist note or software workflow shall not silently introduce or remove a requirement. Technical changes follow the amendment and approval controls in Annex Y.

c) Inter-evaluator calibration shall use identical controlled cases, preserve individual decisions before discussion, identify disagreement causes and retest equivalent cases after clarification. Agreement percentages shall be reported with the case count and nature of disagreement; agreement alone does not prove that a shared interpretation is technically correct.

Required evidence / record: Conflict record; authorized interpretation; affected-population review; blind-case decisions and calibration results.

Decision control: Unresolved material contradiction holds the dependent acceptance; seniority does not replace a technical basis.

ANNEX AL / NORMATIVE

Contemporary quality-management controls and process effectiveness

This annex strengthens the organizational core in Clauses 4–10. The requirements address implemented behaviour and measurable outcomes, not a mandatory new departmental structure. Each requirement applies to the organization or provider responsible for the activity; a personnel applicant does not inherit the corporate management system.

Linked provisions: 4–10; 20.1–20.6; B; D; V; W; X; Y

This annex forms part of the approved edition. Requirements apply within its stated scope. Numerical examples and explanatory diagrams remain informative.

AL.1 Context review with an explicit decision output

- a)** The context review shall identify the planning horizon, relevant conditions, evidence source, confidence and owner for each material assumption. It shall examine technology, workforce, supply concentration, physical environment, infrastructure, information dependencies and changes to customer obligations at the level relevant to the actual business and mission.
- b)** Each material issue shall be dispositioned as a controlled risk, a selected opportunity, an operating constraint or a monitored condition with an explicit trigger. The organization shall record what changed in requirements, objectives, resources or controls. A static list of external issues without an assessed operational consequence shall not demonstrate implementation.
- c)** Climate relevance shall be tested against product operating envelopes, site exposure, utilities, transport, material availability and adopted customer commitments. A decision of no material relevance shall explain the assessed boundary and evidence. This assessment does not create a universal emissions target or substitute environmental performance for product acceptance.

Required evidence / record: Context-to-action matrix; horizon and assumptions; climate-relevance analysis; resulting plan changes.

Decision control: The review closes only when material issues have an accountable disposition and the affected plans are updated.

AL.2 Interested parties and commitment classification

- a)** The organization shall classify each relevant expectation as binding obligation, voluntarily adopted commitment, information to monitor or out-of-scope request. It shall identify the source, affected output, decision owner, fulfillment evidence and change mechanism. Marketing statements accepted as commitments shall enter the same control.
- b)** Customer, user, worker and public-exposure perspectives shall be considered where they identify a credible effect on an assured output. Conflicting needs shall be resolved before commitment or dependent work. A purchasing approval shall not be presumed to authorize a technical or safety departure.
- c)** Sensitive information shall be shared through an authorized need-to-know arrangement. When confidentiality limits direct disclosure, a competent permitted reviewer shall retain access to necessary evidence. An unsupported assurance statement is not an alternative to a material unavailable record.

Required evidence / record: Party/commitment register; classification and owner; conflict resolution; secure evidence-access arrangements.

AL.3 Leadership, resources and protected technical challenge

- a)** Top management shall show how quality, safety, mission and customer commitments affect budgets, staffing, schedules and escalation decisions. Resource decisions shall identify the acceptance and independent-review workload as well as production demand. The management representative shall have direct access to the accountable executive for unresolved conformity concerns.
- b)** Performance incentives shall be reviewed for pressures to conceal defects, delay notifications, accept incomplete evidence, suppress dissent or move unfinished work downstream. An adverse incentive shall be corrected and its affected work population reviewed. A policy statement alone shall not demonstrate that technical authority can resist commercial pressure.
- c)** The organization shall test its stop-work path through safe administrative or simulated challenges. The challenge shall demonstrate that a qualified concern can reach the correct authority, preserve affected status and obtain an evidence-based restart decision without retaliation. A drill shall not create an actual unsafe operating condition.

Required evidence / record: Resource decisions; incentive review; authority map; safe stop-work exercise and remedial actions.

Decision control: Critical control or independent-review capacity shall not be removed to achieve an unqualified delivery target.

AL.4 Quality culture, ethical conduct and awareness

- a)** Quality culture shall be evaluated using observable behaviour: reporting of weak signals, response to adverse evidence, treatment of suppliers, control of rework, truthfulness of records and management completion of corrective actions. The organization shall use more than a survey or attendance count and shall consider whether low reporting reflects barriers rather than absence of problems.
- b)** Role-specific awareness shall include the contribution to conformity and safety, the consequences of deviation, the route for protected reporting and the limits of personal authority. Interviews or representative decisions shall test understanding. Persons creating, changing or accepting evidence shall demonstrate refusal of fabricated or retrospectively altered records.
- c)** Good-faith reporting shall be separated from disciplinary findings. An allegation shall initiate fair fact-finding and proportionate protection, not an automatic declaration of misconduct. Outcomes and lessons shall be communicated within lawful confidentiality limits. Training effectiveness shall be reviewed through changed behaviour or competent performance.

Required evidence / record: Behavioural indicators; awareness demonstrations; protected cases; investigation controls; training-effectiveness evidence.

AL.5 Process ownership and interface agreements

- a)** Every process shall have a controlled definition of purpose, inputs, suppliers, outputs, customers, sequence, resources, competence, operating criteria, risks, opportunities and measures. At each cross-functional handover, the sending and receiving responsibilities shall identify acceptance, rejected-input handling, escalation and record location.
- b)** For shared services, remote functions and outsourced steps, the map shall identify the actual performer and the organization retaining the obligation. A process owner shall not close an interface gap merely by assigning the same issue to another department. Interface performance shall include incomplete, late or inconsistent transfers.
- c)** The organization shall periodically trace an actual output through the process network and test whether declared interactions match work performed. Broken links, duplicated approvals and uncontrolled local alternatives shall generate improvement or corrective action according to the actual

requirement gap.

Required evidence / record: Process definitions; interface agreements; observed end-to-end trail; handover performance and actions.

AL.6 Separate risk treatment and opportunity pursuit

a) Risk planning shall identify adverse scenarios, consequences, exposure, dependencies, uncertainty, prevention, detection, mitigation and residual acceptance. Opportunity planning shall separately state the proposed benefit, feasibility assumptions, resources, owner, trial boundary and evidence that the benefit was achieved.

b) An opportunity may introduce new risks; these shall enter the risk process before trial or deployment. A projected economic or environmental benefit shall not reduce the assessed severity of a hazard or cancel an unmet requirement. Ordinal risk scores may prioritize attention but shall not be represented as measured probabilities.

c) Effectiveness of a risk control shall be linked to verified implementation and relevant outcome evidence. Closure of a task is not the same as demonstrated reduction in risk. When evidence contradicts an assumption, the responsible authority shall reopen the assessment and identify affected releases.

Required evidence / record: Separate risk and opportunity records; pre-trial review; control verification; benefit evaluation; reopened assumptions.

AL.7 Objectives and metric specification

a) Each objective shall identify the desired result, baseline, denominator, reporting window, responsible owner, target rationale, resources and review point. The metric specification shall state inclusion and exclusion rules, handling of missing data, data source, aggregation level and the action triggered by adverse performance.

b) Conformity, delivery, safety, reliability, customer experience and evidence integrity shall not be merged into a score that can conceal a mandatory failure. Leading indicators shall be periodically compared with relevant outcomes to test usefulness. A favourable reporting period shall not erase an unresolved earlier escape.

c) Changes to targets or denominators shall be approved prospectively with the reason and comparison impact retained. Historical performance shall remain reproducible under the original definition. For small populations, counts and exposure shall accompany percentages and the interpretation shall acknowledge limited information.

Required evidence / record: Metric dictionary; target approval; source reconciliation; historical definitions; adverse-result decisions.

AL.8 Planned, emergency and temporary change

a) The change record shall identify the old baseline, proposed baseline, purpose, affected responsibilities, criteria, risks, resources, timing, user communication and evidence required before implementation. Changes to organization, suppliers, tools, software, data or physical process shall enter the same consequence-led control.

b) An emergency route shall identify the authority, narrow permitted scope, additional protection, monitoring and termination or conversion condition. It shall not excuse a missing safety approval or an irreversible action dependent on unavailable evidence. Temporary status shall have a genuine expiry, not an automatically renewed administrative label.

c) Post-change review shall verify intended performance, configuration, training, interface compatibility, record migration and adverse effects. The review shall assess work performed during transition and

rollback feasibility. Closing an implementation ticket shall not alone establish successful change.

Required evidence / record: Change impact; before/after baselines; approved emergency limits; post-change evidence; rollback and transition review.

Decision control: Dependent use remains held until required qualification, competence, data and approvals are available.

AL.9 Capacity, resilience and competent substitution

a) Capacity evaluation shall consider bottlenecks in production, inspection, testing, engineering support, review, decision and supplier response. The organization shall define workload assumptions, availability, expected rework, maintenance and the consequences of accelerated delivery. Capacity calculations shall use compatible periods and units.

b) Continuity plans shall identify time-critical dependencies and qualified alternatives. A nominated substitute is not a demonstrated alternative until capability, configuration, access, training and evidence continuity are verified. Exercises shall include loss of specialist staff or an essential source and the integrity of restored technical records.

c) Restart after disruption shall verify current instructions, equipment status, material condition, competence and acceptance capability. Meeting a recovery-time objective shall not establish technical integrity or permit release of outputs produced under unverified conditions.

Required evidence / record: Capacity model; bottleneck review; qualified alternate evidence; continuity exercises; restart acceptance.

AL.10 Documented information and long-life knowledge

a) At point of use, personnel shall be able to identify the applicable instruction, version, approval status, configuration, effectivity and required records. An offline copy or cache shall have a control that detects obsolescence before it affects acceptance. Combined documents are acceptable when required responsibilities and information remain accessible.

b) Knowledge preservation shall identify critical rationale, tacit process understanding, field lessons and reconstruction resources. Handover shall verify the receiving person or system can apply and retrieve the knowledge, not merely acknowledge receipt of a file. Supplier exit and workforce turnover shall be planned for long-life products.

c) Corrections to evidence shall retain the prior value, reason, actor and approval. Archive migration shall verify identifiers, units, relationships, signatures and readable content. Access shall be proportionate to purpose; destruction shall not proceed while a relevant preservation obligation or investigation applies.

Required evidence / record: Point-of-use checks; knowledge transfer demonstrations; correction history; migration and retrieval tests.

AL.11 Customer communication, satisfaction and escalation

a) The organization shall define communication channels for product information, inquiries, requirements, changes, complaints, customer property and disruptions. Safety, life-limit and configuration information shall reach the actual user or maintainer where the purchasing contact alone cannot discharge the duty.

b) Customer satisfaction evidence shall include meaningful feedback and delivery or acceptance experience. Response rates, selection bias and segment differences shall be disclosed where they affect interpretation. Absence of complaints, payment or successful shipment shall not alone establish customer satisfaction.

c) Material concerns shall link to the affected object, configuration and recipients, and shall enter the relevant containment or corrective process. The record shall distinguish acknowledgment, technical

agreement, authorized concession and final closure. Silence shall not be treated as an approval requiring an explicit decision.

Required evidence / record: Communication matrix; user handovers; segmented feedback; issue escalation; actual acceptance and concession records.

AL.12 Internal audit with demonstrated coverage

- a)** The internal-audit program shall map applicable requirements, process interactions, sites, shifts, remote work and critical controls to completed evaluation evidence. Auditors shall not independently audit their own work. Where suitable separation is unavailable, qualified independent support shall be arranged.
- b)** The specified limits of a complete program within 12 months and C2/C3 critical-control evaluation within six months remain applicable. An audit booking or partial questionnaire is not completed coverage. Sampled trails shall include adverse results, changed configurations, interrupted work, rework and customer issues as relevant.
- c)** Findings shall record exact requirement, evidence, gap, affected population and consequence. The organization shall verify containment and corrective effectiveness and shall expand samples when evidence indicates a systemic issue. Audit effectiveness shall be assessed using the validity of conclusions and recurrence, not only closure speed.

Required evidence / record: Coverage matrix; auditor independence; completed trails; sample expansion; finding effectiveness and recurrence review.

AL.13 Management review and measurable follow-through

- a)** The complete management review shall occur within the specified maximum interval of 12 months and sooner when a serious issue demands escalation. Inputs shall include changes, objectives, process outcomes, customer experience, suppliers, audits, nonconformities, risks, opportunities, culture, security, resilience and resource sufficiency.
- b)** For each material adverse input, the review shall record the accepted analysis, decision, accountable owner, resource commitment, due date and verification method. A general statement that all matters were reviewed shall not demonstrate disposition. Dissent and independent-assurance concerns shall remain visible.
- c)** Follow-up shall determine whether decisions were implemented and produced the intended effect. Repeated deferral shall trigger an explicit assessment of continued operating conditions and escalation to the accountable authority. Completion of minutes does not close an unresolved technical hold.

Required evidence / record: Complete input pack; recorded decisions; resources; action follow-up; unresolved operating restrictions.

AL.14 Corrective action that addresses occurrence and escape

- a)** The response shall preserve evidence, contain affected outputs and identify the population from the last demonstrated valid state. Cause analysis shall test both why the defect occurred and why prevention or detection controls failed to stop its escape. Unsupported blame, retraining alone or a replaced procedure shall not demonstrate a systemic cause is resolved.
- b)** Each action shall connect to a substantiated cause, owner, due date and required change controls. Before closure, the organization shall define a representative observation or challenge, its population and exposure, the expected result and who verifies effectiveness. Adverse side effects shall be assessed.
- c)** Recurrence, ineffective action or invalid earlier evidence shall reopen the analysis and affected-population review. Administrative renumbering shall not reset the finding clocks. Product

disposition, supplier corrective action and system corrective action shall remain separately closed where they address different responsibilities.

Required evidence / record: Occurrence/escape causal evidence; containment population; action-to-cause links; predefined effectiveness test; reopened cases.

AL.15 Improvement, innovation and future capability

a) An improvement proposal shall state the existing limitation, expected benefit, technical risk, trial method and comparison basis. The organization shall distinguish prototype success, demonstrated production capability and operational reliability. A planned capability shall not be described as available or certified.

b) Novel technology shall have bounded experiments, monitored failure modes, specialist review and explicit transition gates. Evidence reuse from earlier technology shall identify mechanisms and conditions that remain valid. The trial shall preserve protection of people, critical assets and controlled information.

c) Implementation shall preserve the familiar management cycle of planning, execution, evaluation and improvement while adding controls justified by consequence. A new label, diagram or large document count shall not substitute for functioning processes and genuine outcome evidence.

Required evidence / record: Improvement baseline; controlled trial; benefit and adverse-effect results; maturity boundaries; transition decisions.

ANNEX AM / NORMATIVE

Product realization, configuration and industrial readiness

This annex deepens Clauses 8, 11, 18, 21 and 23-27. It connects requirements, engineering, sources, execution, acceptance and field evidence. It adds no universal material recipe, product tolerance or design load.

Linked provisions: 8; 11; 18; 21; 23-27; C; D; J; K; L; M; T; AF

This annex forms part of the approved edition. Requirements apply within its stated scope. Numerical examples and explanatory diagrams remain informative.

AM.1 Program quality planning and characteristic cascade

- a)** The program assurance plan shall allocate each customer and mission requirement to design, supplier, process, inspection and release controls. It shall identify special requirements, critical items and key characteristics separately, including the failure consequence and reason for enhanced control.
- b)** The characteristic cascade shall connect the design definition to process parameters, measuring method, reaction plan and retained actual result. A key characteristic concerned with variation is not automatically a safety-critical characteristic, and a safety-critical feature may require individual evidence regardless of statistical capability.
- c)** Planning shall establish completion criteria for each work package, required review independence and the information handed to the next function. Contradictory drawing, model, purchasing and inspection definitions shall be resolved before execution.

Required evidence / record: Program plan; characteristic cascade; source-to-process controls; consistent baseline and handover criteria.

AM.2 Design authority and supplied-design boundaries

- a)** The organization shall identify the authority for product design, manufacturing-process design, service design and configuration change. Build-to-print work may exclude ownership of product design only where the responsibility is actually absent; supplied-data review, process design and escalation of technical errors remain controlled.
- b)** Derived requirements shall retain their parent need, technical rationale, interface assumptions, method and approval. A change that affects a safety allocation or critical interface shall receive the corresponding specialist review even when it is described commercially as minor.
- c)** Before design release, the receiving production, test and support functions shall confirm the data are sufficient and internally consistent for their intended use. An approved model shall state its authoritative dimensions, coordinates, units and tolerances and its relationship to supplementary drawings.

Required evidence / record: Authority matrix; supplied-data review; derived-requirement links; design release and downstream usability checks.

AM.3 Design verification, validation and independence

- a)** Verification shall establish satisfaction of specified requirements; validation shall establish suitability for intended use in the stated context. The plan shall distinguish these objectives and identify the configuration, method, conditions, evidence and reviewer for each.
- b)** Tests and analyses shall cover boundaries, degraded modes and interfaces that can invalidate separately acceptable components. Simulation credibility shall be established for the actual decision use. Unvalidated extrapolation or testing only nominal conditions shall remain an explicit gap.
- c)** Review shall retain failed and interrupted work, counter-evidence, unresolved assumptions and the effect of corrections. Independence shall match Annex B and the claim being made. A designer may explain their analysis but shall not replace a required independent challenge of contested critical evidence.

Required evidence / record: Verification/validation matrix; representative results; model credibility; adverse evidence and independent review.

AM.4 Configuration reconciliation and instance effectivity

- a)** The baseline shall distinguish as-designed, as-planned, as-built, as-tested, as-delivered and as-maintained states. It shall include hardware, software, programmable logic, model weights, calibration parameters, supplied data and service instructions where these affect acceptance.
- b)** At each release or handover, the organization shall reconcile these states and identify approved differences. A part number alone shall not establish the installed version. Digital deployment records shall confirm the actual target population and installation result, including partial or failed updates.
- c)** Effectivity shall identify the first and last affected lot, serial, service event or installed instance. Mixed configurations shall be permitted only after compatibility is established. Re-labeling or moving an item shall not reset configuration, service exposure or earlier unresolved status.

Required evidence / record: Baseline genealogy; instance effectivity; configuration audit; approved difference and deployment records.

AM.5 Supplier qualification and multi-tier verification

- a)** Qualification shall cover the actual performer, site, process, method and supply scope. A corporate approval or customer nomination shall not establish an unevaluated lower-tier capability. The organization shall verify scope, source authenticity, competence, capacity, continuity and relevant adverse performance.
- b)** Flow-down shall reach the point of performance and include technical baseline, acceptance, competence, traceability, change, notifications, records, authorized access and exit duties. Critical acknowledgements shall be tested against actual work rather than inferred from a commercial order acknowledgment.
- c)** An external test or inspection report shall be evaluated for identity, method, conditions, uncertainty and relevance to the supplied population. Conditional development approval may permit controlled trials; it shall not be used as unrestricted production release or an independent SUB attestation.

Required evidence / record: Performer/site dossier; sub-tier trace; flow-down verification; technical report suitability; bounded source status.

AM.6 Production readiness and process-control plan

- a)** Before unrestricted realization, the readiness review shall verify released requirements, material eligibility, qualified processes, current tooling and software, competent people, utilities, work environment, measurement capability, source status, support and traceability.
- b)** The control plan shall state the characteristic or essential variable, method, location, frequency, reaction limit, required actual data, responsible person and disposition route. Process-control limits shall not replace product specifications. A capability index shall not eliminate required individual critical evidence.
- c)** Readiness shall be tested on representative actual or controlled trial work. A favourable prototype or first article shall not alone prove sustainable capacity, stable execution or adequate support. Initial production monitoring shall have objective exit conditions and reviewed adverse trends.

Required evidence / record: Readiness package; control plan; representative route evidence; initial-production monitoring and exit decision.

AM.7 Special-process control of hidden properties

- a)** Qualification shall define the material, geometry, equipment, site, preparation, essential variables, interactions, operators, consumables, post-processing and inspection scope. Demonstration shall include technically justified bounding conditions and relevant failure mechanisms.
- b)** Actual runs shall remain inside the approved window and retain traceable parameters. A process average shall not conceal a material excursion. Where final inspection cannot reliably reveal an affected hidden property, a favourable visible result shall not close the process deviation.
- c)** Changes to sources, recipes, software, tooling, location or inspection shall trigger requalification review before dependent unrestricted use. Partial requalification shall explain which evidence remains bounding and why. Annex AQ supplies process-specific completion topics, not universal recipes.

Required evidence / record: Qualified window; run genealogy; bounding qualification; excursion population; full/partial requalification decision.

AM.8 First article and full characteristic accountability

- a)** The first article plan shall state its trigger, production-representative configuration, full or partial scope and the characteristics requiring demonstration. Material, special-process, functional, digital and interface requirements shall be included, not only dimensions visible on a drawing.
- b)** Every applicable characteristic shall have an actual value when the criterion requires a variable result, or a defined attributable attribute result. The record shall link method, equipment, uncertainty and decision rule, and shall identify deviations or missing evidence.
- c)** Partial verification shall identify the change and justify continuing validity of all omitted characteristics. A selected best-looking sample shall not replace representative production evidence. First article acceptance shall remain separate from process readiness and continuing unit or lot release.

Required evidence / record: Characteristic register; actual results; production identity; partial-scope rationale; independent review and open gaps.

AM.9 Counterfeit prevention, FOD and material eligibility

- a)** The authenticity strategy shall consider material, parts, electronics, software, records and certificates. Provenance shall connect original source, intermediaries, lot or serial, condition, received verification and the actual application. Unverified documentation shall not prove suitability.
- b)** Suspect items shall be segregated and controlled against use or re-entry while evidence is preserved and the population traced. Their return, destruction or other disposition shall be authorized with downstream consequences addressed. Obsolescence or shortage shall not justify an unapproved substitution.
- c)** Foreign-object prevention and contamination controls shall apply at points where an introduced item or residue can affect performance. Tool and consumable accountability, clean-zone restrictions and inspection access shall reflect the work. Closing a work package shall verify removal or authorized retention of temporary items.

Required evidence / record: Authenticity risk and source trace; suspect-population control; FOD and cleanliness records; temporary-item reconciliation.

AM.10 Work transfer and industrial change

- a)** The receiving site shall demonstrate required process, personnel, equipment, utilities, environmental and measurement capability for the transferred work. Sending-site results may support planning but shall not be treated as proof of receiving-site implementation.
- b)** The transfer plan shall retain tools, data, qualified ranges, material history, source visibility, open findings and acceptance responsibilities. Trial output shall be segregated until its permitted use is established. Early output shall receive the planned enhanced checks.
- c)** Concurrent changes shall be evaluated together. A site move combined with a new material source or software update shall not be split into isolated low-risk approvals that conceal the cumulative effect. Transfer closure shall verify stable evidence and continuing support.

Required evidence / record: Receiving-site qualification; transfer baseline; trial status; cumulative-change assessment; initial-output review.

AM.11 Technical release, repair and concession

- a)** Release shall reconcile actual configuration, criteria, required results, material/process evidence, competence, life status and delivery documentation. Mandatory blockers shall be evaluated before any summary performance indicator. The release authority shall identify the exact unit, lot, service or process decision.
- b)** Rework shall restore the defined requirement and receive applicable verification. Repair or use-as-is that departs from the design shall have a lawful approved technical basis and customer approval when required. A concession shall identify the departure and shall not falsely certify that the original criterion was met.
- c)** Repaired, overhauled, reused or transferred items shall retain consumed life and relevant prior damage. A visual inspection or successful functional test shall not create an unsupported as-new or zero-life claim. Escaped output shall remain traceable to recipients and required corrective communication.

Required evidence / record: Release dossier; actual results; concession/repair authority; remaining-life record; delivered-population trace.

AM.12 Field performance, retirement and closed-loop learning

- a)** Field information shall identify configuration, service environment, exposure, failure definition and population. The organization shall assess whether an event invalidates prior qualification, acceptance, a common source or a supported maintenance interval.
- b)** Corrective campaigns shall state the affected population, interim restriction, authorized correction, completion evidence and unresolved recipients. A supplier closure does not automatically close the organization's own oversight deficiency or affected-product disposition.
- c)** Retirement shall control hazardous inventories, reusable material, sensitive data, records and support of remaining users. Unsalvageable items shall be prevented from unauthorized re-entry. Lessons shall update new-program requirements and change review with their actual conditions of applicability.

Required evidence / record: Field exposure and configuration data; campaign tracking; retirement verification; retained support and applied lessons.

ANNEX AN / NORMATIVE

All-space mission and infrastructure assurance

This annex expands Clause 14 and Annex P from Earth-support interfaces to orbital, cislunar, planetary, deep-space and human-system responsibilities. The 32 domain groups below are intersecting coverage dimensions, not 32 new certification routes or an assertion that every capability is operational. Apply every triggered group and the common controls.

Linked provisions: 1; 6.6; 11–14; 18–21; 23–28; B; C; D; M; P; AD

This annex forms part of the approved edition. Requirements apply within its stated scope. Numerical examples and explanatory diagrams remain informative.

AN.1 Mission boundary, domain combinations and unknown technology

- a)** The mission authority shall declare the intended mission, target environment, duration, flight and ground elements, support services, users, operating modes and all irreversible actions within its responsibility. Normal, degraded, emergency, maintenance, extended-life and disposal states shall be included. Claimed suitability shall be limited to the evaluated configuration and domain.
- b)** The applicability matrix shall select all relevant AN-D01–AN-D32 groups and AR verification domains. Coverage may overlap; each obligation shall have one accountable owner and explicit interfaces rather than being counted several times as independent evidence. The record shall identify domains excluded from the proposed claim.
- c)** For an unlisted environment, material, computing method or mission architecture, the authority shall identify new hazards, evidence limitations and required specialist profiles before dependent deployment. An experimental designation does not exempt protection, traceability or authorization. Unsupported future capability shall remain a development objective.

Required evidence / record: Mission scope; combined-domain applicability; lifecycle scenario catalogue; unlisted-technology review; bounded claim.

AN.2 Environment, exposure and qualification equivalence

- a)** The environment specification shall state the physical quantity, units, coordinate or reference system, time basis, distribution or envelope, spatial and temporal variation, uncertainty, combined conditions and evidence source for each relevant exposure. Qualification level, acceptance screening and operating limit shall be separate controlled values.
- b)** The verification matrix shall link each environment to its failure mechanism, article configuration, method, measurement capability, duration or accumulated exposure, margins, test limits and acceptance criterion. Similarity shall be justified characteristic by characteristic; a previous space mission label is not evidence that its environment bounds the new mission.
- c)** Combined and sequential exposures shall be evaluated where order, aging, accumulated damage or recovery can change the result. Limits imposed to protect an article or test facility shall be recorded together with the resulting evidence gap. No unperformed portion of a qualification profile shall be reported as passed.

Required evidence / record: Controlled environment specification; qualification/acceptance distinction; mechanism-based equivalence; cumulative-exposure ledger.

AN.3 Irreversible-action gates and remote evidence

- a)** Before launch commitment, separation, hazardous deployment, proximity engagement, irreversible sampling, human exposure or disposal action, the authority shall verify the exact command configuration, validated procedure, required evidence, resources, protective controls and available intervention. A milestone date or nominal mission performance shall not substitute for the gate decision.
- b)** Where direct inspection or retrieval is impossible, the evidence strategy shall be established before deployment. It shall identify observables, sensor health, telemetry delay, coverage gaps, inference assumptions, alternative explanations and required independent review. Absence of a signal shall not prove absence of a hazard when the observation channel cannot discriminate it.
- c)** The domain cards define mandatory completion topics. Actual parameter values, methods, tolerances and acceptance rules shall be approved in the mission profile before evaluation. Each card shall retain boundary, parameter schedule, evidence, adverse-case result, independent review where triggered and release/hold decision. Unresolved essential observability or command-authority gaps shall hold the dependent action.

Required evidence / record: Irreversible-action dossier; observable-to-claim matrix; actual parameter schedule; remote-evidence limitations; signed decision.

AN-D01 Mission architecture and system-of-systems

Scope and boundary: Space, payload, launch, ground, users, external services and retirement ownership across one mission or a distributed enterprise.

Parameters to approve before evaluation: Mission duration; success and safe-state definitions; interface units, time systems and frames; allowed mode transitions; reserve ownership.

Required evidence: Allocated requirements, interface agreements, integrated scenarios and configuration-controlled assurance case with independent challenge.

Adverse-case challenge: Remove a shared supporting service and examine whether separately accepted elements still meet the combined safe-state requirement.

Decision and claim limit: Hold mission readiness when an essential dependency has no accountable owner or when the integrated outcome is inferred from component passes.

AN-D02 Suborbital and transient microgravity systems

Scope and boundary: Civil research, payload carriage and recovery during short-duration flight or transient environments, including return handling.

Parameters to approve before evaluation: Actual mechanical, thermal and pressure histories; experiment exposure window; payload-to-carrier interfaces; recovery and preservation limits.

Required evidence: Carrier interface verification, payload qualification, synchronized experiment records, recovery-condition evidence and abnormal-event disposition.

Adverse-case challenge: Challenge a delayed event, interrupted power and off-nominal recovery condition without inventing flight-performance values.

Decision and claim limit: Accept only the demonstrated payload configuration and exposure envelope; hold a recovered article with unknown environmental history.

AN-D03 Low Earth orbit spacecraft

Scope and boundary: Single-spacecraft and payload responsibilities in low Earth orbit, including ground support and mission termination.

Parameters to approve before evaluation: Mission-specific radiation, charging, thermal cycles, atomic-oxygen relevance, drag/lifetime assumptions and disposal resources.

Required evidence: Environment basis, component suitability, deployment verification, thermal/power margin evidence and disposal feasibility review.

Adverse-case challenge: Examine degraded attitude knowledge, eclipse power loss or a mission extension that consumes disposal reserve.

Decision and claim limit: Hold deployment or extension when the actual combined environment or protected end-of-life resource cannot be substantiated.

AN-D04 Medium orbit and timing-service systems

Scope and boundary: Space and ground components providing timing, navigation-support or other services from intermediate orbital regimes.

Parameters to approve before evaluation: Radiation exposure; clock stability and time-transfer uncertainty; service error definitions; continuity window; ground-reference dependencies.

Required evidence: Calibration lineage, time/frame convention, service validation, integrity monitoring and configuration-linked anomaly correction.

Adverse-case challenge: Inject a controlled stale reference or inconsistent time basis into an isolated test and confirm that invalid output is detected and bounded.

Decision and claim limit: Do not infer service accuracy from spacecraft health; hold use where time-reference or integrity evidence is unresolved.

AN-D05 Geostationary and long-duration orbital systems

Scope and boundary: Long-life spacecraft, payload and service interfaces whose continuity depends on prolonged environmental and component performance.

Parameters to approve before evaluation: Mission duration; eclipse and thermal cases; power degradation; station/service constraints; remaining resource and support assumptions.

Required evidence: Life-limited item assessment, degradation models, ground continuity, secure-update support and end-of-life budget reconciliation.

Adverse-case challenge: Review simultaneous aged-power reduction, payload demand growth and loss of one supporting ground service.

Decision and claim limit: An extension requires current condition and resource evidence; a historic qualification certificate does not establish remaining capability.

AN-D06 Highly elliptical and variable-environment missions

Scope and boundary: Missions with large changes in environment, contact geometry, thermal conditions or time spent in sensitive regions.

Parameters to approve before evaluation: Time-resolved environment; thermal dwell and gradients; radiation accumulation; communications availability; phase-dependent operating limits.

Required evidence: Mission-phase models validated for their decision use, combined-exposure qualification and operations-specific limits.

Adverse-case challenge: Challenge an adverse phase transition or longer-than-assumed period without ground contact while resource demand changes.

Decision and claim limit: Hold a phase-specific claim when an averaged environment conceals an unevaluated peak or transient.

AN-D07 Constellations and distributed spacecraft fleets

Scope and boundary: Multiple spacecraft, shared ground functions, crosslinks, fleet updates and service coordination under common or divided ownership.

Parameters to approve before evaluation: Fleet/instance identity; compatible versions; service coverage; correlated failure assumptions; update batches; coordination responsibilities.

Required evidence: Per-instance status, fleet common-cause analysis, phased deployment validation, segregation of failed updates and coordinated incident response.

Adverse-case challenge: Simulate a shared software or timing failure and verify that a fleet-level metric cannot hide an affected subgroup.

Decision and claim limit: Grant only the evaluated fleet scope; unassessed variants and common uncontrolled dependencies block the related continuing claim.

AN-D08 Rendezvous, docking and proximity safety interfaces

Scope and boundary: Interface assurance for authorized proximity, rendezvous or docking work; no trajectory design or tactical employment is prescribed.

Parameters to approve before evaluation: Cooperative interface definition; relative state uncertainty; contact and transfer limits; command authority; abort/safe-state conditions.

Required evidence: Joint interface baseline, independent safety review, representative hardware/software validation and evidence of enforceable operating boundaries.

Adverse-case challenge: Challenge stale state data, incompatible partner configuration or loss of a required cooperative input in a controlled test.

Decision and claim limit: Hold engagement when partner identity, uncertainty or independent safety evidence is inadequate; a nominal simulation is not unlimited permission.

AN-D09 In-orbit servicing and resource transfer

Scope and boundary: Inspection, repair, replacement, replenishment and life-extension services performed without routine physical retrieval.

Parameters to approve before evaluation: Serviced configuration; material/interface compatibility; contamination; resource accounting; remote-inspection capability; task and abort boundaries.

Required evidence: Service-specific profile, before/after condition, custody and transfer records, representative qualification and technically reviewed remote evidence.

Adverse-case challenge: Test inability to confirm completion, unexpected contact condition or an unexplained resource balance.

Decision and claim limit: Do not declare successful restoration from command transmission alone; acceptance requires observable evidence for the exact service outcome.

AN-D10 In-space assembly and manufacturing

Scope and boundary: Orbital assembly, material processing and manufacturing where gravity, vacuum, access or thermal conditions affect process behaviour.

Parameters to approve before evaluation: Material/feedstock identity; process essential variables; environmental range; inspection access; sample representativeness; return or in-situ use limits.

Required evidence: Environment-specific qualification, run genealogy, validated monitoring, post-process verification and partial-requalification rationale.

Adverse-case challenge: Challenge a hidden-property excursion that cannot be detected by the available remote camera.

Decision and claim limit: A successful machine operation does not establish product conformity; hold use when hidden critical properties are not demonstrably controlled.

AN-D11 Earth-observation payloads and derived data

Scope and boundary: Payload calibration, acquisition, processing and distribution of observation products within stated quality and use boundaries.

Parameters to approve before evaluation: Measurands; spectral/spatial/temporal response; calibration uncertainty; reference frames; processing versions; quality flags and latency.

Required evidence: Calibration chain, independent validation, data provenance, algorithm checks and a trace from sensor input to delivered product.

Adverse-case challenge: Test a stale calibration, changed processing model or unavailable quality flag without concealing lower-quality outputs.

Decision and claim limit: Conclusions apply to the declared data product and conditions; spacecraft operating status is not proof of every derived measurement.

AN-D12 Space communications and hosted services

Scope and boundary: Space links, ground terminals, hosted payload interfaces and delivered communications services, excluding an unbounded network claim.

Parameters to approve before evaluation: Frequency/interface permissions; link and capacity budgets; latency; coverage/outage definitions; data integrity; service dependencies.

Required evidence: Compatible interface verification, budget rationale, service-window results, secure configuration and recovery tests.

Adverse-case challenge: Challenge a failover that restores connectivity but loses message integrity or creates a configuration mismatch.

Decision and claim limit: Time or availability targets cannot compensate for invalid data; hold assured service until both performance and integrity are demonstrated.

AN-D13 Scientific observatories and sensitive payloads

Scope and boundary: Optical, radio, particle, cryogenic and other science systems whose scientific validity depends on controlled environment and calibration.

Parameters to approve before evaluation: Sensitivity; resolution; background; pointing/interface limits; contamination; thermal state; calibration and processing uncertainty.

Required evidence: Payload-specific suitability, contamination/thermal control, calibration history, validation against meaningful references and data-reduction traceability.

Adverse-case challenge: Examine subtle contamination, background drift or an out-of-domain calibration rather than only total payload failure.

Decision and claim limit: Limit science claims to the validated measurement domain; an attractive image or functioning sensor is not a calibrated result.

AN-D14 Cislunar transfers and infrastructure

Scope and boundary: Spacecraft and services operating between Earth-support systems and lunar vicinity, including relay and navigation-support interfaces.

Parameters to approve before evaluation: Mission phase and contact windows; timing; thermal/radiation basis; resource reserves; navigation-support quality; prolonged autonomy bounds.

Required evidence: Cross-provider interfaces, phase-specific assurance, communication-delay scenarios and independent review of critical resource allocations.

Adverse-case challenge: Challenge loss of relay service or inconsistent reference-frame data during a phase with limited intervention.

Decision and claim limit: Hold dependent actions when the autonomy or degraded-service basis does not cover the actual phase.

AN-D15 Lunar orbital, landing and surface mission interfaces

Scope and boundary: Qualification and integration evidence for lunar mission elements and their ground/space interfaces, without specifying guidance or vehicle-design recipes.

Parameters to approve before evaluation: Local environment; dust; thermal cycles; illumination; communications; surface uncertainty; landing-to-surface handover assumptions.

Required evidence: Environment-specific component qualification, integrated system validation and traceable handover of configuration, resources and operating limits.

Adverse-case challenge: Examine an adverse surface condition, reduced illumination or delayed handover that invalidates a nominal resource plan.

Decision and claim limit: A terrestrial demonstration supports only the mechanisms it validly represents; unresolved lunar-specific effects remain HOLD.

AN-D16 Lunar habitats and surface infrastructure

Scope and boundary: Habitats, utilities, construction interfaces, mobility support and long-duration inhabited or uninhabited lunar facilities.

Parameters to approve before evaluation: Occupancy/mission limits; environmental envelopes; utility capacity; redundancy assumptions; contamination; maintenance access; emergency dependencies.

Required evidence: Integrated habitat/utility testing, failure-mode review, maintenance demonstration, configuration and essential-resource ledgers.

Adverse-case challenge: Challenge combined loss of a utility and delayed external support, including the time required for a safe protective response.

Decision and claim limit: No occupancy or critical-service release without the required integrated protective evidence and explicit continuing-support responsibilities.

AN-D17 Planetary surface exploration and mobility

Scope and boundary: Rovers, landers, surface instruments and support services in atmosphere, dust, terrain and gravity conditions different from Earth.

Parameters to approve before evaluation: Surface/environment model; temperature/pressure; dust and corrosion relevance; energy; communications delay; autonomy domain; recovery access.

Required evidence: Mechanism-specific qualification, representative terrain/interface trials, validated remote acceptance and bounded autonomy/fallback evidence.

Adverse-case challenge: Challenge poor observability, energy degradation and a surface condition outside the trained or demonstrated model domain.

Decision and claim limit: Hold autonomous continuation outside the approved domain unless a separately validated safe response applies; do not assume a human can intervene promptly.

AN-D18 Outer-planet and remote icy-environment missions

Scope and boundary: Long-duration spacecraft and payload responsibilities with weak links, limited energy, long delays and harsh remote environments.

Parameters to approve before evaluation: Life/support horizon; cold and radiation exposure; power degradation; storage capacity; contact opportunity; autonomous fault-management limits.

Required evidence: Long-life component and digital support evidence, credible environment assumptions, fault-injection tests and protected data/command records.

Adverse-case challenge: Test a fault occurring during prolonged contact loss together with aged power and unavailable original supplier support.

Decision and claim limit: A long-duration claim requires current evidence for the remaining mission, not only a successful launch or early checkout.

AN-D19 Small-body, comet and irregular-surface missions

Scope and boundary: Operations and payload interactions near bodies with uncertain surface properties and environmental models.

Parameters to approve before evaluation: Uncertainty in local environment and contact properties; dust; thermal state; observation coverage; safe-state and sampling boundaries.

Required evidence: Uncertainty register, bounded scenarios, representative material/interface evidence, command validation and updated condition assessment.

Adverse-case challenge: Challenge a newly observed surface property that invalidates prior similarity assumptions.

Decision and claim limit: Suspend the dependent planned action until the updated environment and interface evidence supports its authorized boundary.

AN-D20 Sample acquisition, custody and return

Scope and boundary: Scientific sampling, containment, transfer, transport and return-chain evidence across mission and receiving facilities.

Parameters to approve before evaluation: Sample identity; contamination and preservation limits; custody; container compatibility; containment integrity; receiving acceptance conditions.

Required evidence: End-to-end custody records, contamination controls, representative containment verification and accountable receiving-facility readiness.

Adverse-case challenge: Test a broken custody link, uncertain container condition or missing preservation history in a controlled evidence exercise.

Decision and claim limit: Do not infer uncontaminated or safely contained status from a successful return event; unknown condition requires controlled assessment.

AN-D21 Solar and heliophysics environments

Scope and boundary: Payloads and mission elements exposed to significant radiant heating, plasma, charging or solar-event variability.

Parameters to approve before evaluation: Relevant flux/exposure envelope; thermal absorption/emission assumptions; charged-particle effects; degraded sensor response; protective modes.

Required evidence: Environment model limitations, coupled thermal/electrical assessment, material suitability, sensor calibration and protective-mode validation.

Adverse-case challenge: Challenge an event outside the nominal planning percentile or a sensor condition that masks the relevant threat.

Decision and claim limit: Hold unsupported envelope extension; an average exposure value cannot justify a critical peak or combined condition.

AN-D22 Very long-duration and beyond-current-domain concepts

Scope and boundary: Extended deep-space, precursor or other future concepts whose required evidence exceeds demonstrated technology or support horizons.

Parameters to approve before evaluation: Demonstrated versus projected functions; lifetime assumptions; communication delay; energy and data stewardship; unverified mechanisms.

Required evidence: Explicit feasibility gaps, bounded research demonstrations, mechanism-level evidence, long-life knowledge plan and independent review of extrapolation.

Adverse-case challenge: Separate optimistic projections from measured capability and challenge the survival of critical knowledge after supplier and workforce change.

Decision and claim limit: This profile permits controlled development, not a declaration of operational readiness for an unvalidated future mission.

AN-D23 Launch vehicle and payload interface assurance

Scope and boundary: Quality and lifecycle assurance for launch services, payload interfaces, ground handling and acceptance boundaries; no propulsion construction parameters.

Parameters to approve before evaluation: Payload configuration; mechanical/electrical/environmental interfaces; test history; hold points; authority; transportation and launch-site conditions.

Required evidence: Interface compatibility, manufacturing and test genealogy, joint readiness review, article differences and required lawful launch approvals.

Adverse-case challenge: Challenge a late payload change or a discrepancy between as-tested and as-integrated configuration.

Decision and claim limit: Launch-service acceptance shall not be inferred from an organizational certificate; unresolved mandatory interface evidence blocks the dependent gate.

AN-D24 Spaceports, test ranges and ground infrastructure

Scope and boundary: Facilities and shared services supporting launch, integration, testing, recovery or command functions within actual operating authority.

Parameters to approve before evaluation: Facility boundaries; utilities; contamination zones; safety interfaces; emergency resources; configuration; contractor and tenant responsibilities.

Required evidence: Commissioning records, compatible service interfaces, qualified personnel, maintenance, exercises and evidence for critical protective functions.

Adverse-case challenge: Test loss of an essential utility or conflicting authority between facility, tenant and service provider.

Decision and claim limit: A facility claim does not automatically cover tenants or operating licences; hold affected work when a critical interface is unowned.

AN-D25 Re-entry, recovery and reusable assets

Scope and boundary: Assurance of recovery, inspection, refurbishment and reuse for identified civil aerospace assets.

Parameters to approve before evaluation: Accumulated exposure and damage; remaining-life basis; inspection capability; recovery environment; repair limits; repeat-use configuration.

Required evidence: Mission history, inspection and repair evidence, validated damage-detection limits, requalification review and authorized life accounting.

Adverse-case challenge: Challenge inaccessible damage or missing exposure history following an off-nominal event.

Decision and claim limit: No automatic life reset or reuse from appearance; release requires an evidence-supported remaining-life and configuration decision.

AN-D26 Human spaceflight and crewed mission integration

Scope and boundary: Human exposure across vehicle, ground, habitat, mission support and safe-return responsibilities.

Parameters to approve before evaluation: Human-system needs; crew/passenger assumptions; duration; workload; communication delay; essential resources; emergency and rescue interfaces.

Required evidence: Independent safety case, representative integrated testing, validated human tasks and explicit support and emergency responsibilities.

Adverse-case challenge: Test multiple degraded dependencies and whether a required intervention is actually feasible with available information and time.

Decision and claim limit: Acceptance of risk by an occupant does not replace required technical protections or operating permissions.

AN-D27 Life support, habitation and essential human services

Scope and boundary: Quality and interface assurance for life-support and habitation functions, not medical treatment instructions or universal physiological limits.

Parameters to approve before evaluation: Program-approved atmospheric, thermal, water, waste, resource and habitability criteria; monitoring capability; replenishment and contingency assumptions.

Required evidence: Authorized specialist criteria, calibrated monitoring, integrated endurance/abnormal-mode evidence and resource/custody records.

Adverse-case challenge: Challenge sensor drift, consumable imbalance, maintenance error or simultaneous loss of a supporting resource.

Decision and claim limit: Hold occupancy-dependent acceptance when an essential criterion, uncertainty treatment or protective demonstration is missing.

AN-D28 Extravehicular and crew-equipment interfaces

Scope and boundary: Task-specific assurance of suits, mobility aids, tools, interfaces, communication and recovery arrangements for external human work.

Parameters to approve before evaluation: Task/environment limits; consumable reserve; interface compatibility; reach and workload; monitoring; emergency return assumptions.

Required evidence: Specialist qualification, representative integrated task demonstration, current life/condition records and independent review.

Adverse-case challenge: Challenge loss of a task interface, degraded communications or an inaccessible inspection feature under safe simulation.

Decision and claim limit: An equipment component pass does not establish complete task suitability; all essential human-system dependencies must be demonstrated.

AN-D29 Space power, storage and energy stewardship

Scope and boundary: Generation, storage, distribution and support interfaces for mission energy, including specialized sources under separate lawful authority.

Parameters to approve before evaluation: Power and energy by mode; aging; conversion losses; reserve allocation; thermal interactions; protection limits; material/source controls.

Required evidence: Configuration-specific qualification, resource budgets, independent coupled-hazard assessment and tested protection/recovery logic.

Adverse-case challenge: Challenge simultaneous peak load, aged capacity and a reserve already allocated to another mission duty.

Decision and claim limit: A positive nominal arithmetic margin is insufficient when uncertainty or double-counted reserves remove required protection.

AN-D30 Radiation, space weather and charging

Scope and boundary: Environment and susceptibility assurance for components, materials, electronics, human-system interfaces and mission data.

Parameters to approve before evaluation: Dose/fluence and units; energy spectrum; event duration; shielding assumptions; susceptibility; charging; prediction confidence and margins.

Required evidence: Specialist environment basis, article-representative test or justified analysis, uncertainty, lot variability and event-response plans.

Adverse-case challenge: Examine an incorrect spectrum assumption, limited test sensitivity or a common susceptibility in redundant channels.

Decision and claim limit: Do not infer mission immunity from a generic radiation-resistant label; qualification applies only to the demonstrated mechanism and conditions.

AN-D31 Orbital responsibility, debris and disposal

Scope and boundary: Tracking, coordination, collision-information use, debris prevention, passivation, disposal and retirement responsibilities.

Parameters to approve before evaluation: Object identity; state uncertainty; information latency; decision authority; protected disposal resources; failure and observation assumptions.

Required evidence: Current responsibility agreements, validated information chain, resource reconciliation, event records and disposal verification or bounded inference.

Adverse-case challenge: Challenge uncertain observation, unavailable coordination or mission extension consuming protected retirement capability.

Decision and claim limit: A nominal plan is not verified disposal; retain uncertainty and hold unsupported extension or success claims.

AN-D32 Ground segment, command, time and remote autonomy

Scope and boundary: Ground stations, mission-control software, command chains, telemetry, time services and autonomous response under delayed or absent communication.

Parameters to approve before evaluation: Command authority; authentication; configuration; time/frame standards defined internally; latency/staleness; telemetry validity; autonomy envelope.

Required evidence: End-to-end command rehearsals, negative tests, permission records, consistent time/units, recovery evidence and operator competence.

Adverse-case challenge: Challenge replayed commands, stale telemetry, wrong-target configuration and a recovery that restores access but not data integrity.

Decision and claim limit: No critical command or acceptance based solely on transmission success; verify authorized target, current state and meaningful evidence.

ANNEX AO / NORMATIVE

Aviation systems, operations and advanced mobility interfaces

This annex supplements Clause 15 and Annex Q. It covers the organizational quality and technical evidence interfaces of aviation; it does not replace an aircraft design code, operating permission, maintenance authorization or product-specific engineering basis.

Linked provisions: 8; 11-13; 15; 18-21; 23-28; B; M; Q; T; AD

This annex forms part of the approved edition. Requirements apply within its stated scope. Numerical examples and explanatory diagrams remain informative.

AO.1 Aircraft-to-service scope integration

a) The responsible organization shall identify design, production, installation, maintenance, operation and support duties separately for each aircraft or service scope. It shall record approval interfaces, configuration, operating domain, involved locations and retained outsourced obligations.

b) Installed equipment shall be evaluated in the actual aircraft environment. Component qualification shall not automatically establish installation compatibility, electromagnetic performance, cooling, power quality, human factors or safe failure propagation. Product changes shall update operating and maintenance information.

c) The aviation profiles below shall be combined with the applicable manufacturing, digital, energy, human and verification annexes. Compatibility assumptions shall have an owner on each side of the interface and objective acceptance evidence. An unresolved essential installation or service dependency prevents the corresponding release.

Required evidence / record: Aircraft/service scope tuple; approval-interface matrix; installed-configuration evidence; triggered-profile selection.

AO-D01 Fixed-wing aircraft and integrated equipment

Scope and boundary: Airframe, installed systems, technical support and service interfaces for the actual civil or military fixed-wing scope.

Parameters to approve before evaluation: Operating/load environment; installation interfaces; power/cooling; software; life limits; maintenance and user information.

Required evidence: Controlled aircraft/equipment baseline, integration verification, qualified manufacturing and authorized release dossier.

Adverse-case challenge: Challenge a component substitution that changes interface behaviour while retaining the same commercial product name.

Decision and claim limit: Hold integration acceptance until changed configuration and affected requirements are verified.

AO-D02 Rotorcraft and vibration-sensitive installations

Scope and boundary: Rotorcraft and associated equipment whose dynamic environment and continued support affect conformity.

Parameters to approve before evaluation: Actual vibration and transient environment; attachment; fatigue exposure; contamination; maintenance access; operating modes.

Required evidence: Mechanism-based qualification, representative boundary conditions, cumulative-exposure history and installation review.

Adverse-case challenge: Challenge a changed installation or mission duty that invalidates the original vibration or life assumption.

Decision and claim limit: No whole-aircraft suitability claim from a component test under unrelated boundary conditions.

AO-D03 Unmanned and remotely operated aviation

Scope and boundary: Aircraft, control station, communication, navigation support, remote personnel and third-party services as one operational system.

Parameters to approve before evaluation: Defined operating domain; link quality/latency; lost-link response; human workload; update identity; external service assumptions.

Required evidence: System-level validation, domain enforcement, representative lost-service tests and current operator/task competence.

Adverse-case challenge: Test a degraded link and stale state while the remote operator lacks sufficient time or information to intervene.

Decision and claim limit: Hold deployment when a nominal human-in-the-loop statement is the only protective evidence.

AO-D04 Powered-lift and advanced air mobility

Scope and boundary: Novel aircraft architectures and their charging/fueling, landing-site, maintenance and passenger interfaces.

Parameters to approve before evaluation: Architecture-specific loads and energy; degraded modes; power/thermal coupling; turnaround; ground infrastructure compatibility.

Required evidence: Integrated hazard assessment, duty-specific qualification, validated degraded operation and emergency information for support personnel.

Adverse-case challenge: Challenge aged energy storage combined with a changed mission profile and unavailable ground support.

Decision and claim limit: Alternative energy or novelty does not waive the required safety, qualification or operational approval.

AO-D05 Flight deck, controls and human-system integration

Scope and boundary: Crew interfaces, alerts, automation, controls and operational procedures within actual design responsibility.

Parameters to approve before evaluation: Task allocation; authority; display/alert definitions; response time; workload; foreseeable misuse; mode-transition limits.

Required evidence: Representative user validation, control/alert consistency, normal and abnormal scenarios and resolved usability hazards.

Adverse-case challenge: Challenge misleading mode indication, conflicting alerts and an intervention demand that exceeds available time.

Decision and claim limit: A warning or trained operator shall not replace a necessary feasible design protection.

AO-D06 Cabin, occupant and emergency interfaces

Scope and boundary: Passenger/crew interfaces, cabin materials, equipment, emergency information and maintenance constraints.

Parameters to approve before evaluation: Occupancy assumptions; installation; relevant fire/smoke and environmental criteria; accessibility; emergency task performance.

Required evidence: Product-specific qualification, representative installation tests, user validation and current maintenance/replacement data.

Adverse-case challenge: Examine substituted material, obstructed access or a maintenance change affecting an essential emergency function.

Decision and claim limit: Hold affected release until actual installed compatibility and protective function are substantiated.

AO-D07 Structures, flight-critical hardware and life control

Scope and boundary: Structural and critical mechanical components through manufacture, integration, inspection, repair and retirement.

Parameters to approve before evaluation: Approved loads; fatigue spectrum; material state; damage-detection capability; life consumption; repair and configuration limits.

Required evidence: Material/process genealogy, qualified analysis/tests, NDT capability, recorded exposure and authorized remaining-life decisions.

Adverse-case challenge: Challenge hidden damage, unsupported similarity or unknown previous repair and exposure.

Decision and claim limit: Do not reset life by inspection or overhaul label; unresolved critical condition blocks the affected release.

AO-D08 Avionics, electrical and electromagnetic integration

Scope and boundary: Electrical distribution, avionics, sensors, harnesses and digital interfaces in the installed aircraft configuration.

Parameters to approve before evaluation: Power quality; transients; grounding/bonding; cable/shield configuration; electromagnetic modes; timing and degraded states.

Required evidence: Installation-specific verification, configuration-controlled test setup, actual results and traced anomaly closure.

Adverse-case challenge: Test a wiring, shield or software change that modifies performance while component certificates remain unchanged.

Decision and claim limit: Accept only the configuration and modes covered; omitted installation effects remain HOLD.

AO-D09 Airports, air-navigation data and operational support

Scope and boundary: Airfield infrastructure, navigation-support data, ground equipment and services that affect aircraft or people.

Parameters to approve before evaluation: Service boundary; compatibility; data accuracy/timeliness; local procedures; maintenance; tenant and authority interfaces.

Required evidence: Commissioning and service validation, data lineage, current capability, exercised handovers and change assessment.

Adverse-case challenge: Challenge a stale data feed, equipment incompatibility or unowned tenant interface.

Decision and claim limit: Facility or provider certification does not automatically cover all stations, tenants or flight operations.

AO-D10 Maintenance, repair and continuing airworthiness support

Scope and boundary: Line/base maintenance, component work, repairs, modifications and technical asset support within verified capability.

Parameters to approve before evaluation: Current approved data; product/task scope; tools; personnel authority; parts eligibility; life limits; independent check needs.

Required evidence: Complete work package, removed/installed part trace, interruption handovers, post-work configuration and authorized release.

Adverse-case challenge: Challenge missed restoration of a protective feature or unknown life status after a shift change.

Decision and claim limit: No work beyond task authorization and verified capability; credential and maintenance release are separate.

AO-D11 Aviation fuel, electrical charging and ground energy

Scope and boundary: Quality, compatibility and safety interfaces of energy supply, storage, transfer and support for the declared aircraft architecture.

Parameters to approve before evaluation: Product/material compatibility; supply quality; contamination; interface limits; isolation/protection; condition and custody.

Required evidence: Authorized specialist basis, controlled supply records, integrated compatibility verification and emergency support information.

Adverse-case challenge: Examine an unapproved source substitution or apparently compatible connector with different control behaviour.

Decision and claim limit: An environmental benefit claim does not establish fuel interchangeability or electrical compatibility.

AO-D12 Flight-support services, disruption and data continuity

Scope and boundary: Operational planning support, digital services, training-related outputs and external dependencies under the provider's actual authority.

Parameters to approve before evaluation: Service outcomes; observation window; timeliness; correctness; data rights; capacity; continuity and exit obligations.

Required evidence: End-to-end delivered-service evidence, qualified alternatives, recovery integrity and customer handover.

Adverse-case challenge: Challenge restoration that meets time targets but uses incomplete or obsolete operational data.

Decision and claim limit: Availability alone does not prove service conformity; correct, current and authorized information remains essential.

ANNEX AP / NORMATIVE

Defense, maritime and critical-industrial assurance

The focus is quality, safe industrial operation, lawful information handling, configuration, independent evidence and long-life support. This annex supplies no weapon construction, energetic formulation, targeting, evasion or tactical employment instructions. Such restricted matters remain outside the technical instruction content of this publication.

Linked provisions: 1.5; 11-13; 16-21; 23-28; B; M; R; S; AF

This annex forms part of the approved edition. Requirements apply within its stated scope. Numerical examples and explanatory diagrams remain informative.

AP.1 Controlled-domain responsibility and protected review

- a)** The program shall distinguish technical acceptance, contractual acceptance, information-access authorization and operational permission. It shall identify the actual party responsible for each. One approval shall not be presented as satisfying all responsibilities unless the authorized scope expressly does so.
- b)** Classified or otherwise controlled information shall be reviewed only by lawfully authorized, technically competent personnel using approved channels. Restrictions shall preserve necessary independent challenge. Where adequate review cannot be lawfully arranged, the unsupported claim shall remain held or be explicitly restricted.
- c)** Defense designation, commercial urgency, membership or an existing management-system certificate shall not remove applicable quality, safety, environmental or evidence duties. The following domain profiles shall identify scope-specific parameters and authorized specialist procedures without placing restricted operating recipes in this general standard.

Required evidence / record: Separate authority records; controlled evidence-access plan; independent reviewers; actual domain scope and restrictions.

AP-D01 Multi-domain program governance

Scope and boundary: Air, land, maritime, space and connected support activities within assigned contractual and lifecycle responsibility.

Parameters to approve before evaluation: Object/configuration; acceptance authority; domain interfaces; information class; criticality; support horizon.

Required evidence: Obligation matrix, controlled baseline, cross-domain integration evidence and independent technical challenge.

Adverse-case challenge: Challenge conflicting commercial and technical acceptance definitions at a shared interface.

Decision and claim limit: Hold dependent acceptance until the responsible authorities resolve the actual obligation without concealing a missing approval.

AP-D02 Land platforms and mission-purpose mobility

Scope and boundary: Road and off-road mission vehicles and support equipment, limited to safe platform integration and quality assurance.

Parameters to approve before evaluation: Mass distribution; loads; braking/steering; stability; thermal/electrical capacity; duty and transport conditions; occupant interfaces.

Required evidence: Modified-platform assessment, configuration-specific qualification, material/process records and maintenance evidence.

Adverse-case challenge: Examine a payload integration change that invalidates the base-platform evidence.

Decision and claim limit: A commercial chassis approval does not establish suitability of the modified mission configuration.

AP-D03 Surface maritime platforms

Scope and boundary: Surface vessels, mission-support machinery, structures and onboard services within the evaluated scope.

Parameters to approve before evaluation: Marine environment; corrosion; structural/mechanical/electrical interfaces; watertight boundaries; service duty; life and access.

Required evidence: Qualified fabrication and coatings, inspection capability, commissioning, degradation monitoring and configuration records.

Adverse-case challenge: Challenge inaccessible corrosion or an unreviewed utility change affecting a protective function.

Decision and claim limit: Do not infer through-life integrity from continued operation or a generic system certificate.

AP-D04 Underwater systems and pressure-boundary interfaces

Scope and boundary: Quality and safety assurance of submerged platforms, housings, equipment and support interfaces.

Parameters to approve before evaluation: Approved pressure/environment basis; material condition; joints; inspection access; cyclic exposure; leak detection and life limits.

Required evidence: Specialist design/inspection basis, qualified manufacture, traceable tests and authorized condition/life assessment.

Adverse-case challenge: Challenge a repaired boundary with incomplete prior exposure or insufficient detection capability.

Decision and claim limit: No universal pressure or depth rating is created; actual qualified limits and required permissions control.

AP-D05 Military aircraft and space-support hardware

Scope and boundary: Defense-purpose aviation and space products with combined domain and contract obligations.

Parameters to approve before evaluation: Actual aircraft/mission configuration; environment; interfaces; criticality; information restrictions; continuing-support duties.

Required evidence: Applicable aviation/space evidence plus contractual flow-down, controlled access and independent release.

Adverse-case challenge: Test whether restricted access has been used to replace a required technical observation with a management statement.

Decision and claim limit: An unavailable essential record remains HOLD even when the program is sensitive.

AP-D06 Mission electronics and protective integration

Scope and boundary: Safe integration, configuration and lifecycle support of electronic, sensing, computing and communications equipment.

Parameters to approve before evaluation: Power/cooling; electromagnetic compatibility; timing; trust boundaries; approved functions; safe states and maintenance configuration.

Required evidence: Integration tests, controlled builds, interface verification, defensive security review and current support records.

Adverse-case challenge: Challenge a shared power or software dependency that defeats nominally independent channels.

Decision and claim limit: Component acceptance does not prove system independence or safe integrated behaviour.

AP-D07 Remote systems and bounded human authority

Scope and boundary: Quality and safety controls for authorized remote or autonomous functions, excluding targeting and tactical behaviour.

Parameters to approve before evaluation: Authorized functions; prohibited actions; operating domain; intervention feasibility; lost-link states; configuration and monitoring.

Required evidence: Controlled task validation, authority model, safe-state tests and independent review of consequential automation.

Adverse-case challenge: Challenge stale sensor information and an intervention assumption that cannot be met under communication delay.

Decision and claim limit: Do not grant unbounded autonomy from simulation performance or a nominal human approval step.

AP-D08 Field support, storage and obsolescence

Scope and boundary: Maintenance, repair, spares, distribution and technical continuity across extended service life and distributed locations.

Parameters to approve before evaluation: Life/condition; preservation; cannibalization; substitutions; tooling/data access; supplier exit; repair authority.

Required evidence: Traceable removed/installed items, approved substitutions, life ledger, qualified receiving sources and readable support records.

Adverse-case challenge: Challenge unknown-origin spare parts or a discontinued digital tool needed to reconstruct evidence.

Decision and claim limit: No unsupported as-new status or life reset; restrict work until provenance and technical suitability are resolved.

AP-D09 Hazardous and restricted industrial activities

Scope and boundary: Governance interfaces for specialized hazardous energy, energetic or radiological activities performed by authorized specialists.

Parameters to approve before evaluation: Lawful scope; competence; facility capability; approved safety boundaries; evidence access; emergency and environmental obligations.

Required evidence: Actual specialist authorizations, independent safety review, controlled procedures and verified protective functions.

Adverse-case challenge: Use an administrative exercise to test missing authority, expired competence or inaccessible essential evidence; do not create a hazardous live test.

Decision and claim limit: This standard grants no operating permission and provides no restricted handling or construction instruction.

AP-D10 Critical plant, manufacturing infrastructure and decommissioning

Scope and boundary: Industrial machinery, essential utilities, construction interfaces, commissioning, integrity and retirement supporting assured outputs.

Parameters to approve before evaluation: Design duty; protection; loads/environment; inspection/maintenance; overrides; temporary repair; as-built condition; disposal boundary.

Required evidence: Qualified fabrication, hidden-work inspection, commissioning, protective-function tests, integrity decisions and verified decommissioning.

Adverse-case challenge: Challenge a failed emergency isolation or hidden-work record that has been reclassified as a minor punch-list issue.

Decision and claim limit: Safety or mandatory performance blockers cannot be deferred through a cosmetic priority change or production pressure.

ANNEX AQ / NORMATIVE

Material families and critical-process qualification

The 22 process profiles below supplement 8.5.1.2, Clause 18, Clause 25 and Annex L. They specify what must be technically defined, demonstrated and retained. They do not supply universal temperatures, energy densities, chemical formulations, material allowables or workmanship limits.

Linked provisions: 7.2; 7.5–7.7; 8.4–8.7; 18; 25; 27; J; K; L; M; AF

This annex forms part of the approved edition. Requirements apply within its stated scope. Numerical examples and explanatory diagrams remain informative.

AQ.1 Qualification envelope and essential-variable ownership

- a)** The process authority shall define material/geometry families, input condition, preparation, equipment, software, environment, personnel, essential-variable interactions, post-processing, measurement and acceptance for each actual process. A qualified family shall have a defensible relationship to relevant mechanisms; a shared machine or procedure title is not sufficient.
- b)** Qualification shall test representative and technically justified bounding conditions, including variation that can affect hidden properties. The plan shall state sample selection, repeats, destructive or non-destructive methods, uncertainty, failed-run treatment and independent review. All original trials and authorized exclusions shall remain traceable.
- c)** Approval shall identify the actual operating window and ongoing controls. Excursions shall hold the affected population from the last valid state. Restoration of settings does not demonstrate conformity of earlier output. The authority shall verify the capability of any proposed additional inspection to detect the relevant effect.

Required evidence / record: Material/geometry grouping; approved variables; qualification results; method capability; run genealogy; excursion disposition.

AQ.2 Change, transfer and continued process capability

- a)** Requalification review shall follow changes in input source, material state, geometry, consumables, preparation, equipment, software, location, operator arrangements, inspection or post-processing, as well as adverse trends and significant interruption. Multiple simultaneous changes shall receive an integrated impact assessment.
- b)** Partial requalification shall identify retained evidence and demonstrate why it still bounds unchanged characteristics. Transfer to a new site shall require receiving-site capability evidence. A source's general approval shall not automatically qualify every process or the output produced by it.
- c)** The following profiles shall be completed against actual product requirements. The process approval record shall link to routine acceptance, condition monitoring, calibration, competence and point-of-use instructions. A process qualification result shall not replace product or service acceptance.

Required evidence / record: Requalification triggers; cumulative-change review; receiving-site results; controlled approval scope; routine acceptance linkage.

AQ-P01 Thermal treatment

Scope and boundary: Thermal processes affecting material state, properties and residual stresses.

Parameters to approve before evaluation: Material condition; load arrangement; heating/cooling history; uniformity; sensor placement; atmosphere and downstream operations.

Required evidence: Qualified thermal equipment, calibrated instrumentation, actual batch history and representative material-property evidence.

Adverse-case challenge: An unrecorded local temperature or changed load geometry outside demonstrated uniformity.

Decision and claim limit: Hold the affected batch; a furnace setpoint or certificate alone does not establish article exposure.

AQ-P02 Fusion joining

Scope and boundary: Joining processes whose thermal input, material state and discontinuities influence structural or functional performance.

Parameters to approve before evaluation: Base/filler materials; geometry; joint preparation; essential equipment settings; environment; post-treatment; inspection access.

Required evidence: Qualified procedure and task personnel, consumable genealogy, actual execution and suitable surface/volumetric evidence.

Adverse-case challenge: A repair or parameter change that alters a hidden region not covered by final visual inspection.

Decision and claim limit: Release only within the qualified material/geometry and procedure envelope; unapproved repair remains held.

AQ-P03 Solid-state joining

Scope and boundary: Mechanical or other solid-state joining with interface properties dependent on preparation and process history.

Parameters to approve before evaluation: Material pairing; surface condition; fit/alignment; essential force/motion/thermal variables; tooling; post-processing.

Required evidence: Interface-specific qualification, representative destructive/functional evidence, machine-state checks and run records.

Adverse-case challenge: An interface contamination or changed tooling condition despite acceptable external appearance.

Decision and claim limit: Do not infer bond or joint integrity from appearance or machine completion alone.

AQ-P04 Brazing and soldering

Scope and boundary: Metallic joining and interconnection processes requiring controlled wetting, material compatibility and thermal history.

Parameters to approve before evaluation: Substrate/filler compatibility; preparation; joint geometry; flux/atmosphere; thermal history; cleaning and inspection criteria.

Required evidence: Procedure qualification, lot and life records, actual processing, inspection capability and required functional evidence.

Adverse-case challenge: Changed consumable, residue or inaccessible joint condition outside the qualification basis.

Decision and claim limit: Hold acceptance where hidden integrity or contamination cannot be established by the selected method.

AQ-P05 Chemical surface preparation

Scope and boundary: Cleaning, etching or other chemical preparation that affects adhesion, corrosion, dimensions or material integrity.

Parameters to approve before evaluation: Material compatibility; chemical identity and condition; exposure sequence; contamination; rinse/dry controls; delay to next process.

Required evidence: Controlled bath/chemical records, method suitability, representative surface-property tests and downstream linkage.

Adverse-case challenge: Expired chemistry or excessive delay before bonding despite a visually clean surface.

Decision and claim limit: Surface condition shall be demonstrated for its actual purpose; generic cleanliness is insufficient.

AQ-P06 Plating and conversion coatings

Scope and boundary: Deposited or converted surface layers affecting protection, fit, electrical behaviour or material susceptibility.

Parameters to approve before evaluation: Substrate; preparation; coating composition/thickness; uniformity; material compatibility; post-treatment and contamination controls.

Required evidence: Qualified process window, batch genealogy, thickness/property verification and relevant material-degradation assessment.

Adverse-case challenge: A changed substrate lot or process condition affecting a mechanism not visible in thickness data.

Decision and claim limit: Thickness alone does not establish all required surface or substrate properties.

AQ-P07 Thermal spray and protective deposition

Scope and boundary: Thermally deposited functional or protective surfaces within approved material and geometry families.

Parameters to approve before evaluation: Feedstock; substrate preparation; geometry; equipment state; essential deposition variables; bond/porosity criteria; finishing.

Required evidence: Feedstock trace, qualified process, representative interface/property evidence and production monitoring.

Adverse-case challenge: A changed repair area or inaccessible interface outside demonstrated adhesion and inspection conditions.

Decision and claim limit: Hold use when the interface or relevant functional property has not been validly demonstrated.

AQ-P08 Organic coatings and sealants

Scope and boundary: Paints, protective films and sealants affecting durability, contamination, fire behaviour or interfaces.

Parameters to approve before evaluation: Material compatibility; mixing/life; preparation; layer thickness; cure history; environment; recoat and repair boundaries.

Required evidence: Material genealogy, qualified application/cure, actual life history and specified protective or functional test evidence.

Adverse-case challenge: Out-time exceedance or a nominal colour match concealing different material performance.

Decision and claim limit: An appearance match is not material equivalence or proof of protective performance.

AQ-P09 Composite material processing

Scope and boundary: Polymer-matrix and related composite processing where constituent history and process conditions control hidden properties.

Parameters to approve before evaluation: Constituent identity; storage/out-time; lay-up; orientation; compaction; cure; tooling; environment; inspection limitations.

Required evidence: Constituent genealogy, actual process history, representative coupons/articles, qualified NDT and authorized deviations.

Adverse-case challenge: A cure excursion, undocumented orientation change or defect below the reliable detection capability.

Decision and claim limit: No release solely from a favourable exterior or unrepresentative coupon; evaluate affected structural properties.

AQ-P10 Structural bonding

Scope and boundary: Load-bearing or critical bonded interfaces controlled through preparation, compatibility, cure and service environment.

Parameters to approve before evaluation: Adherend and adhesive identity; surface condition; mixing/out-time; geometry; cure; contamination; aging and inspection access.

Required evidence: Bond-specific qualification, constituent/cure trace, representative durability evidence and process-control effectiveness.

Adverse-case challenge: A weak bond mechanism not detectable by the available production inspection.

Decision and claim limit: A superficial inspection cannot erase an essential-variable excursion affecting hidden bond strength.

AQ-P11 Metal additive manufacture

Scope and boundary: Additively produced metallic items with build-dependent material properties and post-process history.

Parameters to approve before evaluation: Feedstock/reuse; build orientation/location; machine state; digital file; essential parameters; post-treatment; inspection.

Required evidence: Build-specific qualification, powder genealogy, property variability, monitoring validation and final article evidence.

Adverse-case challenge: Changed reuse policy and post-process source evaluated together, including anisotropy and inaccessible defects.

Decision and claim limit: Machine qualification alone does not qualify all geometries, materials or subsequent builds.

AQ-P12 Polymer additive manufacture

Scope and boundary: Additively produced polymer or composite items used within a qualified functional and environmental envelope.

Parameters to approve before evaluation: Feedstock condition; orientation; geometry; process/software; porosity; aging/moisture; post-processing and inspection.

Required evidence: Material/build genealogy, environment-specific properties, dimensional/functional verification and controlled changes.

Adverse-case challenge: A slicing update or storage exposure invalidating mechanical, fire or dimensional assumptions.

Decision and claim limit: Do not transfer qualification solely from a common resin name or printer model.

AQ-P13 Casting

Scope and boundary: Cast products with properties dependent on melt history, geometry, solidification and repair.

Parameters to approve before evaluation: Material chemistry; feedstock; geometry; thermal/process history; defect mechanisms; heat treatment; repair limits.

Required evidence: Batch trace, representative material and defect evidence, qualified processes and authorized repair records.

Adverse-case challenge: A critical region not represented by separately cast coupons or accessible inspection.

Decision and claim limit: Hold unsupported region or repair claims; certificate chemistry does not establish complete casting integrity.

AQ-P14 Forging and forming

Scope and boundary: Deformation processes influencing geometry, material flow, microstructure and residual properties.

Parameters to approve before evaluation: Input condition; deformation/thermal history; tooling; lubrication; geometry; surface condition; subsequent treatment.

Required evidence: Qualified family rationale, actual processing, representative property verification and appropriate inspection.

Adverse-case challenge: A geometry or tooling change altering material flow while nominal dimensions remain acceptable.

Decision and claim limit: Dimensional conformity alone does not establish the required internal material state.

AQ-P15 Precision machining

Scope and boundary: Material-removal processes producing critical geometry, surfaces and interfaces.

Parameters to approve before evaluation: Material state; tool/program; offsets; fixturing; temperature; surface integrity; burrs; measurement and tool-life controls.

Required evidence: Controlled programs, tool/fixture qualification, actual measurements, compensation history and surface checks.

Adverse-case challenge: A fixture maintenance event changes the datum without triggering measurement re-verification.

Decision and claim limit: Hold potentially affected outputs until configuration, metrology and population consequences are resolved.

AQ-P16 Non-conventional machining

Scope and boundary: Processes whose electrical, thermal or chemical effects may alter surface or subsurface properties.

Parameters to approve before evaluation: Material; essential energy/process variables; geometry; fluids; surface layer; microcracking; post-processing; inspection.

Required evidence: Qualified mechanism-specific limits, representative material evidence, run records and validated detection methods.

Adverse-case challenge: Nominal geometry passes while an unexamined recast or damaged layer remains.

Decision and claim limit: A dimension-only acceptance cannot establish unverified surface-integrity requirements.

AQ-P17 Mechanical surface enhancement

Scope and boundary: Controlled surface deformation or finishing used to achieve specified surface condition or residual properties.

Parameters to approve before evaluation: Material/geometry; treatment media; coverage; intensity or equivalent parameter; masking; equipment; subsequent operations.

Required evidence: Qualified procedure, media and equipment records, representative surface/property evidence and change control.

Adverse-case challenge: A later finishing operation removes or changes the qualified surface condition.

Decision and claim limit: Retained benefit shall be demonstrated in the final configuration, not inferred from an earlier process pass.

AQ-P18 Electronics assembly

Scope and boundary: Board, semiconductor-package and electrical assembly within its actual criticality and environment.

Parameters to approve before evaluation: Part/source; loaded configuration; ESD/moisture; solder/bond/coating; cleanliness; thermal history; inspection and functional tests.

Required evidence: Part genealogy, qualified operators/processes, environmental suitability, inspection and configuration-linked test results.

Adverse-case challenge: An obsolete component substitute with different susceptibility or unsupported screening assumptions.

Decision and claim limit: Screening and visual conformity do not remove every latent failure mechanism; actual suitability controls release.

AQ-P19 Wire, cable and harness assembly

Scope and boundary: Electrical and data interconnect assemblies with controlled termination, routing, protection and identity.

Parameters to approve before evaluation: Wire/contact materials; termination; tooling; shielding/bonding; separation/routing; bend/strain; identification and test configuration.

Required evidence: Qualified terminations, tool status, actual inspection/electrical results and installation-linked configuration records.

Adverse-case challenge: A shield or routing change causes an installation effect not represented by a bench continuity test.

Decision and claim limit: Continuity alone does not demonstrate shielding, strain protection or installed electromagnetic compatibility.

AQ-P20 Optical assembly

Scope and boundary: Optical and photonic assemblies sensitive to alignment, cleanliness, thermal state or calibration.

Parameters to approve before evaluation: Material/coating; alignment; cleanliness; adhesive/cure; mechanical/thermal interfaces; measurement conditions; stability.

Required evidence: Controlled assembly environment, alignment/calibration evidence, process genealogy and performance over qualified conditions.

Adverse-case challenge: A contamination or thermal-interface change shifts performance after a nominal room-condition acceptance.

Decision and claim limit: Limit conclusions to demonstrated optical properties and conditions; appearance is not calibrated performance.

AQ-P21 Critical mechanical assembly

Scope and boundary: Fastened, fitted, sealed or moving assemblies whose integrity depends on correct sequence and actual condition.

Parameters to approve before evaluation: Part identity; fits; preload or other approved assembly variables; lubrication; cleanliness; tools; sequence; independent checks.

Required evidence: Controlled assembly records, validated tools/methods, actual critical results and restored protective functions.

Adverse-case challenge: Interrupted work or shared credentials conceal an omitted essential assembly step.

Decision and claim limit: No completion from a final signature alone; each required step and critical result must be traceable.

AQ-P22 Cleanliness and contamination-sensitive processing

Scope and boundary: Processes in which particulate, molecular, biological or chemical contamination affects conformity.

Parameters to approve before evaluation: Actual contaminant and allowable state; sampling location; collection efficiency; blanks; environment; storage and transfer.

Required evidence: Validated sampling/analysis, blank and recovery controls, condition monitoring, custody and excursion assessment.

Adverse-case challenge: A clean-room recovery is claimed to close the condition of previously exposed articles without assessment.

Decision and claim limit: Restored surroundings do not prove restored product condition; affected articles require technically valid disposition.

ANNEX AR / NORMATIVE

Test, inspection and qualification-domain matrix

The 38 verification domains expand Annex M. They are planning and evidence dimensions, not blanket laboratory authorizations. The specific article, characteristic, method, environmental profile, decision rule and specialist competence shall be defined before a test can support acceptance.

Linked provisions: 7.5–7.7; 7.12; 8.3.4; 11.6; 14–20; 23; 28; M; AH; AD

This annex forms part of the approved edition. Requirements apply within its stated scope. Numerical examples and explanatory diagrams remain informative.

AR.1 Complete technical test specification

- a)** The test specification shall identify the claim, requirements, article and configuration, representativeness, method, setup, instrumentation, ranges, uncertainty, conditions, sequence, duration, tolerances, data processing, acceptance criteria and separate safety-abort criteria. Responsibility for specimen selection and population inference shall be explicit.
- b)** Test levels and durations shall be justified from actual duty, failure mechanisms and the engineering/obligation basis. A familiar standard name, generic sector label or available laboratory capability shall not be used as a substitute for the actual specification. Test-article differences and instrumentation effects shall be assessed.
- c)** Unperformed, interrupted, limited or failed work shall remain visible. Repetition shall follow an approved plan with original results preserved. All domain cards below define required completion topics; the values are supplied by the competent project authority, not inferred from a sample calculation.

Required evidence / record: Approved test specification; article differences; traceable raw data; abort/acceptance separation; uncertainty and decision basis.

AR.2 Qualified facilities, method fitness and independent validity

- a)** The provider shall demonstrate the method, range, environment, equipment, personnel and detection capability needed for the requested conclusion. A quality-system certificate is not proof of technical competence for every domain. Subcontracted measurements shall retain sample identity and authorized technical review.
- b)** Calibration and intermediate checks shall be appropriate to the result, not merely current on a calendar. Data acquisition, channel mapping, units, time synchronization, filtering and calculation software shall be verified. A report shall identify limitations of access, resolution, bandwidth, sampling and uncertainty.
- c)** Continuing validity shall use relevant checks, controls, comparisons or justified alternatives and shall investigate adverse performance. Independent witnessing shall cover actual method execution where required; an edited presentation shall not replace representative work.

Required evidence / record: Method/range authorization; calibrated channels; verified data chain; comparison performance; witnessed competence.

AR.3 Sequence, cumulative exposure and qualification reuse

- a)** The plan shall assess whether exposure sequence, accumulated damage, material conditioning, repair or software changes affect subsequent results. A qualification article shall retain an exposure ledger, and its difference from production or flight units shall be reviewed.
- b)** Similarity shall state the reference configuration and evidence, each difference, affected mechanism, bounding argument, uncertainty and approval. A previous test shall not be reused for an unrelated material, geometry, installation, environment or service life without a valid equivalence argument.
- c)** Requalification shall cover all requirements affected by the actual change, not only a previously failed point. The final dossier shall connect every requirement to a valid method and result or an explicit unresolved status.

Required evidence / record: Exposure ledger; sequence rationale; mechanism-based similarity; regression/requalification coverage; final requirement matrix.

AR-V01 Static load and strength

Scope and boundary: Quasi-static structural or mechanical response for defined load paths and boundary conditions.

Parameters to approve before evaluation: Loads; constraints; alignment; measurement range; strain/displacement; uncertainty; failure and acceptance definitions.

Required evidence: Calibrated channels, setup photographs, configuration, raw load/response history and independent assessment.

Adverse-case challenge: Unexpected load redistribution or a fixture that makes the article less representative.

Decision and claim limit: Restrict conclusions to demonstrated boundary conditions; nominal applied force alone is not strength acceptance.

AR-V02 Modal and dynamic characterization

Scope and boundary: Natural response, mode shapes and damping used to support a stated structural model or integration decision.

Parameters to approve before evaluation: Support conditions; excitation; sensor mass/placement; bandwidth; damping estimation; correlation metric.

Required evidence: Repeatable data, model/test comparison, configuration and uncertainty, with poorly observed modes identified.

Adverse-case challenge: A changed support or missing mode alters the coupled response.

Decision and claim limit: Model correlation shall be adequate for its decision use; one matched frequency is not complete validation.

AR-V03 Random vibration

Scope and boundary: Broadband vibration exposure and response for the declared environment and article.

Parameters to approve before evaluation: Input spectral density; frequency range; duration; axes; control/response sensors; notching; fixture and damage budget.

Required evidence: Actual spectra and time history, controller limits, article/fixture configuration and post-exposure results.

Adverse-case challenge: A notched or interrupted band is silently reported as full profile completion.

Decision and claim limit: Report achieved exposure and resulting gaps; no universal spectrum is prescribed.

AR-V04 Sinusoidal vibration and resonance dwell

Scope and boundary: Swept or dwell excitation for identified mechanisms and installation conditions.

Parameters to approve before evaluation: Frequency/amplitude; sweep rate; axes; dwell rationale; resonance tracking; response limits and fixture influence.

Required evidence: Achieved profiles, resonance/response data, deviations, functional monitoring and inspected condition.

Adverse-case challenge: Control sensor location misses a critical response or drift changes the resonance.

Decision and claim limit: Acceptance requires the relevant response and functional evidence, not only shaker execution.

AR-V05 Acoustic environment

Scope and boundary: Acoustic loading or noise-sensitive performance in a defined test or operating environment.

Parameters to approve before evaluation: Spectrum; overall level; spatial uniformity; duration; reverberation; article configuration; microphone calibration.

Required evidence: Measured achieved field, specimen representativeness, monitoring and post-test evidence.

Adverse-case challenge: A chamber field is not representative at the critical article surfaces.

Decision and claim limit: Bound the conclusion to demonstrated field conditions and relevant failure mechanisms.

AR-V06 Mechanical shock and transient response

Scope and boundary: Shock exposure and response for the stated handling, installation or mission mechanism.

Parameters to approve before evaluation: Pulse or response-spectrum basis; axis; duration; damping; sensor bandwidth; fixture; transient and cumulative limits.

Required evidence: Actual time histories, instrument checks, achieved response, saturation review and functional/physical outcome.

Adverse-case challenge: Saturated sensors or a filtered record conceal the critical peak.

Decision and claim limit: A nominal pulse label cannot replace valid measured transient evidence.

AR-V07 Fatigue and cyclic durability

Scope and boundary: Cumulative cyclic performance for a defined duty spectrum and failure mechanism.

Parameters to approve before evaluation: Load spectrum; sequence; mean load; environment; inspection intervals; cycle definition; scatter and termination.

Required evidence: Traceable exposure, failures/censoring, configuration, damage observations and justified life interpretation.

Adverse-case challenge: Nonrepresentative sequencing or removed failed specimens bias the inferred life.

Decision and claim limit: A limited cyclic test is not proof of all-life safety; retain the actual population and model boundary.

AR-V08 Fracture and damage tolerance

Scope and boundary: Evidence used to assess relevant flaws, growth mechanisms and inspection/remaining-life decisions.

Parameters to approve before evaluation: Material state; geometry; defect characterization; environment; growth model; detection limits; uncertainty.

Required evidence: Authorized specialist basis, representative material/structural data, NDT capability and independent review.

Adverse-case challenge: A presumed detectable flaw size lacks demonstrated detection probability.

Decision and claim limit: Do not make a quantitative integrity claim from an unqualified inspection threshold.

AR-V09 Thermal cycling and temperature extremes

Scope and boundary: Response to specified temperature conditions, gradients, cycles and recovery.

Parameters to approve before evaluation: Temperature locations; rates; dwell; gradients; modes; conditioning; measurement uncertainty and cycle count.

Required evidence: Actual article temperature histories, environment logs, function and material effects, deviations and recovery evidence.

Adverse-case challenge: Chamber temperature is used as article temperature without demonstrated equivalence.

Decision and claim limit: Conclusions require achieved article exposure and defined acceptance, not chamber settings alone.

AR-V10 Thermal vacuum and thermal balance

Scope and boundary: Space-environment thermal/vacuum behaviour and model correlation for the actual article and interfaces.

Parameters to approve before evaluation: Pressure; thermal boundaries; dissipation; emissivity/absorption assumptions; modes; sensor locations; stabilization.

Required evidence: Calibrated achieved conditions, model/test correlation, power balance, contamination monitoring and article differences.

Adverse-case challenge: A hidden conductive path or uncertain radiative property makes the model nonrepresentative.

Decision and claim limit: A test completion label does not validate an unbounded thermal model or mission envelope.

AR-V11 Pressure, altitude and leakage

Scope and boundary: Integrity or function under defined pressure differences and gas or liquid boundary conditions.

Parameters to approve before evaluation: Medium; temperature; pressure reference; stabilization; leak measurand; sensitivity; geometry and safe limits.

Required evidence: Qualified setup, calibrations, raw corrected results, uncertainty and authorized pressure-system safeguards.

Adverse-case challenge: Temperature drift or background leakage is mistaken for article leakage.

Decision and claim limit: Accept only under a valid measurement model and qualified pressure/environment scope.

AR-V12 Humidity and condensation

Scope and boundary: Material, electrical or functional effects of moisture and related environmental sequences.

Parameters to approve before evaluation: Humidity/temperature; dwell; condensation; conditioning; exposure/measurement sequence; article protection state.

Required evidence: Achieved conditions, specimen history, insulation or functional evidence and post-exposure assessment.

Adverse-case challenge: A dry recovery before measurement conceals the relevant temporary failure mechanism.

Decision and claim limit: The method shall match the claimed in-use or post-exposure condition.

AR-V13 Corrosion and environmental durability

Scope and boundary: Corrosion mechanisms and protective performance of materials, joints or coatings.

Parameters to approve before evaluation: Relevant environment; material pairing; preparation; duration; cyclic conditions; acceptance and interpretation limits.

Required evidence: Qualified exposure, initial condition, spatial assessment and mechanism-based relation to intended service.

Adverse-case challenge: A short accelerated exposure is claimed as a universal service-life conversion.

Decision and claim limit: No time equivalence without a validated acceleration and failure-mechanism basis.

AR-V14 Dust, sand, icing and particulate exposure

Scope and boundary: Environmental effects on motion, visibility, cooling, sealing and interfaces.

Parameters to approve before evaluation: Particle/ice properties; distribution; exposure; flow; temperature; orientation; modes; removal/recovery state.

Required evidence: Representative exposure, actual condition, function, wear/ingress and post-test evidence.

Adverse-case challenge: A benign particulate substitute fails to represent the abrasive or electrostatic mechanism.

Decision and claim limit: State the demonstrated environment and limitations; passing one condition is not all-environment qualification.

AR-V15 Fluid compatibility and chemical contamination

Scope and boundary: Materials and interfaces exposed to actual operational or maintenance fluids.

Parameters to approve before evaluation: Fluid identity; concentration; material state; temperature; duration; stress; cleaning and acceptance properties.

Required evidence: Source/material trace, exposure records, relevant property tests and interaction assessment.

Adverse-case challenge: A fluid brand or appearance is treated as equivalent despite different compatibility.

Decision and claim limit: Unverified compatibility holds affected use; no generic chemical recipe is prescribed.

AR-V16 Accumulated radiation exposure

Scope and boundary: Material or device response to specified cumulative radiation mechanisms under an approved safe test basis.

Parameters to approve before evaluation: Dose/fluence units; spectrum; rate; bias/temperature; shielding assumptions; article/lot variability; dosimetry.

Required evidence: Authorized specialist test, calibrated exposure, measured response and mission-equivalence limitations.

Adverse-case challenge: Equivalent total dose is assumed despite materially different spectrum or operating conditions.

Decision and claim limit: No universal radiation suitability from dose alone; mechanism and conditions control the claim.

AR-V17 Transient radiation susceptibility

Scope and boundary: Device or system susceptibility to transient radiation-induced effects.

Parameters to approve before evaluation: Relevant particles/energy; operating states; detection coverage; event definition; fluence and statistical treatment.

Required evidence: Specialist authorization, representative configurations, actual events and exposure, uncertainty and recovery results.

Adverse-case challenge: Undetected events or reused nonrepresentative components bias a zero-event claim.

Decision and claim limit: Report sensitivity and confidence limits; zero observed events is not zero susceptibility.

AR-V18 Electrostatic discharge and charging

Scope and boundary: Electrostatic or space-charging susceptibility of actual assemblies and interfaces.

Parameters to approve before evaluation: Charge/exposure model; coupling; materials; grounding; modes; recovery; instrument bandwidth and safety limits.

Required evidence: Configuration-specific tests, achieved conditions, failure/recovery records and susceptibility boundaries.

Adverse-case challenge: A test path bypasses the actual vulnerable installation interface.

Decision and claim limit: Qualification applies only to the demonstrated coupling and operating configuration.

AR-V19 Electromagnetic emissions

Scope and boundary: Unintended emissions from products or installations under representative modes and cabling.

Parameters to approve before evaluation: Frequency range; detector/bandwidth; geometry; cable/grounding; ambient; limits; uncertainty; modes.

Required evidence: Calibrated setup, ambient checks, actual spectra, configuration and technically reviewed margins.

Adverse-case challenge: A quiet mode or unrepresentative cable hides the intended worst-case condition.

Decision and claim limit: Do not infer every installation conforms from one benchtop emission result.

AR-V20 Electromagnetic immunity and external-field effects

Scope and boundary: Susceptibility to conducted/radiated disturbances, including high-intensity field interfaces where relevant.

Parameters to approve before evaluation: Field/coupling; frequency; modulation; dwell; modes; cable/shielding; monitoring; failure and recovery criteria.

Required evidence: Achieved exposure, calibrated monitoring, installation representativeness and recorded transient/latent effects.

Adverse-case challenge: Monitoring misses a short loss of an essential function during exposure.

Decision and claim limit: Function and latent effects shall meet the pre-agreed criteria; nominal exposure completion is insufficient.

AR-V21 Lightning-induced transients

Scope and boundary: Indirect lightning effects on representative electrical/electronic interfaces under authorized testing.

Parameters to approve before evaluation: Applicable coupling paths; waveform basis; levels; polarity; modes; wiring/protection configuration and monitoring.

Required evidence: Qualified setup, achieved transients, protected testing, functional results and installation/zone rationale.

Adverse-case challenge: A changed harness or grounding path invalidates the original coupling basis.

Decision and claim limit: Limit conclusions to the demonstrated installation conditions; no universal transient level is imposed.

AR-V22 Direct lightning and external protective surfaces

Scope and boundary: Direct-effects evidence for materials, structures and interfaces requiring specialized facility authorization.

Parameters to approve before evaluation: Actual attachment/environment basis; material/geometry; protection; current/energy measurement; acceptance and safe test limits.

Required evidence: Specialist plan and authority, representative article, measured exposure, damage inspection and residual-property evidence.

Adverse-case challenge: Surface appearance conceals damage to a critical underlying feature.

Decision and claim limit: A visual pass alone shall not close required residual-strength or system-function evidence.

AR-V23 Electrical power quality and transients

Scope and boundary: Electrical input/output behaviour including interruptions, abnormal supply and protective response.

Parameters to approve before evaluation: Voltage/current; frequency; ripple; impedance; sequence; duration; modes; protection and recovery conditions.

Required evidence: Verified sources and instruments, actual waveforms, configuration and functional/latent-failure assessment.

Adverse-case challenge: A recovered function is assumed intact without checking corruption or latent protective failure.

Decision and claim limit: Acceptance shall verify both required operation and post-event integrity.

AR-V24 Harness, bonding and shielding verification

Scope and boundary: Installed interconnect, ground/bond and shield evidence beyond simple continuity.

Parameters to approve before evaluation: Material/contact; routing; termination; resistance/impedance; frequency where relevant; strain; environment; test access.

Required evidence: Actual installed configuration, calibrated results, workmanship and interface verification.

Adverse-case challenge: A continuity pass conceals an inadequate high-frequency shield path.

Decision and claim limit: Use a method capable of measuring the claimed property in the relevant configuration.

AR-V25 Battery and energy-storage qualification

Scope and boundary: Safety and performance evidence for identified cells, modules and systems under authorized specialist procedures.

Parameters to approve before evaluation: Configuration; life/condition; operating/storage domain; protective functions; propagation assessment; integration and support.

Required evidence: Traceable sources, system-specific qualification, degradation evidence and independently reviewed coupled hazards.

Adverse-case challenge: Changed cells or control software invalidate the tested protection or thermal assumptions.

Decision and claim limit: No unrestricted safety claim from a cell certificate or isolated capacity test.

AR-V26 Fire, flammability, smoke and protective containment

Scope and boundary: Material and system behaviour under the actual required fire/smoke or containment basis.

Parameters to approve before evaluation: Material state; geometry; exposure; ventilation; conditioning; measured endpoints; installation and safety boundaries.

Required evidence: Authorized facility, representative tests, actual observations/results and qualified interpretation.

Adverse-case challenge: Small-sample material behaviour is claimed as complete cabin or system fire safety.

Decision and claim limit: Scale, installation and mechanism limits shall be explicit; no generic pass is all-system approval.

AR-V27 Chemical composition and material identity

Scope and boundary: Analytical identification and composition evidence for a defined sample and parent population.

Parameters to approve before evaluation: Sampling; preparation; matrix; calibration; blanks; range; detection/quantification capability; uncertainty.

Required evidence: Sample-parent custody, validated method, reference/blank checks, raw data and correct result interpretation.

Adverse-case challenge: Contamination or matrix interference produces a plausible but invalid composition.

Decision and claim limit: Identity or composition does not establish every mechanical or environmental property.

AR-V28 Mechanical and physical material properties

Scope and boundary: Coupon or specimen evidence for properties relevant to a defined parent material and process.

Parameters to approve before evaluation: Geometry; orientation; conditioning; loading/rate; temperature; measurement; fracture/invalid-test definitions.

Required evidence: Parent trace, calibrated apparatus, raw curves, specimen validity and population/anisotropy assessment.

Adverse-case challenge: A separately prepared coupon does not represent the critical production region.

Decision and claim limit: Bound property claims to representative material, condition and test method.

AR-V29 Non-destructive examination and detection capability

Scope and boundary: Inspection of specified materials, geometries and defect mechanisms with declared access and reliability.

Parameters to approve before evaluation: Defect class/size; material; geometry; access; procedure; reference artefacts; personnel; false results and confidence.

Required evidence: Qualified technique, representative challenge specimens, actual results and documented inaccessible areas.

Adverse-case challenge: A single successful easy reference is used to imply high probability of detection across the range.

Decision and claim limit: Quantitative detection claims require suitable statistical and physical evidence; inaccessible features remain explicit.

AR-V30 Dimensional metrology and calibration

Scope and boundary: Measurement of geometry or other calibrated quantities for specified decision use.

Parameters to approve before evaluation: Measurand; datum/frame; units; temperature; probe/fixtures; corrections; covariance; uncertainty and rule.

Required evidence: Traceable calibration, validated method, actual corrected values, raw data and repeat/independent checks.

Adverse-case challenge: Known bias is ignored or a displayed rounded value changes a borderline decision.

Decision and claim limit: Use unrounded corrected results and the agreed uncertainty rule; invalid inputs produce HOLD.

AR-V31 Electronic interconnection and assembly inspection

Scope and boundary: Workmanship, connection and functional evidence for actual electronic assemblies.

Parameters to approve before evaluation: Component/configuration; joints; ESD/moisture history; inspection access; functional coverage; environmental suitability.

Required evidence: Qualified process/personnel, original part trace, inspection records and build-linked functional results.

Adverse-case challenge: Accessible joints pass while an unexamined critical interconnection remains unsupported.

Decision and claim limit: Inspection limitations shall constrain the conclusion; a board power-on test is not complete acceptance.

AR-V32 Software and programmable-hardware verification

Scope and boundary: Requirements, interfaces, timing, abnormal behaviour and regression in the deployed digital target.

Parameters to approve before evaluation: Build identity; target; dependencies; coverage criteria; timing; resources; faults; anomalies; independence.

Required evidence: Traceable tests, review/analysis, coverage and target differences, with failed cases and approved release.

Adverse-case challenge: A host-only pass or changed dependency is presumed to qualify the deployed target.

Decision and claim limit: Uncovered essential behaviour or unresolved critical anomaly blocks digital release.

AR-V33 AI, autonomy and scenario-based evaluation

Scope and boundary: Performance and safe behaviour of a defined model/use case under its actual operational domain.

Parameters to approve before evaluation: Data lineage; scenarios; partitions; metrics/denominators; confidence; subgroup criteria; drift; fallback; authority.

Required evidence: Independent held-out evaluation, challenge sets, uncertainty, current model card and validated domain enforcement.

Adverse-case challenge: High aggregate accuracy hides failed rare conditions or a leaked evaluation set.

Decision and claim limit: Every essential criterion applies separately; no aggregate compensation for a critical failure.

AR-V34 Defensive cybersecurity and update integrity

Scope and boundary: Authorized defensive evaluation of systems, interfaces, updates and recovery.

Parameters to approve before evaluation: Agreed test scope; trust boundaries; access; dependencies; threat model; safety; restoration and evidence protection.

Required evidence: Controlled authorization, traceable results, corrected weaknesses, signed configuration and verified recovery.

Adverse-case challenge: A recovery restores service while configuration links remain corrupted.

Decision and claim limit: Testing is confined to lawful scope; operational availability alone does not establish evidence integrity.

AR-V35 Human factors, ergonomics and task validation

Scope and boundary: Human-system task performance under representative user and operating conditions.

Parameters to approve before evaluation: Users; task; workload; visibility/access; language; error/recovery; timing; accommodations and safety constraints.

Required evidence: Representative evaluation, scenario results, observations, limitations and verified design responses.

Adverse-case challenge: An expert demonstrator is assumed to represent every intended user or emergency condition.

Decision and claim limit: Training or warnings shall not substitute for necessary design controls and valid intended-user evidence.

AR-V36 Service continuity, availability and recovery

Scope and boundary: Observed service outcomes and trustworthy restoration over a defined population/window.

Parameters to approve before evaluation: Availability boundary; uptime/downtime; response/correctness; exclusions; RTO/RPO; qualified dependencies.

Required evidence: Original event records, transparent metrics, recovery exercises and integrity/accuracy checks.

Adverse-case challenge: Time objectives pass while a required data-integrity or customer-protection check fails.

Decision and claim limit: Hold assured use until every critical service criterion is demonstrated.

AR-V37 Outgassing, cleanliness and planetary-sensitive interfaces

Scope and boundary: Contamination-sensitive space materials, assemblies and sample/biological protection interfaces.

Parameters to approve before evaluation: Species/particle basis; material state; temperature/vacuum; collection efficiency; blanks; preservation; protection obligations.

Required evidence: Qualified material/process evidence, validated sampling, actual contamination results and authorized containment/protection review.

Adverse-case challenge: A nominal low-outgassing label or empty blank is used outside validated measurement conditions.

Decision and claim limit: Report detection and representativeness limits; no unsupported contamination-free claim.

AR-V38 Integrated mission rehearsal and coupled-environment validation

Scope and boundary: System-of-systems evidence connecting physical, digital, operational and human dependencies.

Parameters to approve before evaluation: Scenario coverage; synchronized configuration; environment; interfaces; failure combinations; observability; safety and abort rules.

Required evidence: End-to-end trials, actual role performance, combined-condition results, counter-evidence and independent readiness review.

Adverse-case challenge: Individually passing subsystems fail together after a shared service or configuration change.

Decision and claim limit: Integration readiness requires the actual combined evidence; separate component passes are not sufficient.

ANNEX AS / NORMATIVE

Digital engineering, AI, autonomy and cyber-resilient evidence

This annex strengthens Clauses 7.12, 12 and 13 and Annexes D, N and O. It applies to digital artefacts in products, manufacturing, inspection, maintenance, services and decisions. The purpose is trustworthy, bounded and accountable use.

Linked provisions: 7.9–7.12; 8.1.2; 11.6; 12; 13; 24.5; D; N; O; AJ.7

This annex forms part of the approved edition. Requirements apply within its stated scope. Numerical examples and explanatory diagrams remain informative.

AS.1 Digital item and reproducible release identity

- a)** The controlled digital item shall include source, model weights, programmable logic, build definitions, toolchain, dependencies, configuration, data/schema versions, preprocessing and deployment target as applicable. A human-readable product name is not a complete release identity.
- b)** The release manifest shall connect reviewed inputs to the produced artefact and actual installed instances. Reproducibility or a justified equivalent verification shall establish that the delivered item corresponds to the evaluated baseline. Hash agreement proves identity of bytes, not correctness of their content.
- c)** Partial installation, failed deployment and mixed versions shall be visible. The release authority shall assess compatibility and rollback conditions before deployment and verify the installed state afterward.

Required evidence / record: Item inventory; release/build manifest; provenance; deployed-instance and failure records.

AS.2 Software assurance and coverage justification

- a)** The lifecycle plan shall define requirements, architecture, coding/model constraints, reviews, static or dynamic analysis, integration, verification, release, support and retirement. The assurance depth and independence shall follow consequence, not the implementation language or supplier label.
- b)** Coverage criteria shall be chosen and justified for the actual decision. Requirements, boundaries, abnormal inputs, timing, resource exhaustion, fault handling and relevant internal structure shall be addressed. A high coverage percentage shall not conceal an untested essential function.
- c)** Open anomalies shall state severity, affected configuration, exposure, mitigation, unresolved uncertainty and required authority. An unsupported essential acceptance condition shall block release; unrelated successful tests cannot compensate.

Required evidence / record: Digital assurance plan; justified coverage; anomalies; target representativeness; independent release record.

AS.3 Data quality, labels and evaluation independence

- a)** AI and data-dependent decisions shall define input populations, intended domain, acquisition, rights, labeling methods, missingness, transformations and known limitations. Data lineage shall remain traceable from acquisition through the released model and delivered output.
- b)** Training, tuning and final evaluation partitions shall prevent leakage, duplicate-source contamination and unapproved reuse. The plan shall record relevant correlations, grouped observations and temporal or geographic dependence. A nominal record count shall not be treated as that many independent observations without justification.

c) Evaluation shall include difficult, rare, degraded and out-of-domain cases relevant to consequences. Subgroup metrics shall retain denominators and uncertainty. A failed critical subgroup criterion shall not be hidden in aggregate performance.

Required evidence / record: Dataset manifest; labeling checks; partition/independence review; scenario results and uncertainty.

AS.4 AI performance and bounded authority

a) The use-case profile shall state what decisions the model supports, which actions are permitted, prohibited uses, accountable human roles, operating domain and consequences of error. It shall define essential performance and safety criteria before final evaluation.

b) A model shall not be the sole authority for consequential approval merely because its output is confident or fluent. Human oversight shall be validated for information, competence, workload and time actually available; a mandatory click without meaningful review is not effective oversight.

c) Performance claims shall distinguish prediction, calibration, discrimination, error rates, operational outcomes and physical safety. Confidence intervals quantify the assumptions of a statistical model, not every source of uncertainty from labels, deployment shift or incomplete scenarios.

Required evidence / record: Use-case/authority profile; independent metrics; oversight validation; explicit claim boundaries.

AS.5 Drift, adaptation and enforced domain boundaries

a) The release basis shall define monitored changes in data, environment, sensors, dependencies and model performance, with approved thresholds or observable triggers and accountable response. Monitoring shall be able to detect conditions relevant to the declared failure modes.

b) Changes to weights, training data, thresholds, preprocessing, sensor installation or deployment domain shall undergo impact assessment before affected use. Online adaptation shall remain within a validated envelope; safety-relevant change outside that envelope requires renewed assurance.

c) Domain restrictions shall be operationally enforceable through validated detection, fallback, supervisory or service limits. A note in a model card does not physically enforce a restriction. Failed monitoring or unavailable fallback shall trigger the approved protective state.

Required evidence / record: Drift plan; change history; domain-enforcement tests; fallback and protected-state evidence.

AS.6 Digital twins, simulation and model credibility

a) Each model shall state its decision purpose, physical association, input domain, governing assumptions, implementation, validation data, uncertainty and known failure conditions. Verification of numerical implementation shall be distinguished from validation against the represented system.

b) A digital twin shall detect stale or mismatched configuration, data loss, incompatible units or frames and synchronization errors. The status of its physical counterpart shall be independently ascertainable. A synchronized dashboard is not proof that the model predicts all relevant phenomena.

c) Replacing or reducing a physical test shall require an explicit equivalence argument addressing the characteristic, mechanism, domain, sensitivity, uncertainty and independent approval. Cost or model convenience alone shall not justify removal of necessary evidence.

Required evidence / record: Model credibility dossier; twin configuration and synchronization; sensitivity; approved test-substitution argument.

AS.7 Access, trust boundaries and technical-data security

- a)** The organization shall map users, machine identities, assets, networks, trust boundaries, suppliers and information flows affecting an assured output. Access shall use attributable identity, least necessary privilege and appropriate protection for critical actions.
- b)** Privileged and emergency access shall have specific scope, justification, time limit, log and independent after-use review. Role changes and departures shall revoke or adjust access. Shared credentials shall not conceal who changed an instruction, model or acceptance result.
- c)** Privacy and controlled technical data shall have purpose-based access, authorized transfer, retention and disposal. Confidentiality shall not be used to justify acceptance of essential evidence that no qualified authorized reviewer has examined.

Required evidence / record: Access/trust inventory; permission history; privileged logs; data handling and qualified review access.

AS.8 Dependencies, OT and supply-chain integrity

- a)** Digital dependencies shall be inventoried with source, version, support status, known exposure and approved use. Purchased, open-source, cloud-hosted and generated artefacts shall receive equivalent consequence-led assurance for the actual role.
- b)** Industrial systems shall protect critical programs, parameter sets and evidence against unauthorized alteration and propagation of failure. Patching or additional security software shall be assessed for timing, compatibility and protective-function effects. Deferred changes shall have approved compensating controls and a real review trigger.
- c)** Supplier interfaces shall preserve data ownership, evidence availability, update responsibilities, incident reporting and exit support. Subscription continuity is not a substitute for the ability to reconstruct long-life technical records.

Required evidence / record: Dependency inventory; OT baseline; patch/compensation decisions; supplier evidence and exit agreements.

AS.9 Secure update, interruption and rollback

- a)** An update shall verify authorized origin, integrity, target identity, compatibility, prior approved configuration and required technical review before installation. Interruption, power loss and network failure shall have tested outcomes appropriate to consequence.
- b)** Rollback shall be assessed for configuration, data schema and vulnerability consequences. Restoring an older version shall not reintroduce an unacceptable known exposure or invalidate records. Anti-rollback and recovery objectives shall be reconciled through a justified design and authority decision.
- c)** After deployment, the actual installed version, required functions, security configuration and instance status shall be verified. An installation success message alone shall not establish the acceptance basis.

Required evidence / record: Authorized update manifest; interruption/rollback tests; installed-state evidence; vulnerability and schema compatibility.

AS.10 Incident, evidence preservation and trustworthy recovery

- a)** Incident response shall identify affected systems and technical outputs, preserve original evidence, contain exposure and notify responsible parties through approved channels. Engineering, product-quality and security investigations shall share configuration and population identifiers.
- b)** Recovery shall verify data authenticity, relationship integrity, required functions, current authority and configuration as well as service availability. Recovery-time and recoverable-data-age targets are independent criteria; meeting both does not override an integrity failure.
- c)** Return to assured use shall have a competent accountable decision, remaining limitations, affected-output disposition and monitoring. A restored server or successful backup checksum shall not prove that original records were true or complete.

Required evidence / record: Incident timeline; technical population; restored identity/relationships; independent recovery decision.

AS.11 Generated material and evidence authenticity

- a)** Generated text, code, images, calculations or summaries shall be identified as generated support material until verified for their intended use. They shall not be represented as witnessed events, actual measurements, committee approvals or authentic signatures.
- b)** Material engineering claims shall trace to underlying data and reproducible methods. Generated references, equations or translations shall undergo competent checking before becoming controlled information. A fluent explanation and a script that runs without exception are not independent evidence of correctness.
- c)** The organization shall define which generated material may support drafting, search or analysis and who accepts responsibility for the final record. Confidential data shall not be disclosed to unapproved services.

Required evidence / record: Approved generated-material use; verified claims/calculations; protected input boundaries; accountable review.

AS.12 Long-life digital support and cryptographic change

- a)** The support plan shall preserve source, build tools, dependencies, access rights, model/data definitions and critical knowledge necessary to maintain or reconstruct the assured configuration. Supplier cessation and obsolete platforms shall be considered before release.
- b)** Cryptographic inventories shall identify algorithm, key/certificate dependencies, support horizon, renewal and migration needs. Preservation shall maintain readable evidence and attribution after technical mechanisms change; a signature alone shall not be described as permanent proof.
- c)** Migration, emulation or replacement shall receive technical impact assessment and requalification where needed. The output shall preserve both current operation and truthful historical decisions, including suspensions and gaps.

Required evidence / record: Digital support/escrow basis; reconstruction tests; crypto inventory; verified migration and preserved history.

ANNEX AT / NORMATIVE

Quantitative assurance, measurement and model-governance rules

This annex supplements 2.6, 7.7, 7.12, 11.4–11.7, 25.3 and Annex AD. The equations in Annex AU remain informative examples. Normative acceptance requires a valid application-specific model and pre-agreed decision basis.

Linked provisions: 2.6; 7.6–7.7; 7.12; 11.4–11.7; 20.2; 25.3; E–I; U; Z; AD

This annex forms part of the approved edition. Requirements apply within its stated scope. Numerical examples and explanatory diagrams remain informative.

AT.1 Computation specification and input provenance

- a)** Each acceptance-relevant calculation shall state the decision question, physical or statistical model, variables, units, data sources, transformations, dependencies, assumptions, domain, numerical method and interpretation. Inputs shall be linked to actual verified records or explicitly identified as assumptions.
- b)** The reviewer shall distinguish parameter uncertainty, sampling uncertainty, numerical error, model discrepancy and incomplete boundary coverage. An arithmetic confidence interval shall not be used to conceal an unmodeled mechanism or an omitted lifecycle stage.
- c)** Calculation versions and required dependencies shall be controlled. Any change affecting results or decisions shall trigger targeted re-verification. Material calculations shall be reproducible from retained inputs, not merely described in a narrative.

Required evidence / record: Computation specification; input manifest; uncertainty taxonomy; controlled code/tool and independent review.

AT.2 Units, coordinates, time and precision

- a)** Quantities shall retain compatible units and dimensional meaning. Absolute temperature and temperature difference, power and energy, dose and dose rate, standard and expanded uncertainty, and fractional versus percentage values shall not be interchanged.
- b)** Coordinates, reference frames, epoch and time system shall be explicit when interpretation can affect the result. Calendar-month deadlines shall follow Annex AG; a month shall not silently be replaced by 30 days. Leap-day and end-of-month handling shall be tested.
- c)** Decisions shall use unrounded inputs and appropriate numerical precision. Output rounding shall disclose enough digits to reproduce the reported outcome without suggesting unjustified measurement accuracy.

Required evidence / record: Unit/frame dictionary; conversion checks; calendar tests; precision and reporting rules.

AT.3 Measurement corrections, covariance and coverage

- a)** The measurement model shall identify significant corrections and the uncertainty remaining after correction. Known bias shall not be hidden in an uncertainty term selected to obtain acceptance. All contributions shall be expressed on a compatible basis with sensitivity coefficients where needed.
- b)** Correlation shall be considered when inputs share references, environmental effects, calibration or processing. A proposed covariance matrix shall be physically justified and mathematically valid. Linear propagation shall be checked for adequacy; nonlinear or non-normal cases require a suitable validated alternative.

c) Coverage factor and interval interpretation shall be stated. A factor of two is not an exact universal 95% rule. The evaluator shall not reinterpret a coverage interval as a posterior probability of conformity without an explicit justified probabilistic model.

Required evidence / record: Corrections; uncertainty budget; covariance rationale; model adequacy; coverage basis and interpretation.

AT.4 Statistical design, selection and repeated testing

a) The study shall define population, unit, response, exposure, sampling mechanism, dependence, inclusion/exclusion, stopping rule and inference before outcomes are evaluated. Relevant unsuccessful trials and censored observations shall remain in the record.

b) Judgmental audit samples shall not be described as random statistical evidence. Clustered, repeated or serially correlated measurements shall not automatically count as independent trials. Zero observed defects or failures does not establish zero population risk.

c) Retesting, pooling or excluding results shall follow the approved plan or a technically justified independent disposition with originals preserved. Repeated sampling until a pass is obtained shall not be represented as the original plan.

Required evidence / record: Predefined study; population and dependence; complete results; justified exclusions and repeat plan.

AT.5 Reliability, availability and life interpretation

a) Reliability claims shall identify the mission duration, success/failure definition, configuration, environment, population and statistical or physical model. Point predictions, confidence bounds, demonstrated exposure and qualified service life shall be distinguished.

b) Common-cause failure, shared resources, systematic digital faults, repair errors and time-dependent degradation shall be assessed where relevant. Series or parallel multiplication shall be used only when its dependence and functional assumptions are justified.

c) Availability shall state included downtime, logistics, maintenance and external dependencies. A functioning service can deliver incorrect results; availability is not a substitute for technical conformity. Remaining-life decisions shall account for actual history and uncertainty.

Required evidence / record: Reliability model; failure/censoring definitions; common-cause review; availability boundaries; life ledger.

AT.6 Process stability, capability and measurement variation

a) Capability analysis shall state the characteristic, specifications, sampling plan, rational subgroup, estimator, distribution, measurement suitability and period. The organization shall first evaluate stability and model assumptions before interpreting capability as an ongoing process property.

b) Control limits describe process behaviour; specifications define required output. Neither a high Cpk nor all observed values inside specification removes a special-cause signal. Recalculating limits to absorb an unexplained shift is prohibited.

c) For low-volume, non-normal or dependent data, the authority shall select suitable alternative evidence or a justified model and state limitations. Measurement-system studies shall address relevant operators, parts, interactions and conditions rather than only combine two assumed standard deviations.

Required evidence / record: Study design; stability; estimator/distribution; measurement study; documented low-volume or non-normal alternative.

AT.7 Decision risk, multiple criteria and model comparison

- a)** DR-A, DR-B or an approved DR-C alternative shall be fixed before results. Consumer and producer risks, measurement uncertainty and criticality shall be distinguished. An alternative shall not be chosen retrospectively only because the original result did not pass.
- b)** For multiple characteristics or repeated decisions, the plan shall assess joint risk and dependence. A nominal individual interval does not automatically provide the same simultaneous coverage for an entire population of criteria.
- c)** Alternative models shall be compared against their assumptions, validation domain, sensitivity, data requirements and decision consequences. Selecting the most favourable numerical result without a technically supported model-selection basis is prohibited.

Required evidence / record: Pre-agreed rule; risk interpretation; joint-criterion treatment; model comparison and independent alternative approval.

AT.8 Verification, challenge tests and release

- a)** Calculation verification shall include known-answer, boundary, missing-input, invalid-input, unit and prohibited-state tests. A second method shall be used for material results where feasible. Tolerances shall be justified from numerical representation and required accuracy.
- b)** Test logs shall state inputs, expected outcome, actual outcome, comparison method, tool identity and result. Checking arithmetic does not validate the physical model, data truth or a real operational deployment; these require their own evidence.
- c)** Calculation acceptance shall confirm correct implementation, suitable model, verified data and the applicable independent authority. Any unresolved condition shall hold the dependent conclusion. Annex AZ gives baseline adverse-case challenges to tailor and execute in the actual implementation.

Required evidence / record: Known-answer and boundary log; independent method; model/data review; accountable calculation acceptance.

Decision control: No calculation can create approval authority or replace an unavailable mandatory observation.

ANNEX AU / INFORMATIVE

Quantitative methods and reproducible worked examples

All 38 worked examples use synthetic numerical inputs. They illustrate methods, calculations and interpretation limits; they are not actual test results, design allowables or universal safety targets. The normative decision rules in Annex AD and the model controls in Annex AT govern application to real work.

Linked provisions: 2.6; 7.7; 7.12; 11.4–11.7; 20.2; 25.3; E–I; N; U; Z; AC; AD; AE; AG

Each example states its inputs, method and limitations. Actual application requires a verified engineering basis and approved criteria. Cross-references identify provisions within this AF publication.

AU.1 Measurement uncertainty and correlation

Linked provisions: H.1–H.4; AD.2; AT.3

How does a shared influence change the uncertainty of the same corrected result?

$$u_c^2 = \sum c_i^2 u_i^2 + 2 \sum (i < j) c_i c_j \text{cov}(x_i, x_j)$$

$$U = k u_c; \text{cov}(x_i, x_j) = \rho_{ij} u_i u_j$$

Table AU-1 — Measurement uncertainty and correlation — inputs and assumptions

Input	Stated value	Meaning / assumption
u1-u4	0.0012; 0.0015; 0.0010; 0.0005 mm	Standard uncertainties; sensitivities equal one.
k	2	Illustrative coverage factor, not an exact universal 95% rule.
ρ13	0 or 0.5	Other correlations assumed zero.

1. Independent variance = 4.94e-06 mm²; $u_c = 0.00222261$ mm.

2. Independent $U = 0.00444522$ mm.

3. With $\rho_{13} = 0.5$, $u_c = 0.0024779$ mm; $U = 0.0049558$ mm.

Interpretation: Correlation changes the acceptance-relevant interval even though the corrected nominal value is unchanged.

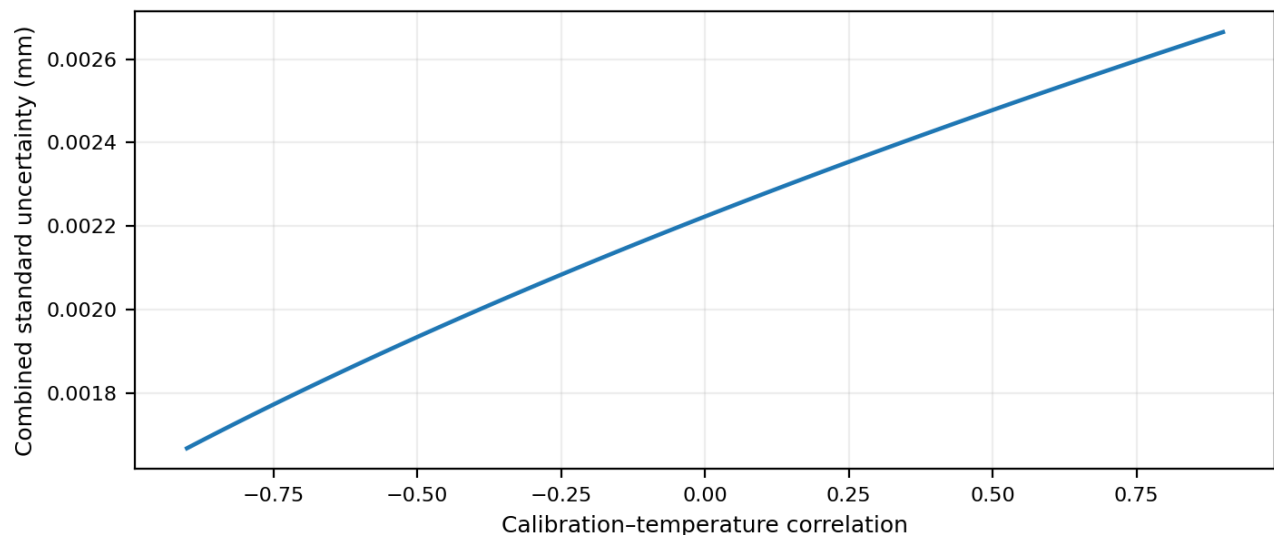


Figure AU.1 — Calculated from the stated example inputs; not actual product or organizational performance.

Assumptions and limits: Inputs are synthetic and all significant known bias is assumed corrected. The covariance and coverage model require actual justification; positive correlation cannot be selected or ignored merely to obtain a favourable decision.

AU.2 Inclusive full-interval acceptance boundaries

Linked provisions: AD.2-AD.6; AK.5

Which results satisfy a pre-agreed inclusive two-sided specification?

PASS if $y - U \geq L$ AND $y + U \leq H$

FAIL under DR-A if $y + U < L$ OR $y - U > H$; otherwise HOLD

Table AU-2 — Inclusive full-interval acceptance boundaries — inputs and assumptions

Input	Stated value	Meaning / assumption
L; H	49.970; 50.030 mm	Inclusive illustrative specification.
U	0.004 mm	Declared expanded uncertainty for this separate example.

1. The nominal acceptance interval is [49.974, 50.026] mm.
2. Equality is inside an inclusive limit. The comparison uses exact stated decimal values.

Interpretation: An overlapping interval is indeterminate under DR-A; it is not automatically proof that the physical article is defective.

Table AU-3 — Inclusive full-interval acceptance boundaries — calculated comparison

y, mm	Lower endpoint	Upper endpoint	Outcome
50.024	50.020	50.028	PASS
50.028	50.024	50.032	HOLD / indeterminate
50.035	50.031	50.039	FAIL under DR-A
50.026	50.022	50.030	PASS
49.974	49.970	49.978	PASS

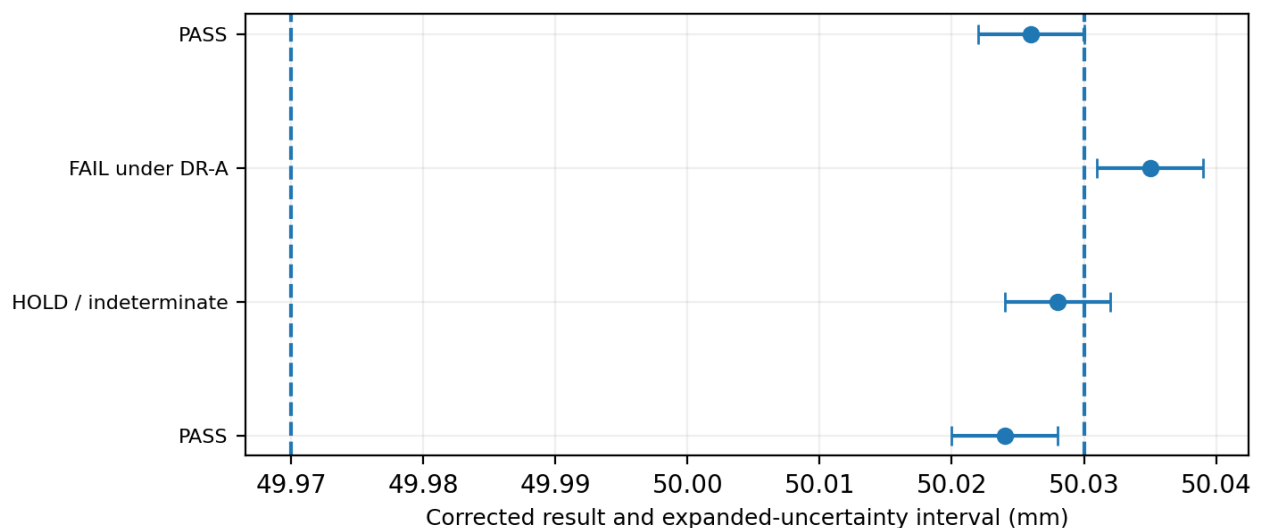


Figure AU.2 — Calculated from the stated example inputs; not actual product or organizational performance.

Assumptions and limits: The separate U value here is not a rounded substitute for Annex H in a real decision. Asymmetric intervals use their actual endpoints. Invalid inputs or an empty acceptance region cannot generate a pass.

AU.3 Nonlinear power model and independent numerical comparison

Linked provisions: 2.6; 7.12; AT.1; AT.3

Does first-order propagation adequately represent a nonlinear product in this stated model?

$$P = V I; E[P] = \mu_V \mu_I + \text{cov}(V, I)$$

$$\text{var}(P) = \mu_I^2 \sigma_V^2 + \mu_V^2 \sigma_I^2 + 2\mu_V \mu_I \text{cov} + \sigma_V^2 \sigma_I^2 + \text{cov}^2$$

Table AU-4 — Nonlinear power model and independent numerical comparison — inputs and assumptions

Input	Stated value	Meaning / assumption
V	Mean 28 V; standard deviation 0.2 V	Synthetic joint-normal input.
I	Mean 4 A; standard deviation 0.05 A	Synthetic joint-normal input.
ρ	0.3	Joint-normal dependence assumption.
Simulation	200,000 draws; seed 91002026	Numerical cross-check only.

1. $\text{cov} = 0.003 \text{ V}\cdot\text{A}$; exact modeled mean = 112.003 W.
2. First-order standard uncertainty = 1.80886705 W; exact modeled standard deviation = 1.80889718 W.
3. Simulation mean = 111.99856466 W; sample standard deviation = 1.80894494 W.

Interpretation: The small nonlinear difference is quantified rather than assumed zero. This model is suitable only within its declared assumptions.

Assumptions and limits: The exact moment expression depends on joint normality. A correlation alone does not define every possible joint distribution. Simulation agreement does not prove actual voltage/current data or model validity.

AU.4 Acceptance-sampling operating characteristic

Linked provisions: I.1-I.2; AT.4; AT.7

How does a declared sampling plan trade producer and consumer risk?

$$P_a(p) = \sum_{k=0..c} C(n,k) p^k (1-p)^{(n-k)}$$

$$\text{Producer risk } \alpha = 1 - P_a(p_A); \text{ consumer risk } \beta = P_a(p_L)$$

Table AU-5 — Acceptance-sampling operating characteristic — inputs and assumptions

Input	Stated value	Meaning / assumption
n; c	105; 2	Random independent Bernoulli status; capable classification.
p _A ; p _L	0.005; 0.05	Hypothetical quality points, not AF acceptance limits.

1. $\alpha = 0.01605316 = 1.60532\%$.

2. $\beta = 0.09918726 = 9.91873\%$.

Interpretation: The plan meets the example risk ceilings at those two illustrative points; it does not establish the quality of a particular accepted lot.

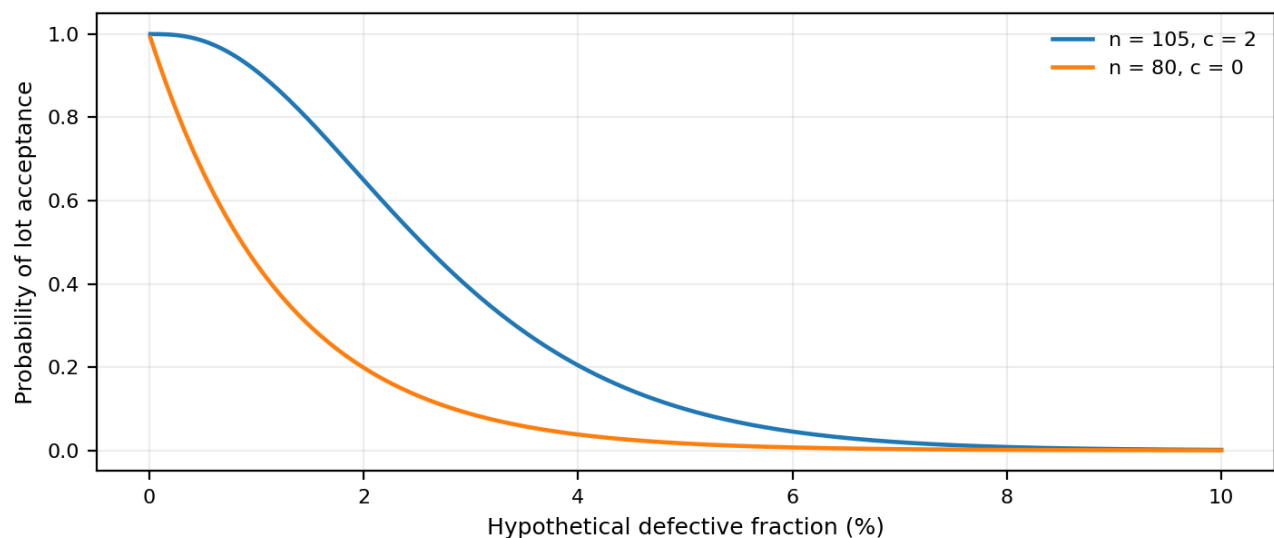


Figure AU.4 — Calculated from the stated example inputs; not actual product or organizational performance.

Assumptions and limits: Detected nonconforming items remain controlled. Critical evidence, mandatory inspection and process qualification are not waived by a count rule. Misclassification, mixed lots and dependent observations invalidate simple interpretation.

AU.5 Finite lot versus large-population approximation

Linked provisions: I.3; AT.4

What changes when sampling is without replacement from a finite lot?

$$P_a = \sum_{k=0..c} [C(D,k) C(N-D,n-k)] / C(N,n)$$

Table AU-6 — Finite lot versus large-population approximation — inputs and assumptions

Input	Stated value	Meaning / assumption
N	1,000 items	Finite homogeneous lot.
D	50 or 5 defective items	Hypothetical lot state.
n; c	105; 2	Random sample without replacement.

1. For D=50, exact finite-lot acceptance probability = 0.08696216; binomial approximation = 0.09918726.

2. For D=5, exact acceptance probability = 0.99037961.

Interpretation: Finite-lot and Bernoulli models answer similar planning questions under different sampling mechanisms and need not agree.

Table AU-7 — Finite lot versus large-population approximation — calculated comparison

Quality point	Finite-lot P _a	Binomial P _a
5% defective	0.08696216	0.09918726
0.5% defective	0.99037961	0.98394684

Assumptions and limits: D is not normally known in an actual received lot. The calculation evaluates plan behaviour at assumed states and does not reveal the true number of defects after acceptance.

AU.6 All-success reliability demonstration

Linked provisions: F.3; AT.4–AT.5

How many independent successful trials demonstrate a stated lower confidence bound?

$$R_L = \alpha^{1/n}; n_{\min} = \text{ceil}[\ln(\alpha) / \ln(R_{\text{target}})]$$

Table AU-8 — All-success reliability demonstration — inputs and assumptions

Input	Stated value	Meaning / assumption
Confidence	95%; $\alpha = 0.05$	One-sided exact binomial procedure.
Target R	0.99	Synthetic mission success target.
Observed successes	300 of 300	Independent representative trials assumed.

1. $n_{\min} = 299$; with 300 successes $R_L = 0.99006392$.
2. The next lower sample size fails the target lower bound, so rounding upward is essential.

Interpretation: No observed failures is compatible with a nonzero failure probability. Trial dependence or a changed configuration changes the evidence basis.

Table AU-9 — All-success reliability demonstration — calculated comparison

R target	Required all-success trials
0.9	29
0.95	59
0.99	299
0.999	2995
0.9999	29956

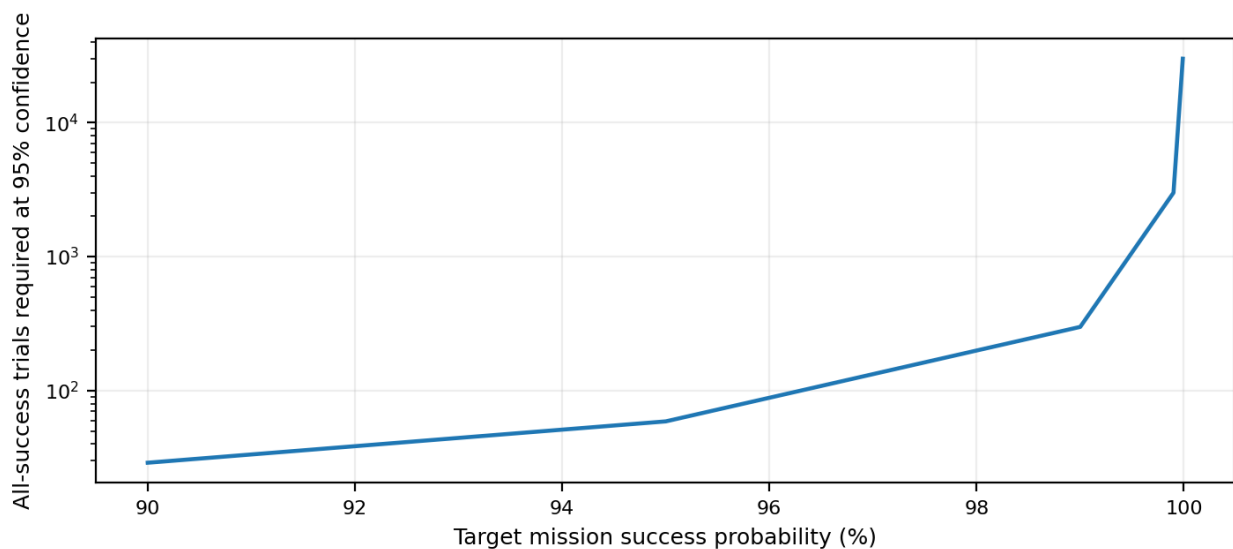


Figure AU.6 — Calculated from the stated example inputs; not actual product or organizational performance.

Assumptions and limits: This target is not an AF safety rate. Repeated trials on one article do not necessarily create independent representative missions.

AU.7 Time-on-test with zero and observed failures

Linked provisions: F.4–F.5; AT.5

What upper constant failure-rate bound is supported by a stated test exposure?

$$\lambda_U = -\ln(\alpha)/T \text{ for zero failures}$$

$$\lambda_U = \chi^2(1-\alpha; 2r+2)/(2T) \text{ for fixed-time Poisson exposure}$$

Table AU-10 — Time-on-test with zero and observed failures — inputs and assumptions

Input	Stated value	Meaning / assumption
α	0.05	One-sided confidence parameter.
T, case A	60,000 item-hours; $r=0$	Valid homogeneous constant-rate exposure.
T, case B	100,000 item-hours; $r=3$	Fixed-time observation model.

1. Case A: $\lambda_U = 4.992887\text{e-}05 \text{ h}^{-1}$; $\theta_L = 20,028.492 \text{ h}$.

2. Case B: $\lambda_U = 7.753657\text{e-}05 \text{ h}^{-1}$; $\theta_L = 12,897.141 \text{ h}$.

Interpretation: Total item-hours and calendar duration are different. Parallel tests shorten elapsed time but do not create extra exposure.

Assumptions and limits: The model does not prove wear-out life, rare-event safety or systematic software reliability. Failures, censored data, interruptions and configuration changes must be retained.

AU.8 Constant-rate and wear-out model comparison

Linked provisions: F.1; F.6; AT.5

Why do different assumed failure mechanisms yield different life estimates?

$$R_{\text{exp}}(t) = \exp(-\lambda t)$$

$$R_{\text{Weibull}}(t) = \exp[-(t/\eta)^\beta]; B_p = \eta[-\ln(1-p)]^{1/\beta}$$

Table AU-11 — Constant-rate and wear-out model comparison — inputs and assumptions

Input	Stated value	Meaning / assumption
λ	0.00002 h ⁻¹	Assumed constant-rate model.
$\beta; \eta$	1.5; 10,000 h	Assumed Weibull shape and scale.
$t; p$	5,000 h; 0.10	Evaluation time and cumulative failed fraction.

1. Exponential $R(5000) = 0.90483742$.

2. Weibull $R(5000) = 0.7021885$; $B_{10} = 2,230.755$ h.

Interpretation: The different values reflect different assumed mechanisms, not a contradiction or a reason to choose the more favourable curve.

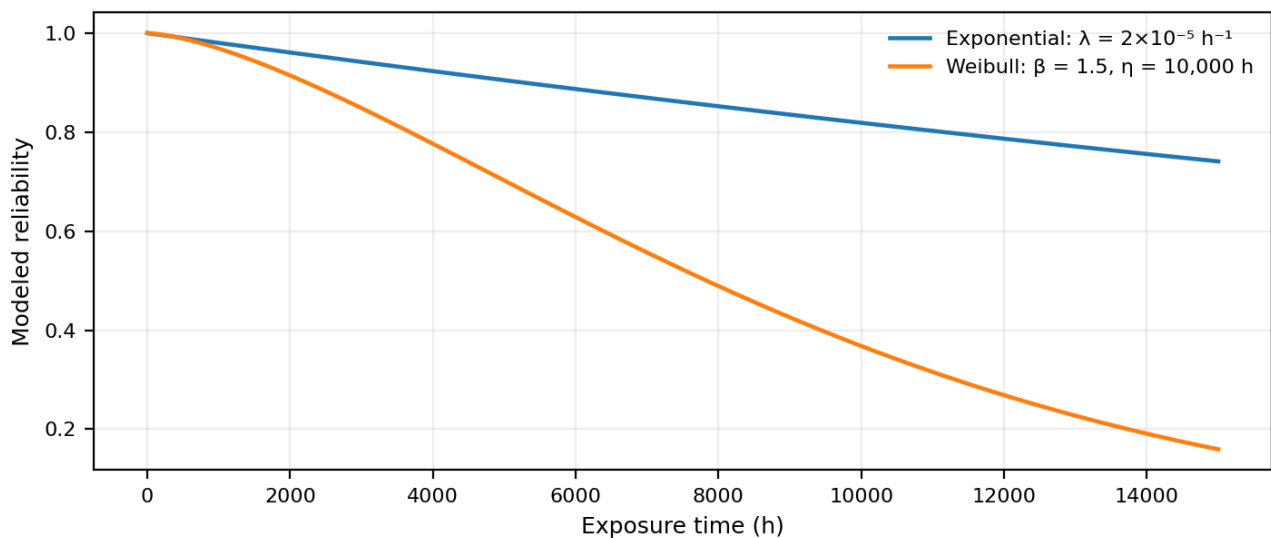


Figure AU.8 — Calculated from the stated example inputs; not actual product or organizational performance.

Assumptions and limits: Parameters are not fitted to actual tests. Real inference must address censoring, uncertainty, environment, sample representativeness and a validated acceleration model.

AU.9 Redundancy and common-cause sensitivity

Linked provisions: E.3–E.4; F.2; AT.5

Can an impressive redundant-channel result survive a shared failure?

$$R_{\text{series}} = \prod R_i; R_{\text{parallel}} = 1 - \prod (1 - R_i)$$

$$P_{\text{loss}} = q + (1 - q) p_A p_B$$

Table AU-12 — Redundancy and common-cause sensitivity — inputs and assumptions

Input	Stated value	Meaning / assumption
$p_A; p_B$	0.002; 0.003	Conditional on no common-cause event, channels independent.
q	0.001	Synthetic event that defeats both channels.

1. Independent joint loss = $6e-06$.
2. With shared event, loss = 0.00100599, or 167.666 times the independent-only result.
3. The Annex F series $R = 0.9830799$; two 0.98 active-parallel elements $R = 0.9996$ under their own assumptions.

Interpretation: Common dependencies can dominate redundancy arithmetic. The model separates conditional channel failure from the shared event.

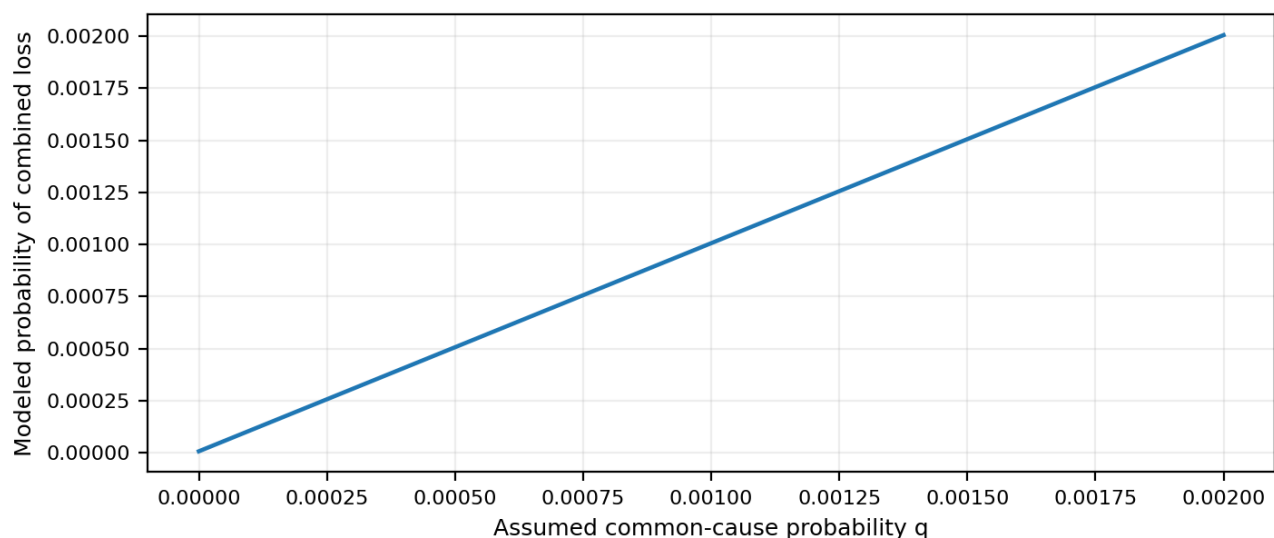


Figure AU.9 — Calculated from the stated example inputs; not actual product or organizational performance.

Assumptions and limits: Perfect switching/load-sharing and sufficient surviving function are assumptions where needed. This is sensitivity analysis, not a validated mission failure probability.

AU.10 Intrinsic versus operational availability

Linked provisions: F.7; 24.4; AT.5

Why can two correctly calculated availability values differ?

$$A_i = \text{MTBF} / (\text{MTBF} + \text{MTTR})$$

$$A_o = \text{uptime} / (\text{uptime} + \text{downtime})$$

Table AU-13 — Intrinsic versus operational availability — inputs and assumptions

Input	Stated value	Meaning / assumption
MTBF; MTTR	1,200 h; 6 h	MTTR includes only active repair in this model.
Observed times	960 h uptime; 40 h downtime	All declared downtime in a 1,000 h window.

1. $A_i = 99.50249\%$.

2. $A_o = 96\%$.

Interpretation: The boundaries differ: logistics, administration and other outages may reduce operational availability beyond active-repair calculations.

Assumptions and limits: A service can be available and still deliver incorrect or unsafe outputs. State exclusions before reporting and evaluate critical accuracy/integrity failures separately.

AU.11 Statistical process-control baseline

Linked provisions: G.1–G.2; AT.6

How are subgroup variation and chart limits calculated from the baseline data?

$$s_{\text{within}} = R/d_2; \bar{X} \text{ limits} = \bar{\bar{X}} \pm A_2R$$

$$R \text{ limits} = D_3\bar{R}, D_4\bar{R}$$

Table AU-14 — Statistical process-control baseline — inputs and assumptions

Input	Stated value	Meaning / assumption
Data	25 subgroups × 5 observations	All 125 baseline values are listed in Table G-1.
Constants for n=5	$d_2=2.326$; $A_2=0.577$; $D_3=0$; $D_4=2.115$	Not valid for arbitrary subgroup size.

1. $\bar{\bar{X}} = 50.00215328$ mm; $R = 0.013546$ mm; $s_{\text{within}} = 0.00582373$ mm.
2. $\bar{X}$ limits = [49.99433724, 50.00996932] mm.
3. R limits = [0, 0.02864979] mm.

Interpretation: The reproducible baseline is a process-behaviour estimate, not a product specification or a declaration of unlimited future stability.

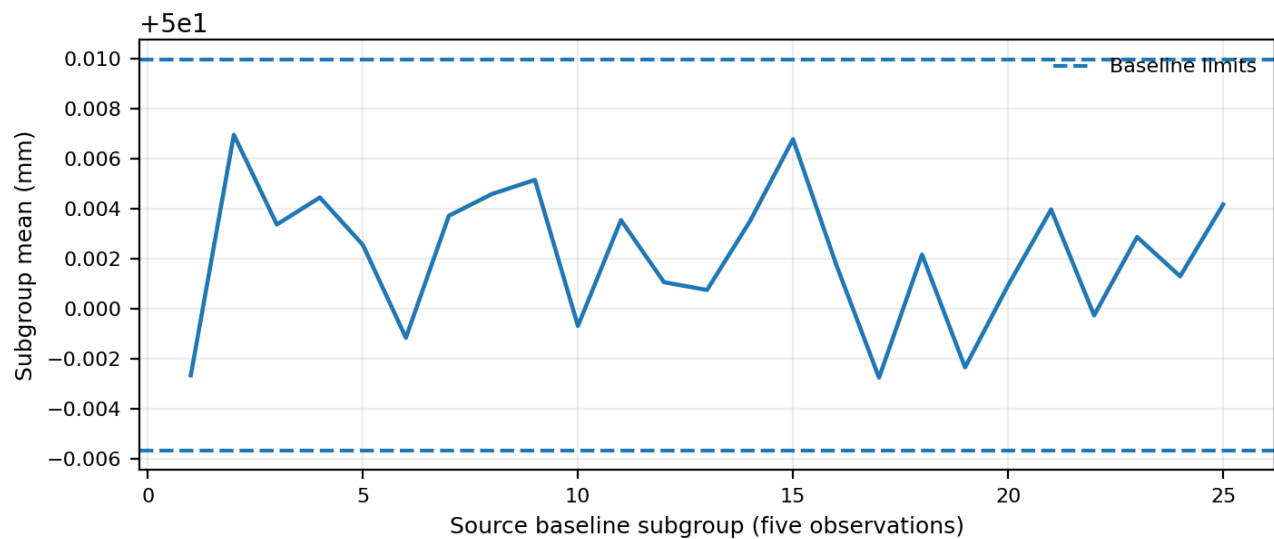


Figure AU.11 — Calculated from the stated example inputs; not actual product or organizational performance.

Assumptions and limits: Monitoring groups 26–30 are shown in Figures G-1 and G-2. This chart intentionally uses only the 25 fully tabulated baseline subgroups. Do not recalculate limits to hide an unexplained shift.

AU.12 Capability and performance index definitions

Linked provisions: G.3; 25.3; AT.6

How do within-subgroup and overall variation change the descriptive index?

$$C_p = (USL - LSL) / (6s_{\text{within}})$$

$$C_{pk} = \min[(USL - \bar{x}) / (3s_{\text{within}}), (\bar{x} - LSL) / (3s_{\text{within}})]$$

Table AU-15 — Capability and performance index definitions — inputs and assumptions

Input	Stated value	Meaning / assumption
Limits	49.970 to 50.030 mm	Synthetic example specification.
s_within	0.00582373 mm	Subgroup range estimator.
s_overall	0.00603166 mm	Sample standard deviation of 125 baseline observations.

1. $C_p=1.717112$; $C_{pk}=1.593865$.
2. $P_p=1.657919$; $P_{pk}=1.53892$ using s_overall.

Interpretation: The indices answer different descriptive questions. Mean centering and the variance estimator both matter.

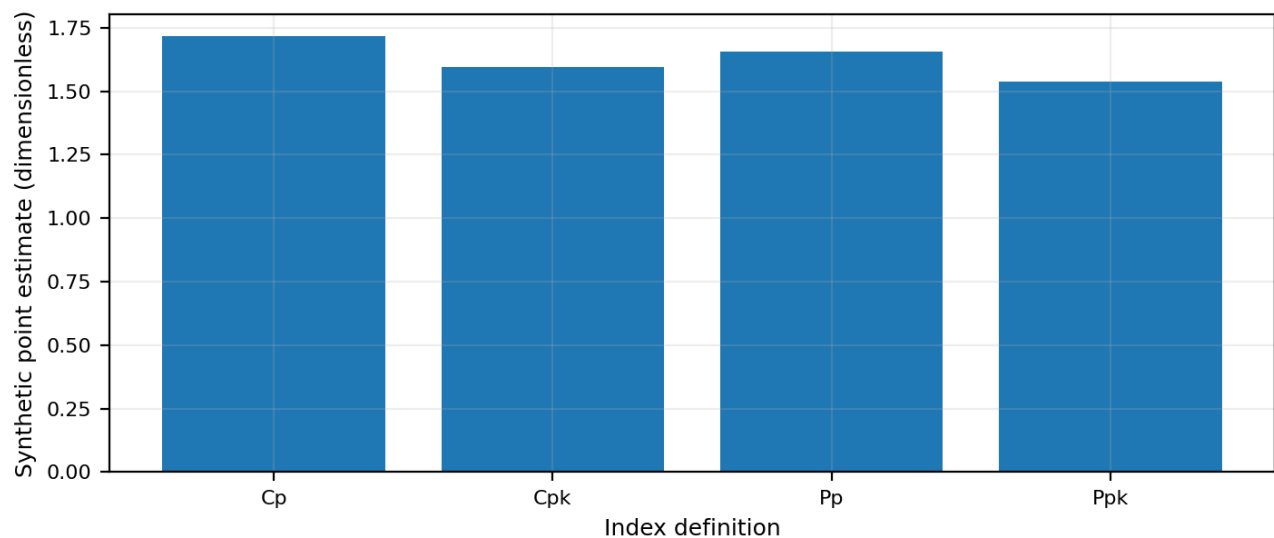


Figure AU.12 — Calculated from the stated example inputs; not actual product or organizational performance.

Assumptions and limits: No universal C_{pk} acceptance threshold is imposed. Interpret normal tails only with suitable stability/distribution evidence and address estimation uncertainty and measurement suitability.

AU.13 Measurement variation: standard-deviation and variance fractions

Linked provisions: G.6; AT.6

Why is a 30% standard-deviation ratio not a 30% variance contribution?

$$s_{\text{gage}} = \sqrt{s_{\text{repeat}}^2 + s_{\text{reproduce}}^2}$$

$$r_{\text{SD}} = s_{\text{gage}} / s_{\text{total}}; r_{\text{var}} = s_{\text{gage}}^2 / s_{\text{total}}^2$$

Table AU-16 — Measurement variation: standard-deviation and variance fractions — inputs and assumptions

Input	Stated value	Meaning / assumption
s_repeat; s_reproduce	0.0015; 0.0010 mm	Independent assumed components.
s_total	0.0060 mm	Observed synthetic total variation.

1. $s_{\text{gage}} = 0.00180278$ mm.

2. $r_{\text{SD}} = 30.04626\%$; $r_{\text{var}} = 9.02778\%$.

Interpretation: The denominator and whether a ratio uses standard deviation or variance must be stated.

Assumptions and limits: This is not a complete gauge study. A real design needs representative parts, operators, interactions, repeat conditions and uncertainty; no universal acceptance percentage is created.

AU.14 AI inspection metrics and denominators

Linked provisions: N.4; AS.3-AS.4

Which aspect of performance does each confusion-matrix metric describe?

Precision= $TP/(TP+FP)$; recall= $TP/(TP+FN)$

Specificity= $TN/(TN+FP)$; F1= $2TP/(2TP+FP+FN)$

Table AU-17 — AI inspection metrics and denominators — inputs and assumptions

Input	Stated value	Meaning / assumption
Counts	TP=190; FP=15; FN=10; TN=785	Positive denotes an actual defect.
Population	1,000 independent labeled examples	Synthetic held-out evaluation assumption.

1. Precision=92.68293%; recall=95%.
2. Specificity=98.125%; accuracy=97.5%; F1=0.9382716.

Interpretation: The 10 missed defects remain material even when accuracy is 97.5%. Precision and recall answer different questions.

Table AU-18 — AI inspection metrics and denominators — calculated comparison

Actual class	Predicted defect	Predicted non-defect
Defect	190	10
Non-defect	15	785

Assumptions and limits: Undefined denominators remain undefined, not zero or a perfect score. Label quality, deployment domain, leakage and dependence require separate assessment.

AU.15 AI uncertainty and separate challenge populations

Linked provisions: N.5; AS.3-AS.4; AT.4

Can good average performance hide weak evidence in a difficult operating condition?

Exact interval: lower beta quantile $B^{-1}(0.025; k, n-k+1)$, upper $B^{-1}(0.975; k+1, n-k)$

Report the interval method, population and confidence convention.

Table AU-19 — AI uncertainty and separate challenge populations — inputs and assumptions

Input	Stated value	Meaning / assumption
Main defect cases	190 detections / 200	Subset of the Annex N 1,000-case main evaluation
Separate challenge	38 detections / 50	Not a subgroup of that main dataset.

1. Main exact interval=[90.9972%, 97.5766%].
2. Main Wilson interval=[91.0422%, 97.2617%].
3. Challenge exact interval=[61.8309%, 86.939%].

Interpretation: A hypothetical lower-endpoint criterion of 90% would fail on the challenge population even though the main point estimate is 95%.

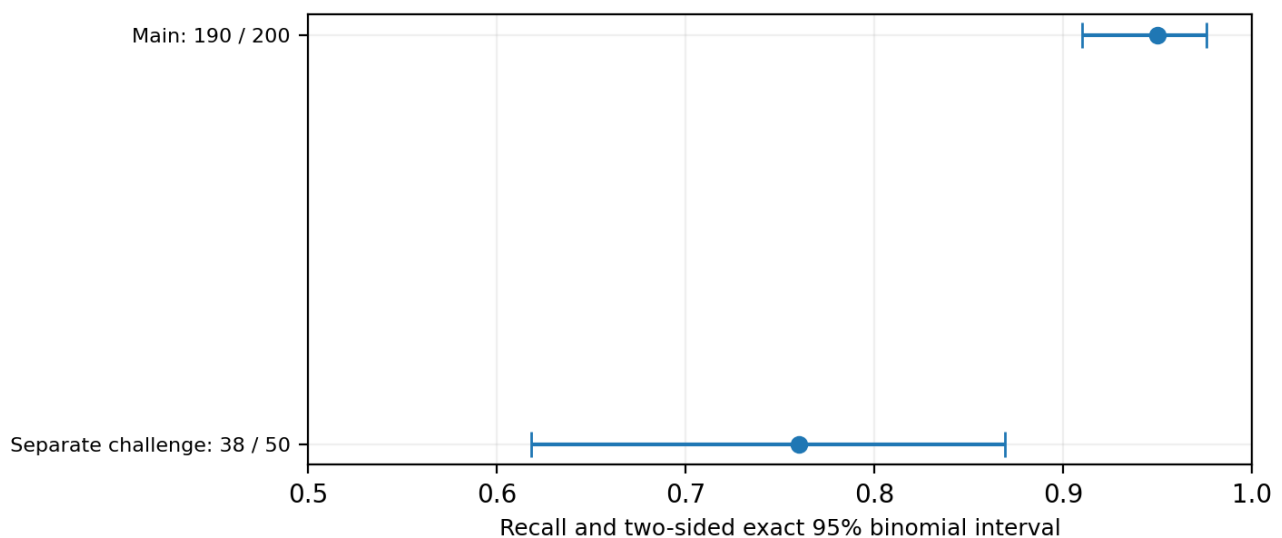


Figure AU.15 — Calculated from the stated example inputs; not actual product or organizational performance.

Assumptions and limits: The hypothetical threshold is not normative. Binomial intervals do not cover mislabeled data, distribution shift or incomplete scenarios.

AU.16 Detection planning and one-point inspection demonstration

Linked provisions: AC.8; 18.6; AT.4

How are issue detection in a sample and observed detector successes different?

$$n_{\text{detect}} = \text{ceil}[\ln(1-C)/\ln(1-p)]$$

For n/n successful independent detections: $\text{POD}_L = \alpha^{(1/n)}$

Table AU-20 — Detection planning and one-point inspection demonstration — inputs and assumptions

Input	Stated value	Meaning / assumption
Detection plan	$p=0.10$; $C=0.95$	Each independent observation has stated issue probability and reliable classification.
Detector trial	29 detections in 29 known relevant defects	Separate synthetic study at one defined condition.

1. Detection planning requires $n=29$; probability of at least one issue= 0.95289871 .

2. Separate detector trial gives one-sided 95% lower bound= 0.90185537 .

Interpretation: The same binomial mathematics answers different questions because the populations and events differ.

Assumptions and limits: Twenty-nine successes at one defect condition do not establish a full probability-of-detection curve over size, material, geometry, operators and access. Audit judgment samples do not inherit this statistical claim.

AU.17 Mean confidence interval versus individual prediction interval

Linked provisions: AT.4; AW comparisons

Why does a precise mean not imply that individual output values are equally narrow?

Mean CI: $\bar{x} \pm t_{(0.975, n-1)} s/\sqrt{n}$

Future observation PI: $\bar{x} \pm t_{(0.975, n-1)} s\sqrt{(1+1/n)}$

Table AU-21 — Mean confidence interval versus individual prediction interval — inputs and assumptions

Input	Stated value	Meaning / assumption
n; $\bar{x}$; s	25; 50.000 mm; 0.006 mm	Independent normal observations assumed.
t quantile	2.06389856	Two-sided 95%; 24 degrees of freedom.

1. Mean half-width=0.00247668 mm; interval=[49.99752332, 50.00247668] mm.
2. Individual prediction half-width=0.01262863 mm; interval=[49.98737137, 50.01262863] mm.

Interpretation: The prediction interval is wider because it includes future observation variation in addition to estimation of the mean.

Assumptions and limits: Neither interval is a population tolerance interval or an automatic product acceptance plan. Normality, independence and unchanged conditions must be justified.

AU.18 Power margin, degradation and reserve accounting

Linked provisions: 11.7; Z.2; AN-D29; AY-PS06

How much reserve remains after explicitly declared adverse allowances?

Margin relative to demand=(capacity–demand)/demand

Available capacity=nominal capacity–degradation; required
demand=base+allowance+protected reserve

Table AU-22 — Power margin, degradation and reserve accounting — inputs and assumptions

Input	Stated value	Meaning / assumption
Nominal	Capacity 5.0 kW; demand 4.0 kW	Illustrative consistent operating mode.
Allowances	Capacity loss 0.3 kW; demand allowance 0.25 kW; reserve 0.2 kW	Distinct, non-overlapping accounting assumptions.

1. Nominal demand-relative margin=25%; unused-capacity fraction=20%.
2. Available=4.7 kW; allocated requirement=4.45 kW; surplus=0.25 kW.
3. Bounded demand-relative margin=5.61798%.

Interpretation: The apparently comfortable nominal margin can shrink when degradation and separate protected duties are included.

Assumptions and limits: This example is not a vehicle or spacecraft power rating. Simultaneous peaks, transients, uncertainty and physical model validity require the actual profile.

AU.19 Stored-energy requirement with conversion and aging

Linked provisions: 11.7; 19.2; AN-D29; AY-PS06

What nominal storage would supply a stated synthetic mission-mode energy?

$$E_{\text{load}} = P \cdot t$$

$$E_{\text{nominal}} = E_{\text{load}} / (\eta \times \text{usable_fraction} \times \text{aged_capacity_fraction})$$

Table AU-23 — Stored-energy requirement with conversion and aging — inputs and assumptions

Input	Stated value	Meaning / assumption
Load	120 W for 0.75 h	Constant useful load in the stated interval.
η	0.90	Conversion efficiency.
Usable fraction; aging	0.70; 0.80	Separate declared fractions; no extra reserve hidden.

1. $E_{\text{load}} = 90 \text{ Wh}$.
2. $E_{\text{nominal}} = 178.57143 \text{ Wh}$.
3. Back-check: $178.57143 \times 0.90 \times 0.70 \times 0.80 = 90 \text{ Wh}$ before presentation rounding.

Interpretation: The computation distinguishes required useful energy from nominal nameplate energy.

Assumptions and limits: Real battery safety, rate/temperature effects, transient loads, life, monitoring and reserve policy require independent technical evidence. Positive energy balance does not qualify a battery system.

AU.20 Loop resistance, voltage drop and dissipation

Linked provisions: 15.2; 19.1; AR-V24

Are loop definition and units consistent in a simple wiring calculation?

$$R = \rho L_{\text{loop}} / A; \Delta V = IR; P_{\text{loss}} = I^2 R$$

Table AU-24 — Loop resistance, voltage drop and dissipation — inputs and assumptions

Input	Stated value	Meaning / assumption
ρ	$1.72 \times 10^{-8} \Omega \cdot \text{m}$	Assumed material resistivity at the stated condition.
$L_{\text{loop}}; A$	10 m total outgoing-and-return length; $2 \text{ mm}^2 = 2 \times 10^{-6} \text{ m}^2$	Do not double or omit the return path.
Current; supply	4 A; 28 V	Synthetic steady state.

1. $R = 0.086 \Omega$; drop = 0.344 V.

2. Load-terminal voltage = 27.656 V; line dissipation = 1.376 W.

Interpretation: The loop and area conversion govern the result; watts and volts are different acceptance quantities.

Assumptions and limits: Contact resistance, temperature, bundling, insulation, protection, transient and electromagnetic effects are not modeled. This is not an installation wire-sizing approval.

AU.21 Ideal radiative thermal balance

Linked provisions: 11.7; AR-V10; AT.1

How does a bounded thermal model translate a stated temperature into net radiation?

$$Q = \epsilon \sigma A (T^4 - T_{\text{env}}^4)$$

$$T = [Q / (\epsilon \sigma A) + T_{\text{env}}^4]^{1/4}$$

Table AU-25 — Ideal radiative thermal balance — inputs and assumptions

Input	Stated value	Meaning / assumption
ϵ ; A	0.8; 0.5 m ²	Ideal grey surface, effective full-view exchange assumed.
T; T _{env}	320 K; 250 K	Absolute temperatures.
σ	$5.670374419 \times 10^{-8} \text{ W} \cdot \text{m}^{-2} \cdot \text{K}^{-4}$	Physical radiation constant in the stated equation.

1. Net ideal transfer $Q = 149.23314 \text{ W}$.

2. Inverse solution returns $T = 320 \text{ K}$.

Interpretation: Absolute temperature and fourth-power behaviour matter; Celsius cannot be substituted directly.

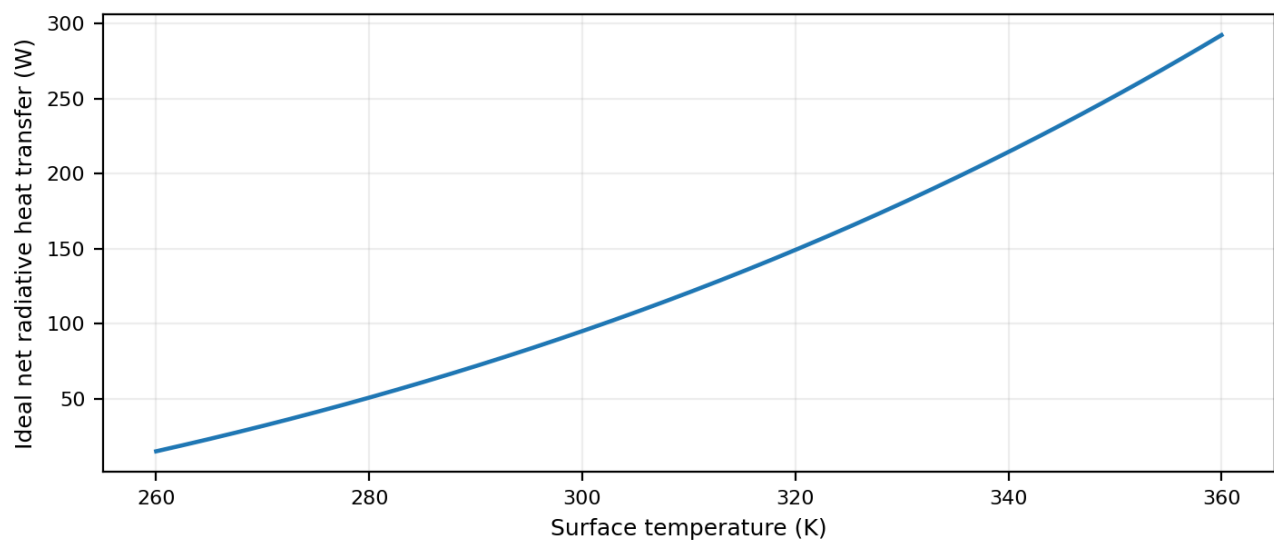


Figure AU.21 — Calculated from the stated example inputs; not actual product or organizational performance.

Assumptions and limits: View factors, solar/albedo inputs, conduction, changing emissivity, geometry and environmental uncertainty are omitted. The illustrative model does not establish a qualified spacecraft thermal condition.

AU.22 First-order thermal transient and time to a threshold

Linked provisions: 11.6–11.7; AR-V09; AT.1

How does an assumed lumped model determine approach to a new environment?

$$\tau = mc/(hA); T(t) = T_{\text{inf}} + (T_0 - T_{\text{inf}})\exp(-t/\tau)$$

$$t = -\tau \ln[(T_{\text{target}} - T_{\text{inf}})/(T_0 - T_{\text{inf}})]$$

Table AU-26 — First-order thermal transient and time to a threshold — inputs and assumptions

Input	Stated value	Meaning / assumption
m; c; hA	10 kg; 900 J/(kg·K); 15 W/K	Constant lumped parameters.
Temperatures	T ₀ =300 K; T _{inf} =330 K; target=325 K	Target lies between initial and limiting temperatures.

1. $\tau = 600$ s.
2. Time to target = 1,075.0557 s = 17.9176 min.

Interpretation: The result is a modeled transient under specified initial and boundary conditions.

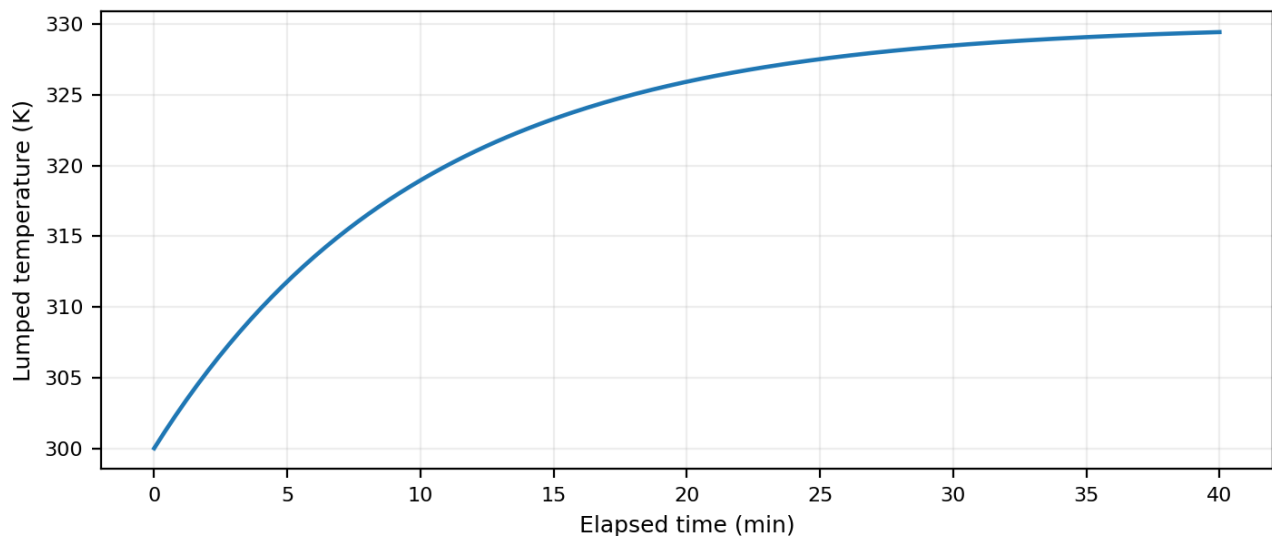


Figure AU.22 — Calculated from the stated example inputs; not actual product or organizational performance.

Assumptions and limits: Lumped validity, internal gradients, temperature-dependent properties and radiative effects require separate justification. An unreachable or equal-asymptote target cannot be forced through the logarithm.

AU.23 Random-vibration spectral integration

Linked provisions: AR-V03; AT.2

How is RMS acceleration obtained from a one-sided acceleration spectral density?

$$a_{\text{rms}} = \sqrt{\int G_a(f) df}$$

For flat bands: $a_{\text{rms}} = \sqrt{[\sum G_i(f_{\text{hi}} - f_{\text{lo}})]}$

Table AU-27 — Random-vibration spectral integration — inputs and assumptions

Input	Stated value	Meaning / assumption
Bands	20-100; 100-500; 500-2,000 Hz	Illustrative non-overlapping integration bands.
PSD	0.01; 0.04; 0.01 g ² /Hz	Synthetic exposure, not a prescribed test profile.

1. Band variances=0.8, 16, 15 g².
2. Total=31.8 g²; RMS=5.639149 g.

Interpretation: The area under the PSD has units of acceleration squared; RMS is its square root.

Table AU-28 — Random-vibration spectral integration — calculated comparison

Band (Hz)	PSD (g ² /Hz)	Contribution (g ²)
20-100	0.01	0.8
100-500	0.04	16
500-2000	0.01	15

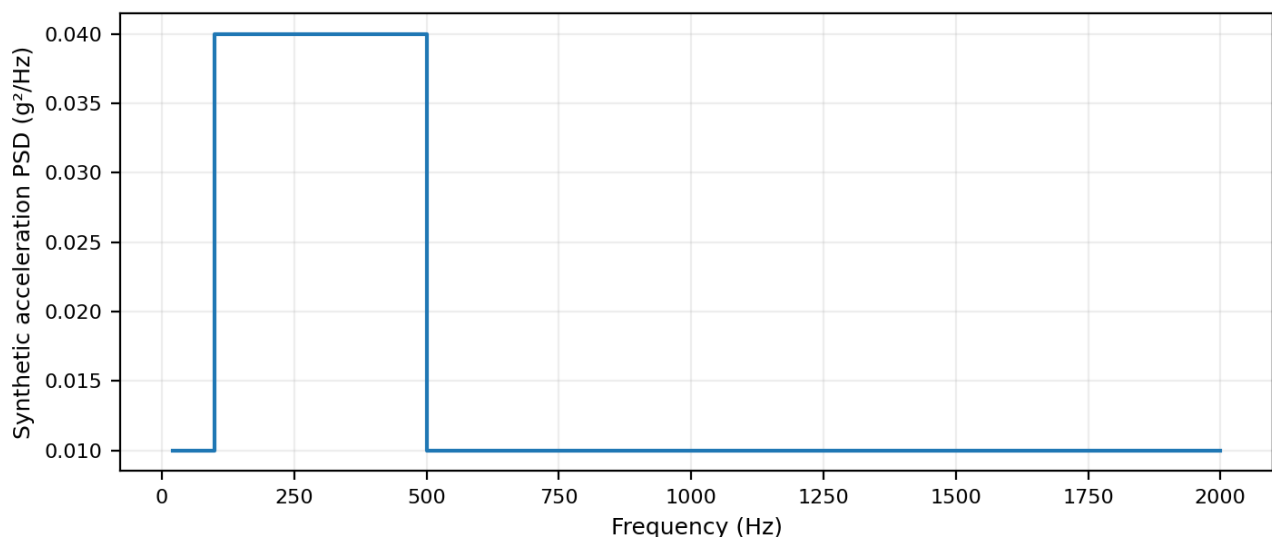


Figure AU.23 — Calculated from the stated example inputs; not actual product or organizational performance.

Assumptions and limits: RMS does not preserve spectral shape, resonance, duration, peak response or damage equivalence. Same RMS is not the same qualification exposure.

AU.24 Linear fatigue-damage accounting and model limits

Linked provisions: 11.4; 18.6; AR-V07-AR-V08

What does a simple accumulated damage indicator say, and what does it omit?

$$D = \sum n_i / N_i$$

Table AU-29 — Linear fatigue-damage accounting and model limits — inputs and assumptions

Input	Stated value	Meaning / assumption
Applied cycles n_i	12,000; 6,000; 2,000	Separate defined duty levels.
Assumed life N_i	200,000; 60,000; 10,000 cycles	Hypothetical mechanism-specific lives.

1. Contributions=0.06, 0.1, 0.2; D=0.36.

Interpretation: The result is an accounting indicator under the linear accumulation model, not an automatic pass because it is below one.

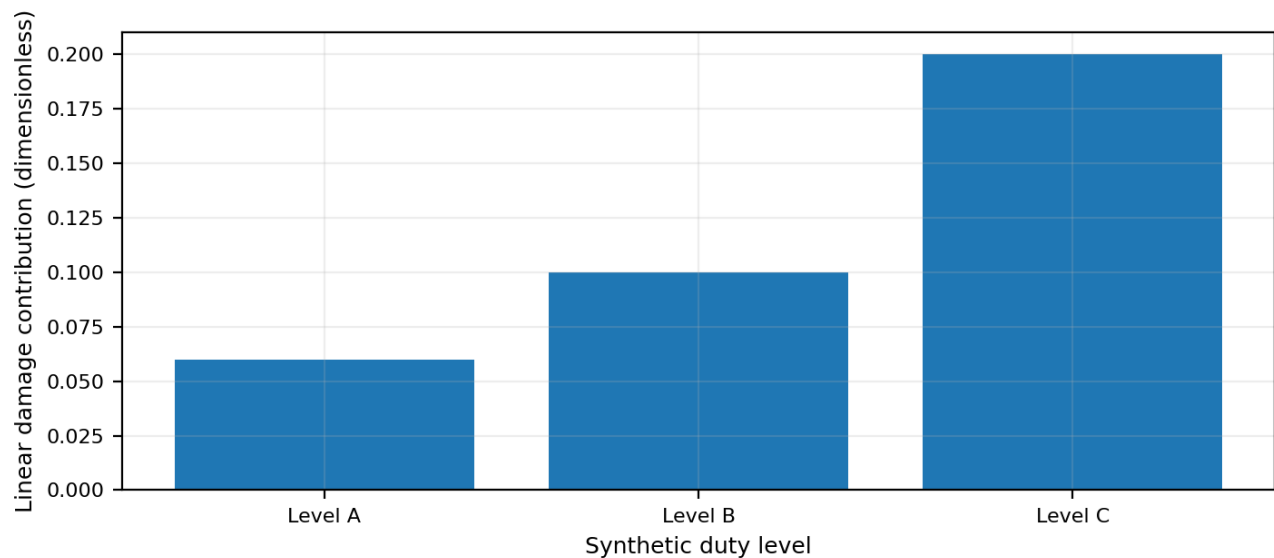


Figure AU.24 — Calculated from the stated example inputs; not actual product or organizational performance.

Assumptions and limits: Sequence, mean stress, scatter, environment, crack growth and inspection limitations are omitted. Real allowable damage or remaining life requires the applicable specialist model and independent authority.

AU.25 Data-rate, storage and unit conventions

Linked provisions: 11.7; 12.9; AS.12

How much storage is needed for a defined set of recorded sessions?

$$V_{\text{bytes}} = R_{\text{bit/s}} \times \text{time}_s \times \text{sessions} / 8$$

$$\text{Reserved capacity} = V_{\text{payload}} \times (1 + \text{declared overhead}_{\text{fraction}})$$

Table AU-30 — Data-rate, storage and unit conventions — inputs and assumptions

Input	Stated value	Meaning / assumption
Useful application rate	20 Mbit/s	Decimal megabits; excludes any unmodeled channel overhead.
Sessions	6 × 1,800 s	Full-rate recording assumed.
Overhead/reserve	25% of payload	Single declared allowance; not counted again.

1. Payload=27 GB; reserved=33.75 GB.

2. The same reserved quantity is 31.43214 GiB.

Interpretation: Decimal GB and binary GiB are different representations of the same byte quantity. State whether rates are useful payload or physical-channel rates.

Assumptions and limits: Real compression, retransmissions, indexing, retention, contact gaps and failure recovery need their own budgets. Available storage does not prove data integrity or retrievability.

AU.26 Ideal communications link-budget arithmetic

Linked provisions: AN-D12; AY-PS07; AT.1

What nominal margin follows from a declared ideal free-space link model?

$$L_{fs} = 20 \log_{10}(4\pi df/c)$$

$$P_r = P_t + G_t + G_r - L_{other} - L_{fs}; C/N_0 = P_r - 10 \log_{10}(kT)$$

$$E_b/N_0 = C/N_0 - 10 \log_{10}(R_b); \text{margin} = E_b/N_0 - \text{required value}$$

Table AU-31 — Ideal communications link-budget arithmetic — inputs and assumptions

Input	Stated value	Meaning / assumption
Distance; frequency	2,000 km; 8.2 GHz	Hypothetical line-of-sight free space.
P_t ; G_t ; G_r ; L_{other}	10 dBW; 20 dB; 35 dB; 2 dB	Consistent logarithmic units.
T ; bit rate; required E_b/N_0	500 K; 20 Mbit/s; 10 dB	Synthetic receiver/decision assumptions.

- $L_{fs} = 176.74466$ dB; $P_r = -113.74466$ dBW.
- $C/N_0 = 87.86481$ dB-Hz; $E_b/N_0 = 14.85451$ dB.
- Nominal margin = 4.85451 dB.

Interpretation: The arithmetic retains the distinction between power, spectral density and energy-per-bit ratios.

Assumptions and limits: Pointing, atmosphere, blockage, polarization, interference, coding, nonlinearity and implementation uncertainty are not fully modeled. This is not a qualified mission link or a spectrum authorization.

AU.27 Communication-delay floor and feasible human intervention

Linked provisions: 12.4; 16.5; AN.3; AS.4

Can a remote human close the protective loop inside a stated synthetic two-second window?

$$t_{\text{oneway}} = d/c$$

$$t_{\text{loop}} \geq 2d/c + t_{\text{processing}} + t_{\text{action}}$$

Table AU-32 — Communication-delay floor and feasible human intervention — inputs and assumptions

Input	Stated value	Meaning / assumption
Distance	400,000 km	Illustrative one-way path.
Processing; action	0.3 s; 0.5 s	Declared additional minimum durations.
Intervention window	2.0 s	Hypothetical application criterion, not an AF universal limit.

1. One-way propagation=1.334256 s; round trip=2.668513 s.
2. Minimum modeled loop=3.468513 s > 2.0 s.

Interpretation: The stated human-intervention control is infeasible even before additional operational delay; the dependent safety argument cannot credit it.

Assumptions and limits: The program must validate another protective arrangement or restrict the activity. The numerical example does not prescribe flight guidance or a specific autonomy architecture.

AU.28 Exposure budget and explicit conservatism

Linked provisions: 14.2; AN-D30; AT.1

How are a nominal exposure, planning allowance and declared margin factor kept distinct?

Planning demand=(nominal exposure+allowance)×factor

Remaining margin=(demonstrated capacity–planning demand)/planning demand

Table AU-33 — Exposure budget and explicit conservatism — inputs and assumptions

Input	Stated value	Meaning / assumption
Synthetic exposure/capacity	20; 30 krad for a declared material-response basis	All values hypothetical and applicable only to the stated mechanism.
Allowance; factor	2 krad; 1.2	Approved planning terms in this example, not universal uncertainty or safety factors.

1. Planning demand=26.4 krad; remaining=3.6 krad.

2. Demand-relative margin=13.63636%.

Interpretation: The budget states where conservatism is applied and prevents the same allowance being counted twice.

Assumptions and limits: Actual spectrum, rate, shielding, bias, environment and susceptibility must be established by authorized specialists. Numerical margin alone does not demonstrate radiation qualification or human safety.

AU.29 Blank-corrected surface count and measurement limitations

Linked provisions: 7.5; AR-V37; AT.3

How do a blank and collection efficiency affect a low-count surface estimate?

$$C = (N_{\text{sample}} - N_{\text{blank}}) / (\text{area} \times \text{efficiency})$$

Illustrative independent Poisson standard uncertainty:

$$u(C) = \sqrt{(N_{\text{sample}} + N_{\text{blank}}) / (\text{area} \times \text{efficiency})}$$

Table AU-34 — Blank-corrected surface count and measurement limitations — inputs and assumptions

Input	Stated value	Meaning / assumption
Counts	Sample 7; matched blank 2	Same relevant collection/exposure basis assumed.
Area; efficiency	100 cm ² ; 0.8	Efficiency treated as exact only for this simplified calculation.

1. Corrected estimate=0.0625 counts/cm².
2. Simplified standard uncertainty=0.0375 counts/cm².

Interpretation: Low counts and substantial relative uncertainty do not support an unsupported contamination-free statement.

Assumptions and limits: This is a particulate counting example, not a biological assay. Efficiency uncertainty, spatial sampling, background variability and a suitable low-count interval model need separate treatment; negative corrected results require a defined reporting rule.

AU.30 Mass properties and configuration-specific integration

Linked provisions: 11.7; 16.3; AM.4

What longitudinal centre of mass follows from an identified synthetic platform configuration?

$$m_{\text{total}} = \sum m_i; x_{\text{CG}} = \frac{\sum (m_i x_i)}{\sum m_i}$$

Table AU-35 — Mass properties and configuration-specific integration — inputs and assumptions

Input	Stated value	Meaning / assumption
Masses	600; 300; 200 kg	Three known items, not a real vehicle.
Positions	0; 2; 3 m	One common datum and direction.

1. Total mass=1,100 kg; first moment=1,200 kg·m.

2. x_{CG} =1.090909 m from the declared datum.

Interpretation: The answer is valid only for the actual listed configuration and common coordinate convention.

Assumptions and limits: Dynamic stability, load distribution, inertia, uncertain masses, consumables and structural capacity are separate questions. A centre-of-mass calculation alone is not a platform integration approval.

AU.31 Partial environmental inventory and comparable improvement

Linked provisions: U.1–U.4; 20.2; AT.1

What does an explicitly bounded inventory support?

$$E_{\text{total}} = \sum A_i EF_i; \text{intensity} = E_{\text{total}} / \text{functional_output}$$

$$\text{For independent category uncertainties: } u_{\text{total}} = \sqrt{[\sum (E_i r_i)^2]}$$

Table AU-36 — Partial environmental inventory and comparable improvement — inputs and assumptions

Input	Stated value	Meaning / assumption
Activities/factors	120,000×0.35; 6,000×2.50; 20,000×1.80; 45,000×0.12	Units: kWh, L, kg, tonne-km; factors produce kg CO ₂ e.
Output	1,000 assemblies	Use and end-of-life excluded.
Relative standard uncertainties	10%; 8%; 20%; 15%	Assumed independent category totals.

1. Total=98,400 kg CO₂e; intensity=98.4 kg CO₂e/assembly.
2. $u=8,460.266$ kg CO₂e; illustrative $k=2$ $U=16,920.532$ kg CO₂e.
3. 12,000 kWh reduction at unchanged assumptions gives 4,200 kg CO₂e reduction and new intensity 94.2.

Interpretation: This is a partial production inventory and a hypothetical sensitivity, not an achieved full-lifecycle reduction.

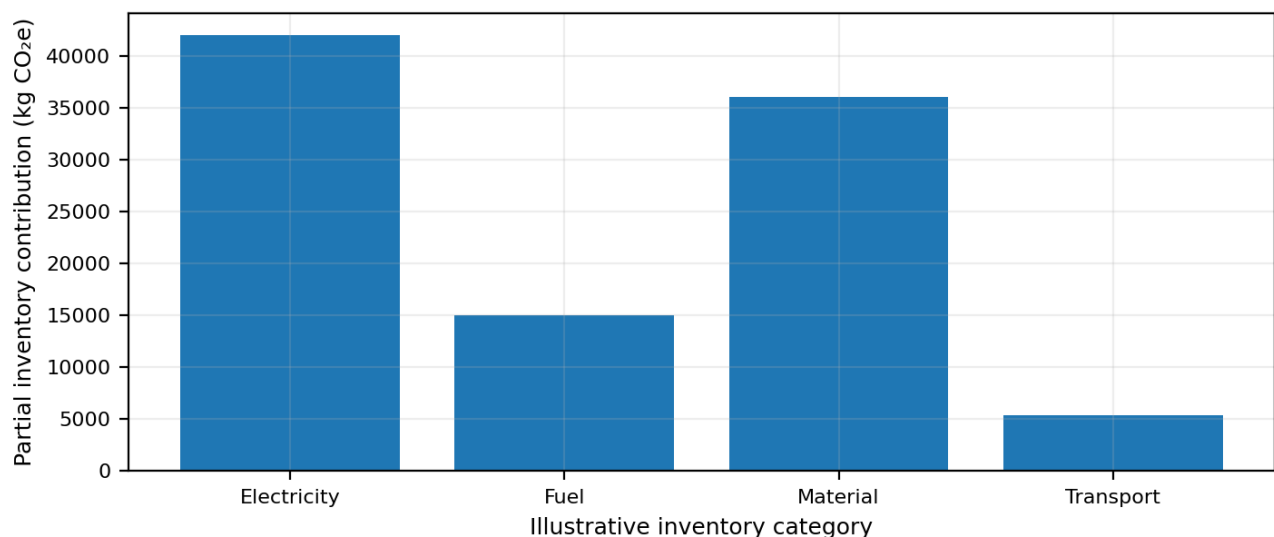


Figure AU.31 — Calculated from the stated example inputs; not actual product or organizational performance.

Assumptions and limits: All factors are invented for arithmetic. Boundary completeness, shared factors, output mix, leakage and technical product suitability require separate evidence. Offsets are not silently subtracted.

AU.32 Quality and delivery metrics without score substitution

Linked provisions: Z.1; AL.7

How do stable denominator definitions prevent misleading performance reports?

FPY=first-pass accepted/entered; RTY=□ conditional stage yields

ppm=nonconforming units/inspected units×10⁶; OEE=availability×performance×quality

Table AU-37 — Quality and delivery metrics without score substitution — inputs and assumptions

Input	Stated value	Meaning / assumption
Inputs	940/1,000 first pass; stage yields 0.98, 0.97, 0.99	Compatible population and stage definitions.
Other inputs	92/100 due orders; 7/20,000 nonconforming units; OEE factors 0.90,0.95,0.98	Separate illustrative populations; not one composite organization.

1. FPY=94%; RTY=94.1094%; on-time delivery=92%.

2. Nonconforming units=350 ppm; OEE=83.79%.

Interpretation: Rolled yield is not the arithmetic average of stage yields; due orders are not only the orders that were shipped.

Assumptions and limits: A favourable metric cannot compensate for failed product criteria, safety controls or evidence. Counts, exclusions and reporting windows remain part of the result.

AU.33 Organizational audit resource model and stage floors

Linked provisions: AC.1-AC.4; AX.5

What minimum productive resources follow from the scope-based planning rules in Annex AC?

$$T_{\text{calc}} = \text{ceil}(2[B(N)K(1+f) + 0.5(S_v - 1) + 0.5H])/2$$

$$T \geq \max(T_{\text{calc}}, S_v); T1 = \max(0.5, \text{ceil}(2 \times 0.25T)/2); T2 = T - T1 \geq 1.5$$

Table AU-38 — Organizational audit resource model and stage floors — inputs and assumptions

Input	Stated value	Meaning / assumption
N; B(N)	80; 5 auditor-days	Effective personnel rounded up before band selection.
K; f	1.35; 0.30	C2 and two distinct complexity triggers .
Sites; extra shifts	1; 0	Additional central/technical resource may still be necessary.

1. Unrounded calculation = $5 \times 1.35 \times 1.30 = 8.775$ auditor-days.
2. Total/readiness/implementation = 9.0/2.5/6.5 days.
3. Surveillance minimum = 4.5 days; renewal minimum = 7.0 days.

Interpretation: These are resource floors, not guarantees that every scope can be adequately evaluated in that time.

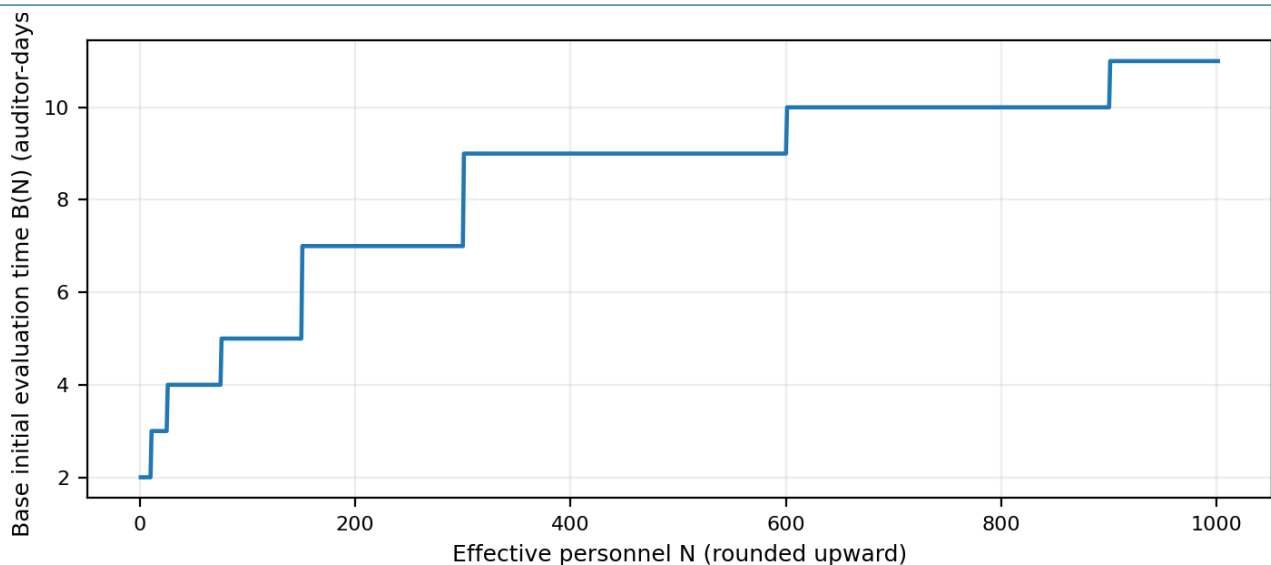


Figure AU.33 — Calculated from the stated example inputs; not actual product or organizational performance.

Assumptions and limits: One auditor-day means eight productive evaluation hours. Travel, breaks, final reporting and independent review/decision are excluded. Product tests and personnel exams use their own profiles.

AU.34 Multisite surveillance sampling and mandatory additions

Linked provisions: AC.5; AX.5

Which locations belong in the low-criticality eligible sample and which must be added?

$$m = \max[\text{ceil}(\sqrt{S}), \text{ceil}(S/2)]$$

$$\text{Minimum random selection} = \text{ceil}(m/4)$$

Table AU-39 — Multisite surveillance sampling and mandatory additions — inputs and assumptions

Input	Stated value	Meaning / assumption
S	9 eligible homogeneous C0/C1 sites	Central, critical, unique and otherwise ineligible locations are outside this pool.

1. $m = \max(3, 5) = 5$; at least 2 of those sites are random.
2. Add central management and every separately mandatory location; rotate coverage across 24 months.

Interpretation: This is a scheme coverage rule, not a statistical confidence level for unvisited sites.

Assumptions and limits: Initial and renewal ORG assessments cover every included physical operating site. Systemic findings trigger expansion; deleting the failing site does not correct shared central deficiencies.

AU.35 Calendar months, leap days and actual status clocks

Linked provisions: AG.1; AG.5–AG.8; AX.7

How are calendar-month periods calculated without inventing a 30-day month?

Due date = corresponding calendar date after m months; if absent, last day of that month.

Table AU-40 — Calendar months, leap days and actual status clocks — inputs and assumptions

Input	Stated value	Meaning / assumption
Input dates	Four fictional calendar examples in the table	Not actual approvals, publication changes or holder records.
Intervals	1, 6, 12 and 24 months	Calendar arithmetic, not fixed day counts.

1. Independent calendar arithmetic and a calendar-aware month-addition method agree on all listed cases.

2. Finding clocks begin from the specified notice/awareness event; delayed final reporting does not postpone them.

Interpretation: Exact status history shall preserve expiration, suspension and later restoration or renewal dates.

Table AU-41 — Calendar months, leap days and actual status clocks — calculated comparison

Fictional start	Months added	Calculated due date
2026-01-31	1	2026-02-28
2025-08-31	6	2026-02-28
2028-02-29	12	2029-02-28
2026-09-29	24	2028-09-29

Assumptions and limits: Restoration alone keeps the original expiry. A new attestation after a gap cannot be backdated to conceal that gap.

AU.36 Personnel competence without compensating scores

Linked provisions: AB.2; AE.3–AE.4; AX.2

Can a high examination total compensate for a failed essential practical step?

Competence gate=(knowledge $\geq$ 0.80) AND (practical $\geq$ 0.85) AND every essential step passed

Table AU-42 — Personnel competence without compensating scores — inputs and assumptions

Input	Stated value	Meaning / assumption
Knowledge	43 correct of 50 scored items = 86%	Minimum item count is satisfied in this example.
Practical	92%	Separate criterion, not averaged with knowledge.
Essential steps	Two passed; one failed	Failed step is predefined as essential.

1. Knowledge gate passes; practical percentage gate passes; essential-step gate fails.

2. The requested positive competence decision is blocked.

Interpretation: A fee, staffing need or average score cannot close the failed essential step.

Assumptions and limits: Remediation and an equivalent practical reassessment are required. Independent credential decisions and employer task authorization remain separate.

AU.37 Independent attestation decision conjunction

Linked provisions: AD.8-AD.9; AK.4

What does a non-compensable grant gate mean in executable terms?

Grant gate=S AND E AND C AND F AND I

Table AU-43 — Independent attestation decision conjunction — inputs and assumptions

Input	Stated value	Meaning / assumption
S/E/C	Valid scope / adequate valid evidence / all applicable mandatory criteria met	Boolean completion tests with evidence behind each.
F/I	In-scope nonconformities closed / independent authorized decision	Observations are not mandatory nonconformities.

1. All five conditions must be true. A high maturity score is not an input that may compensate for a false condition.

2. An eligible gate still requires the real accountable decision, exact scope and actual date.

Interpretation: Initial, renewal and extension decisions cannot retain an open in-scope nonconformity.

Table AU-44 — Independent attestation decision conjunction — calculated comparison

S	E	C	F	I	Outcome
1	1	1	1	1	Eligible gate
1	1	1	0	1	BLOCK
1	0	1	1	1	BLOCK
1	1	1	1	0	BLOCK
0	1	1	1	1	BLOCK

Assumptions and limits: Existing minor continuation uses the separate bounded AD.8 rule. Product concessions and conditional progression are not conformity grants.

AU.38 Repeated testing and inflated acceptance probability

Linked provisions: I.5; AD.6; AT.4

What happens when an unchanged poor-quality population is sampled until one attempt passes?

$$P(\text{at least one pass in } k \text{ independent attempts}) = 1 - (1 - \beta)^k$$

Table AU-45 — Repeated testing and inflated acceptance probability — inputs and assumptions

Input	Stated value	Meaning / assumption
β	0.10 per attempt	Illustrative acceptance probability at one hypothetical poor-quality state.
k	5 attempts	Independent large-population attempts assumed for this sensitivity.

1. Single attempt acceptance=10%.
2. Up to five attempts with stop-on-pass acceptance=40.951%.

Interpretation: The altered stopping rule changes the plan from 10% to 40.951% chance of at least one pass under these assumptions.

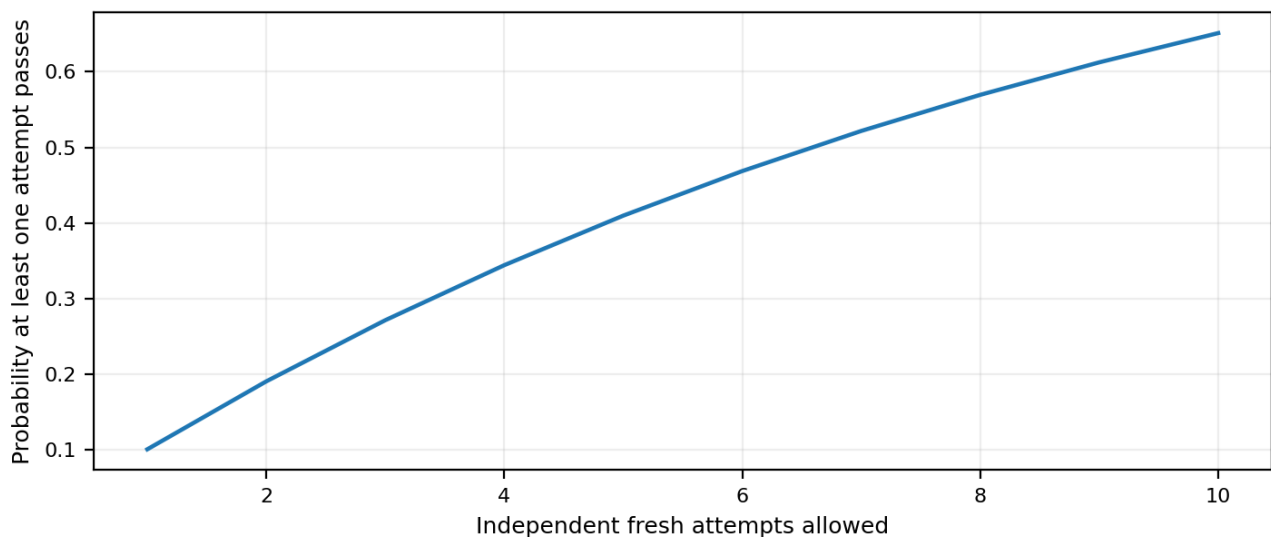


Figure AU.38 — Calculated from the stated example inputs; not actual product or organizational performance.

Assumptions and limits: Actual finite-lot attempts may be dependent. Controlled correction, sorting or changed configurations require their own documented plan; this calculation explains why undisclosed repeated guessing is not the original sampling assurance.

ANNEX AV / INFORMATIVE

Diagram atlas: quality, evidence and decision workflows

These diagrams explain the controlling clauses and annexes. Arrows show dependencies or allowed paths, not proof that an activity occurred. When a diagram is simplified, the full applicable text controls. No path may bypass an essential technical condition or independent authority.

Linked provisions: 4.4; 8; 11; 22-28; C; D; AA-AJ; AK; AL; AM; AS; AT

AV.1 The management-system assurance loop

Controlling provisions: 4-10; AL

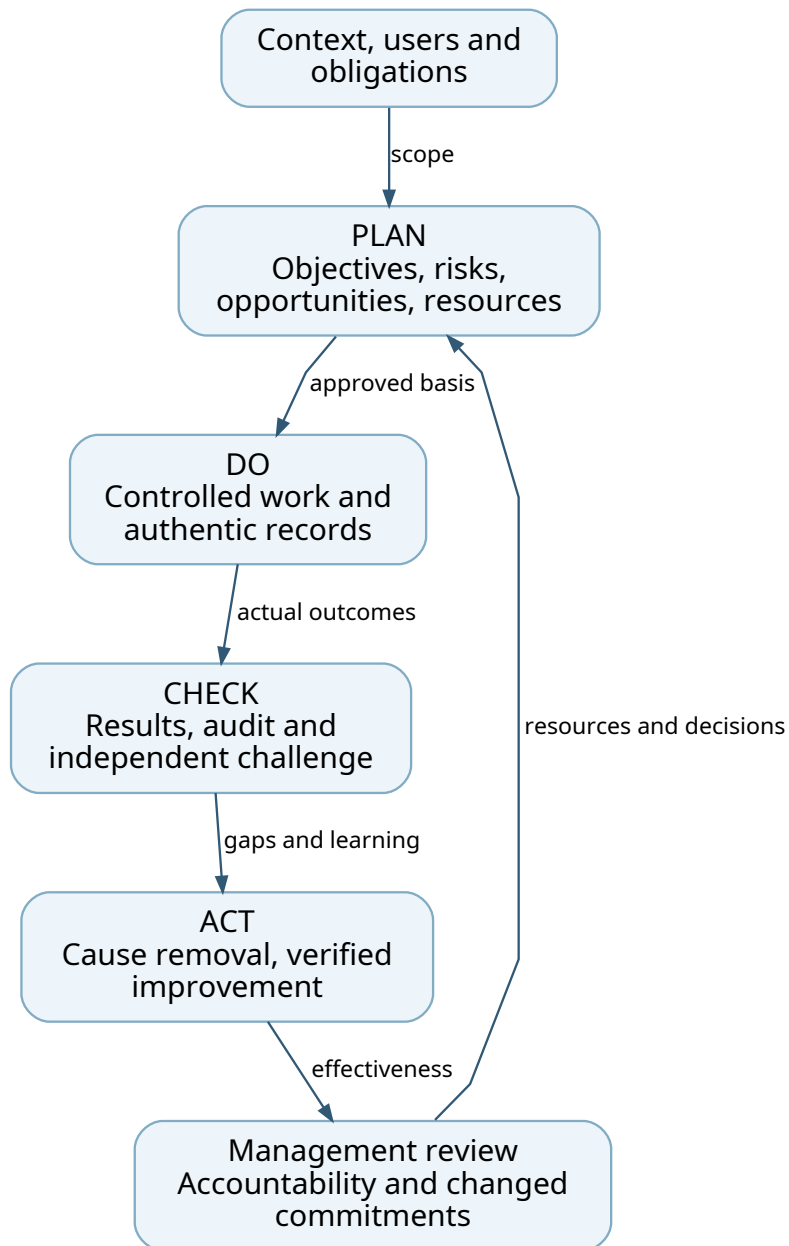


Figure AV.1 — Explanatory workflow. The linked normative requirements and their exceptions control.

- 1.** Planning is not implementation; each activity produces the evidence used by the following activity.
- 2.** Improvement feeds back to the operating basis. Review shall expose failed controls rather than normalize them.
- 3.** Every applicable acceptance condition remains a separate gate; a favourable process metric cannot close it.

AV.2 Requirements, configurations and evidence form one chain

Controlling provisions: 8.1.2; D; AM; AY

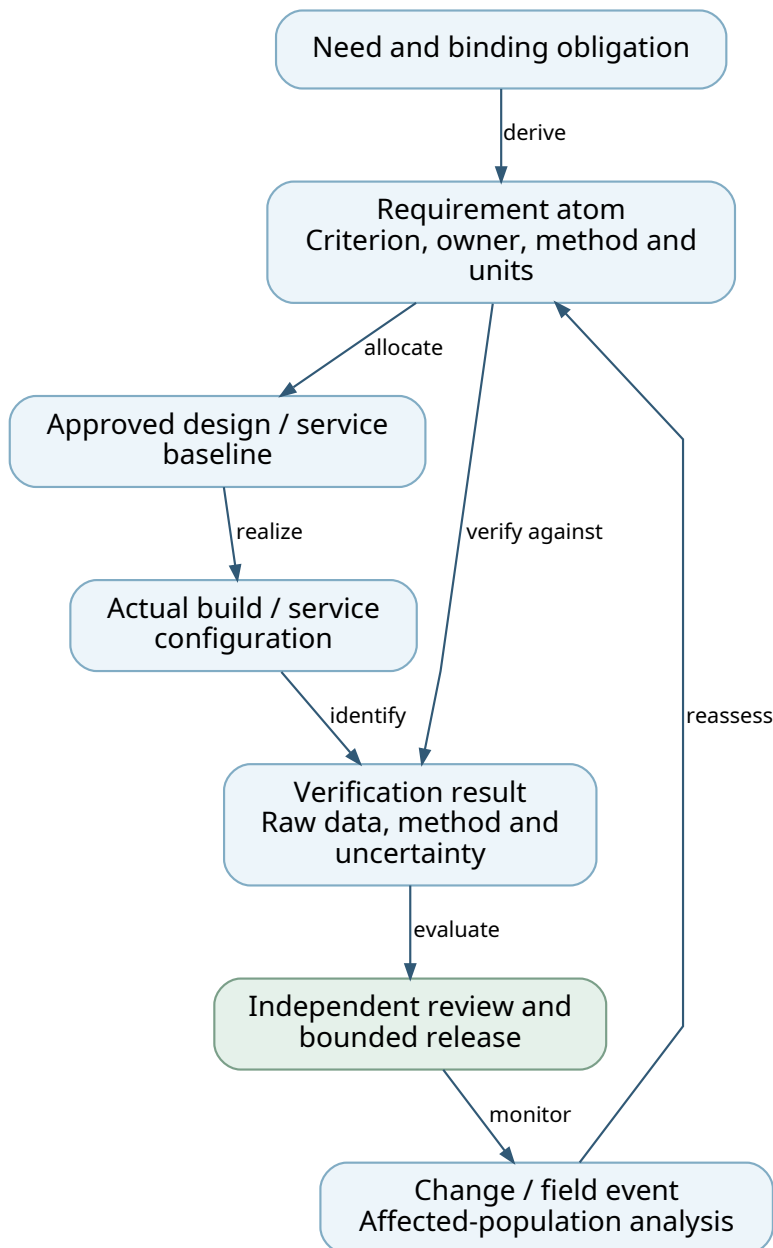


Figure AV.2 — Explanatory workflow. The linked normative requirements and their exceptions control.

1. Every result shall point to the actual evaluated configuration, not merely the current design title.
2. A change can invalidate requirements, methods and prior conclusions; trace backward and forward.
3. A complete chain includes valid relationships and authentic evidence, not just a set of readable files.

AV.3 Verification, validation and the lifecycle V

Controlling provisions: 8.3; 11; C; AM.3

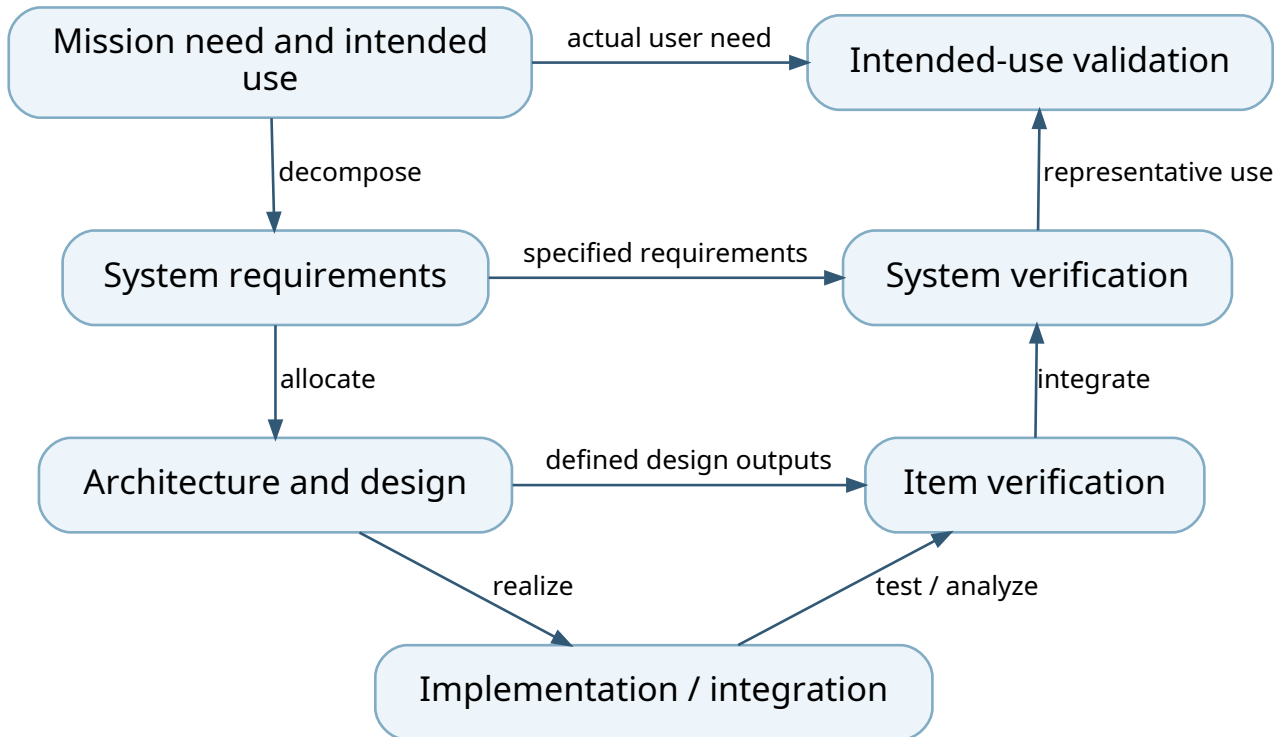


Figure AV.3 — Explanatory workflow. The linked normative requirements and their exceptions control.

- 1.** Verification answers whether the specified requirements are met; validation addresses suitability for intended use.
- 2.** Gate names may vary, but entry criteria, evidence, authority and closure of dependent conditions are mandatory.
- 3.** Component-level results do not by themselves demonstrate integrated system behaviour.

AV.4 Applicability and non-applicability decision

Controlling provisions: 1.3; A; AA; AK.2

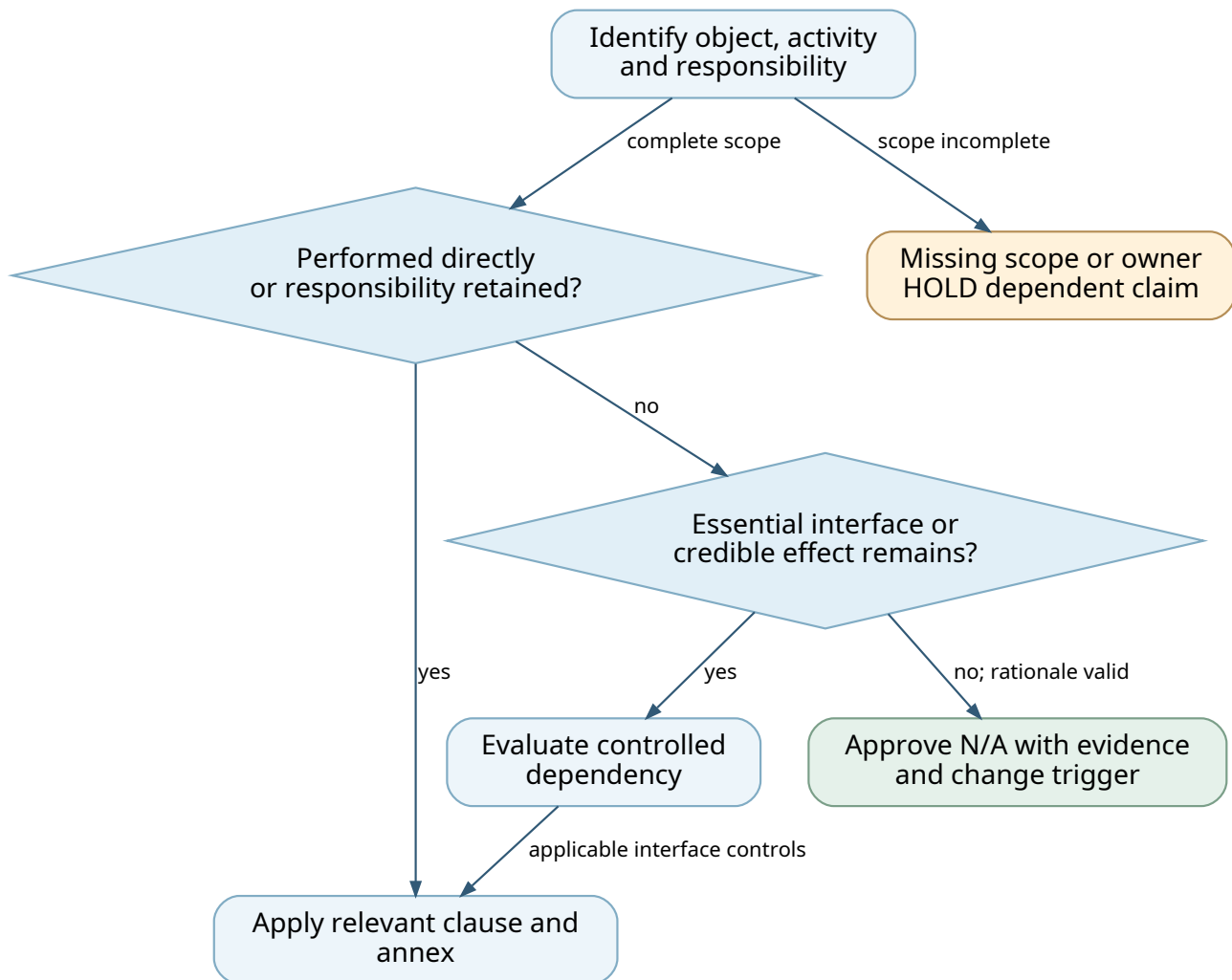


Figure AV.4 — Explanatory workflow. The linked normative requirements and their exceptions control.

1. Outsourcing does not remove retained responsibility. A supplier statement does not establish non-applicability.
2. Evidence unavailable or a failed result is not an N/A justification.
3. The approval shall identify the exact excluded activity and the event that reopens the applicability review.

AV.5 DR-A: full uncertainty interval and explicit outcomes

Controlling provisions: AD.2-AD.6; AK.5; AU.2

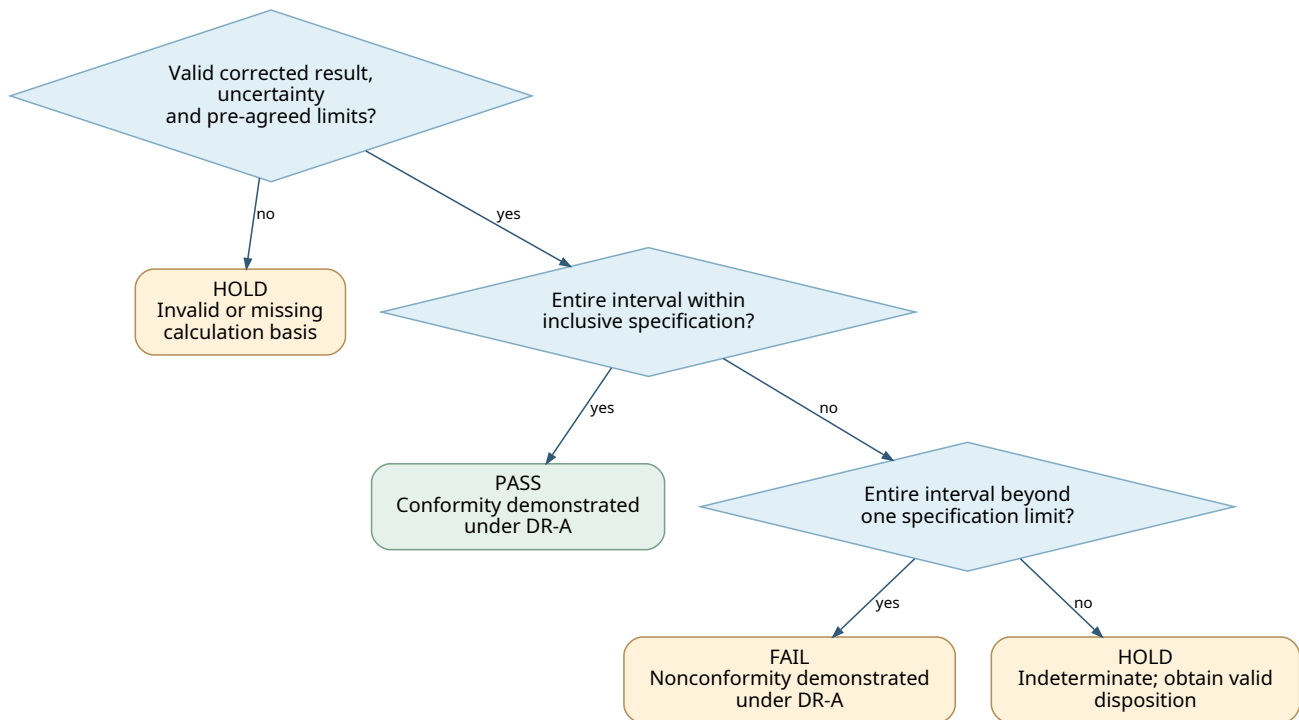


Figure AV.5 — Explanatory workflow. The linked normative requirements and their exceptions control.

- 1.** For symmetric uncertainty, PASS requires $y-U \geq L$ and $y+U \leq H$. Equality is inside an inclusive boundary.
- 2.** FAIL under this rule requires $y+U < L$ or $y-U > H$. Overlap is indeterminate, not automatically a proven defect.
- 3.** The diagram covers one measurement criterion; other release, evidence and attestation gates remain additional.

AV.6 Multi-tier supply and traceable retained accountability

Controlling provisions: 8.4; 27; J; AF; AM.5

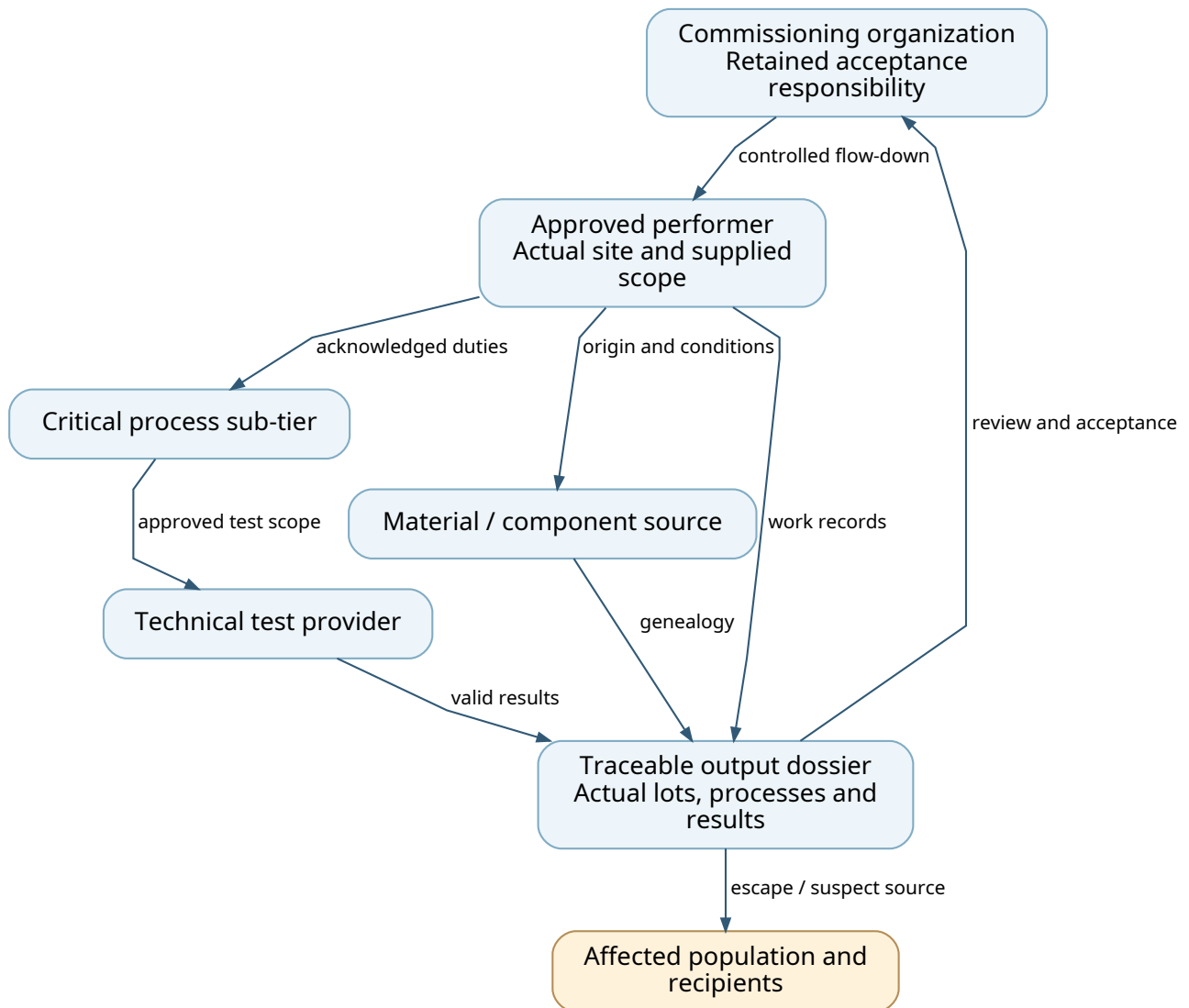


Figure AV.6 — Explanatory workflow. The linked normative requirements and their exceptions control.

1. Commercial intermediary identity shall not obscure the actual point of performance.
2. Acceptance of a purchase order is not evidence that every critical sub-tier understood the technical baseline.
3. Source corrective action, affected-product disposition and buyer oversight correction require their own evidence.

AV.7 Special-process excursion and requalification

Controlling provisions: 8.5.1.2; 25; L; AQ

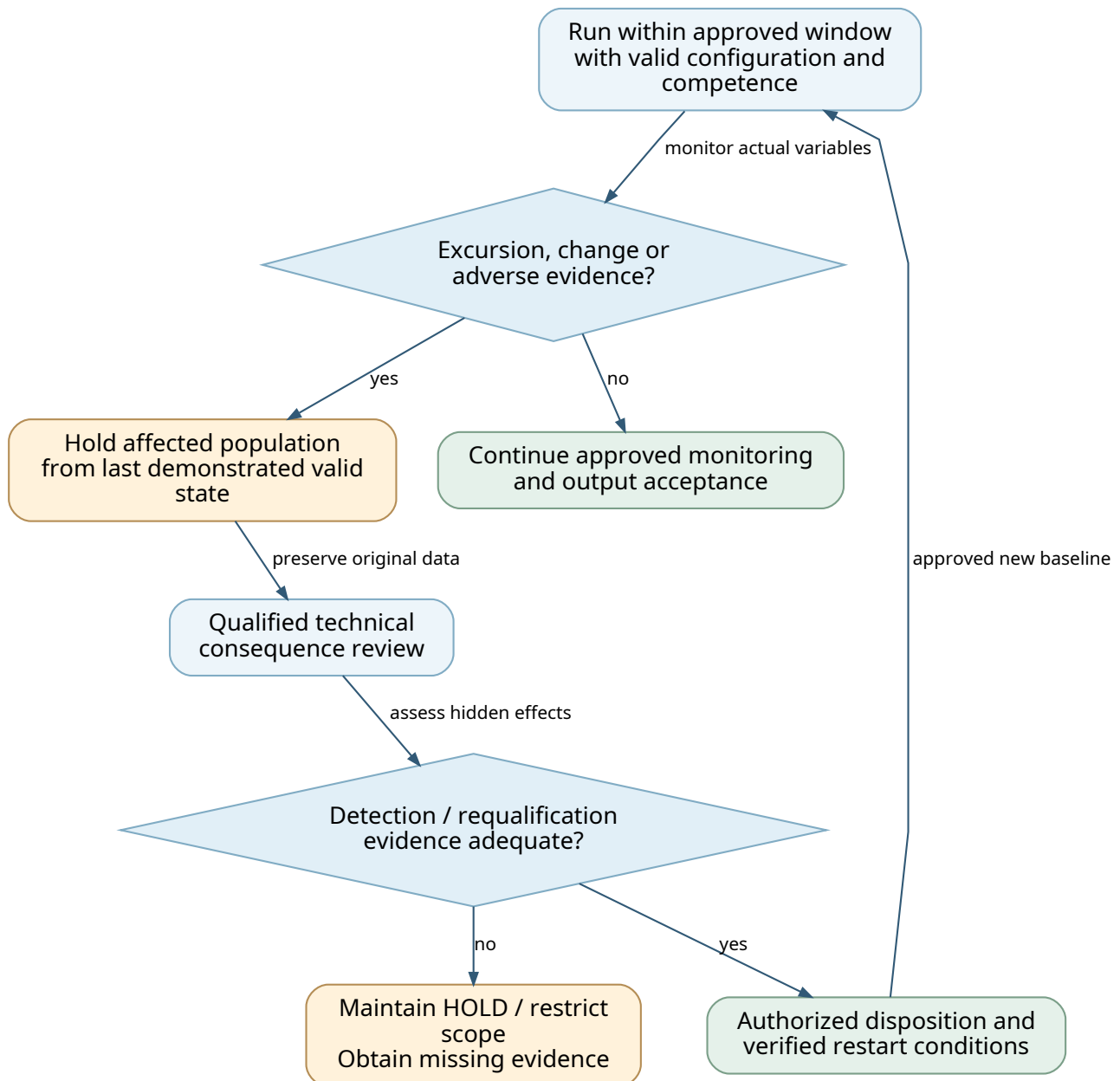


Figure AV.7 — Explanatory workflow. The linked normative requirements and their exceptions control.

1. Restoring a parameter does not retrospectively accept outputs made during the excursion.
2. Visual inspection cannot close a hidden-property concern unless its relevant detection capability is demonstrated.
3. A process qualification and acceptance of each product or service output remain separate decisions.

AV.8 AI release, bounded operation and change

Controlling provisions: 12; N; AS.3–AS.6

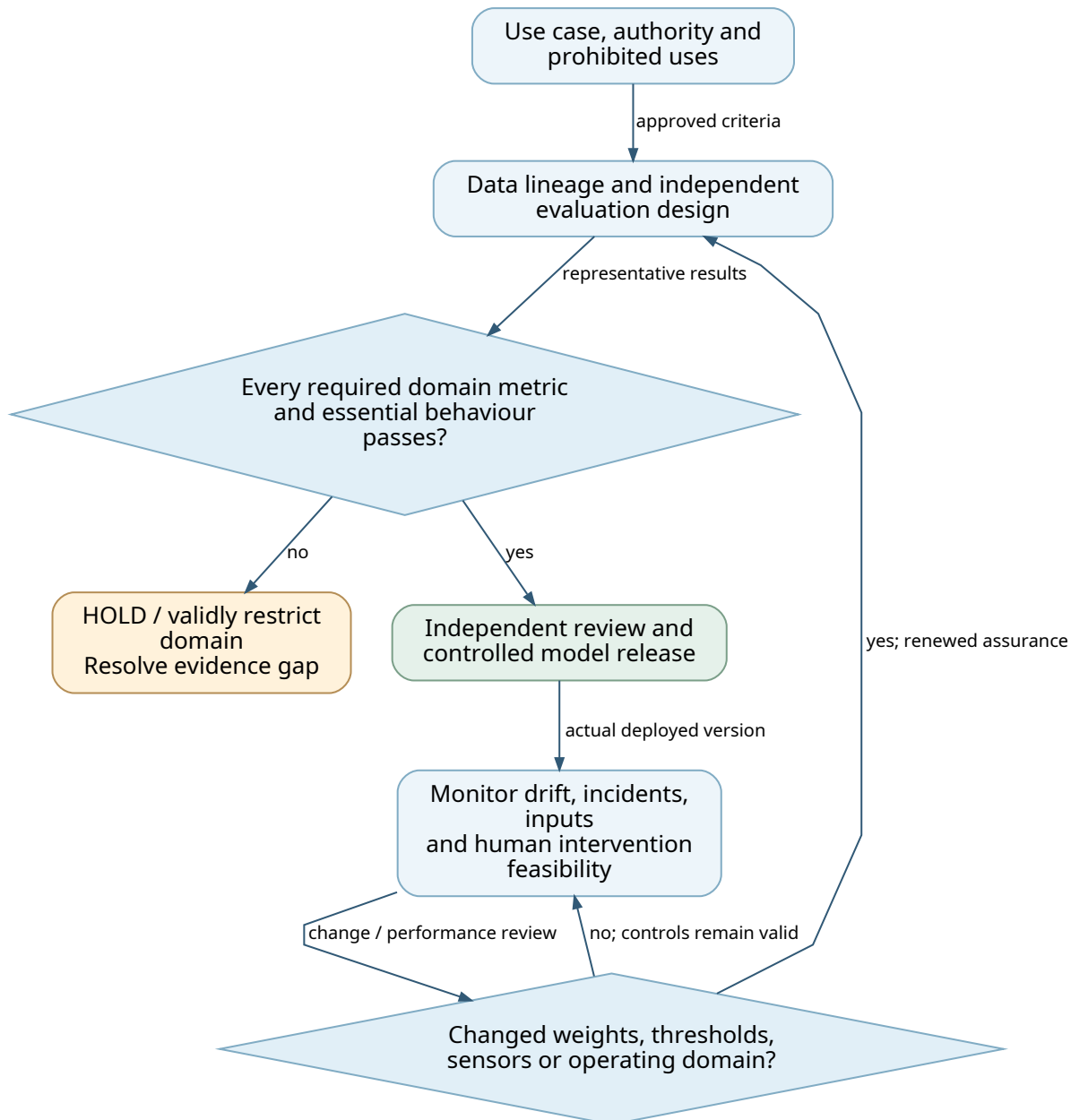


Figure AV.8 — Explanatory workflow. The linked normative requirements and their exceptions control.

1. High overall accuracy cannot hide a failed mandatory scenario or subgroup.
2. A model version includes weights, preprocessing, thresholds and dependencies.
3. A nominal human confirmation is not protection unless time, information and effective intervention are demonstrated.

AV.9 Independent functions and the protected appeal route

Controlling provisions: 22; 28; AB; AD; AI; AX

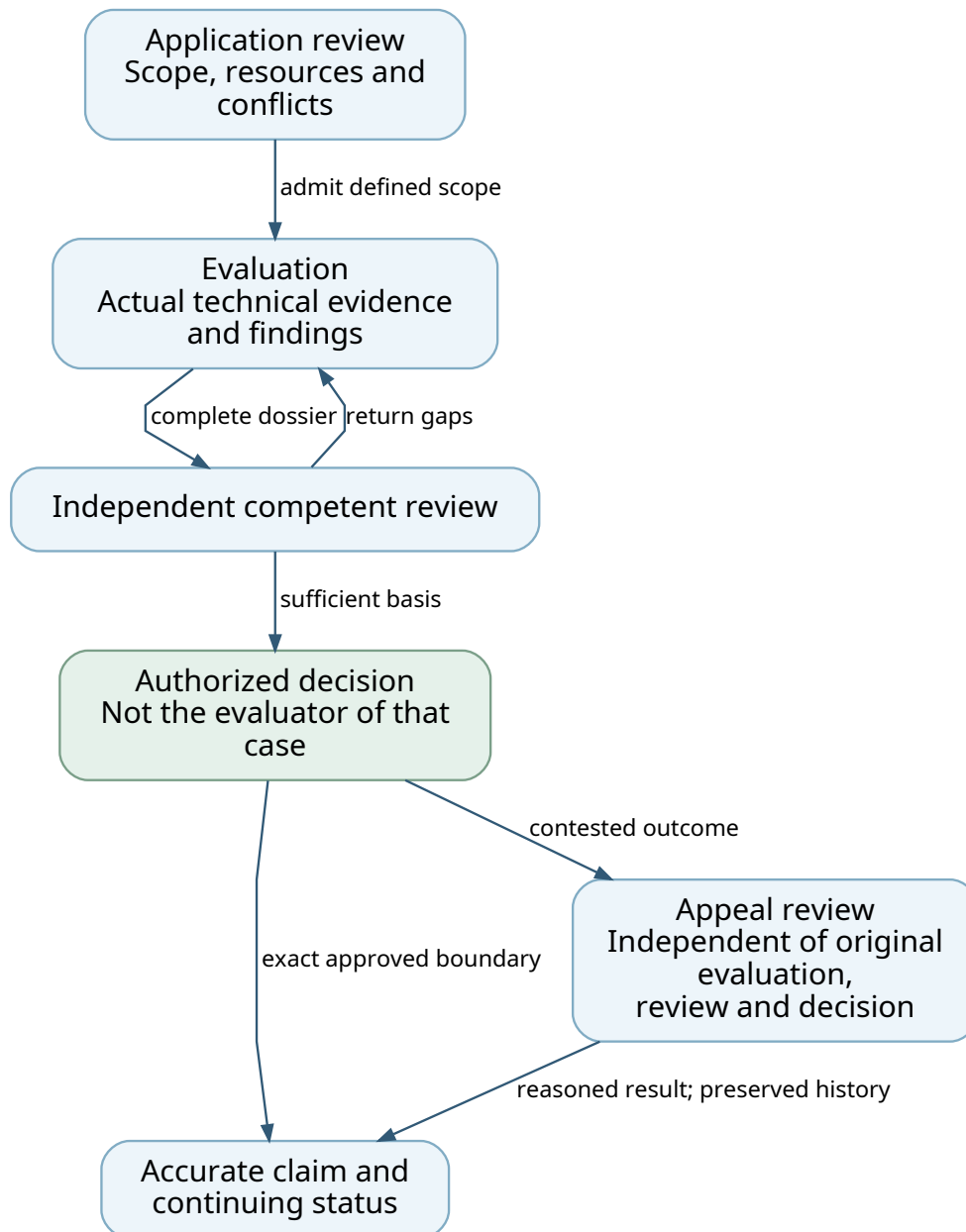


Figure AV.9 — Explanatory workflow. The linked normative requirements and their exceptions control.

1. Review and decision may be combined only by a separately authorized person independent of the evaluation.
2. Role competence and conflicts are checked per assignment; a title alone gives no unlimited technical authority.
3. An appeal does not automatically remove protective measures or extend expiry.

AV.10 Ongoing status and protected historical continuity

Controlling provisions: AG; AX.7

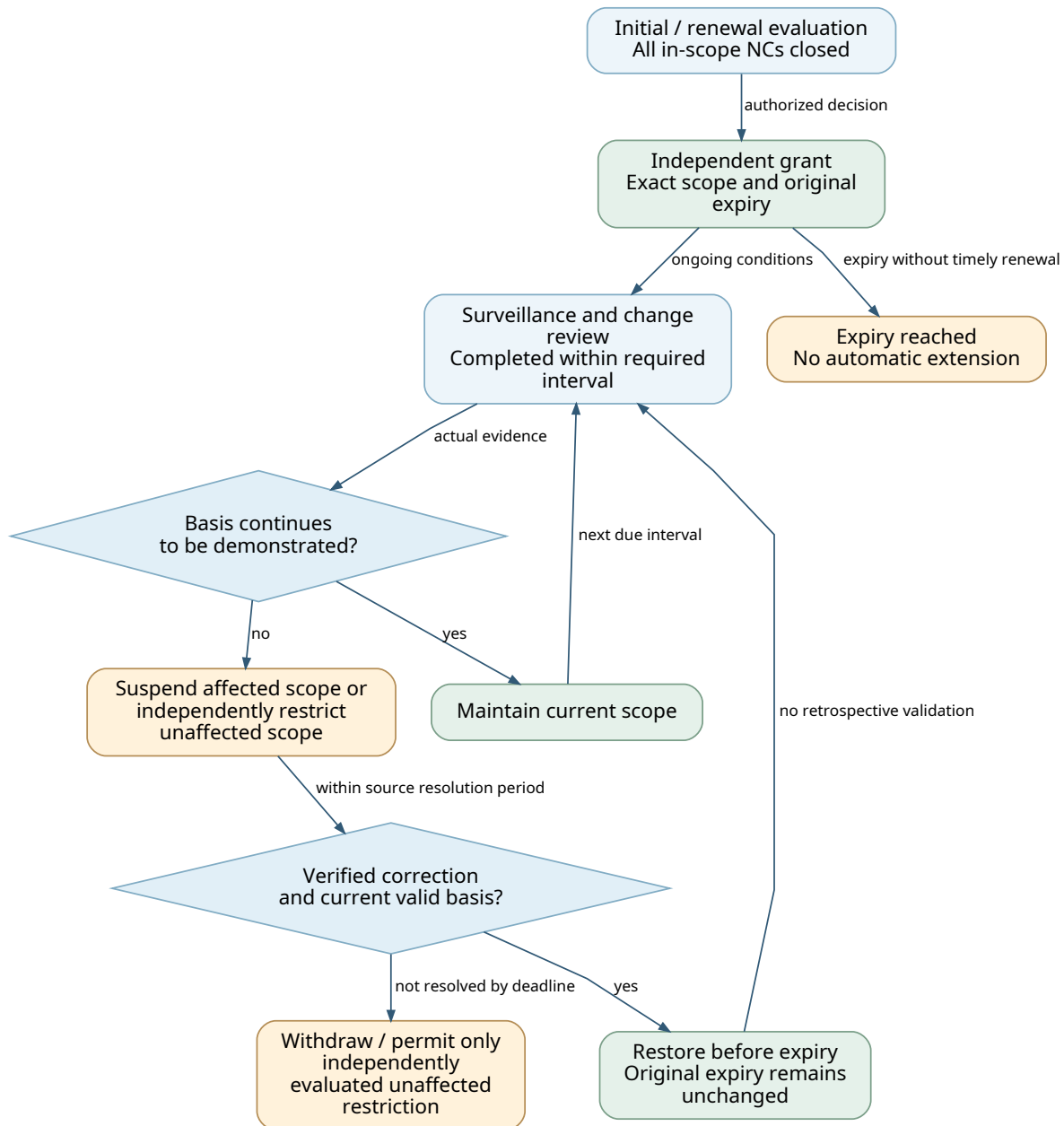


Figure AV.10 — Explanatory workflow. The linked normative requirements and their exceptions control.

1. A scheduled audit, paid fee or new document issue does not equal completed surveillance or renewal.
2. Suspension resolution follows Annex AG; renumbering a finding cannot restart its clock.
3. Instance results do not enter this ongoing-status cycle merely because a generic credential period exists.

AV.11 Irreversible mission action: integrated readiness

Controlling provisions: 11.8; 14; P; AN

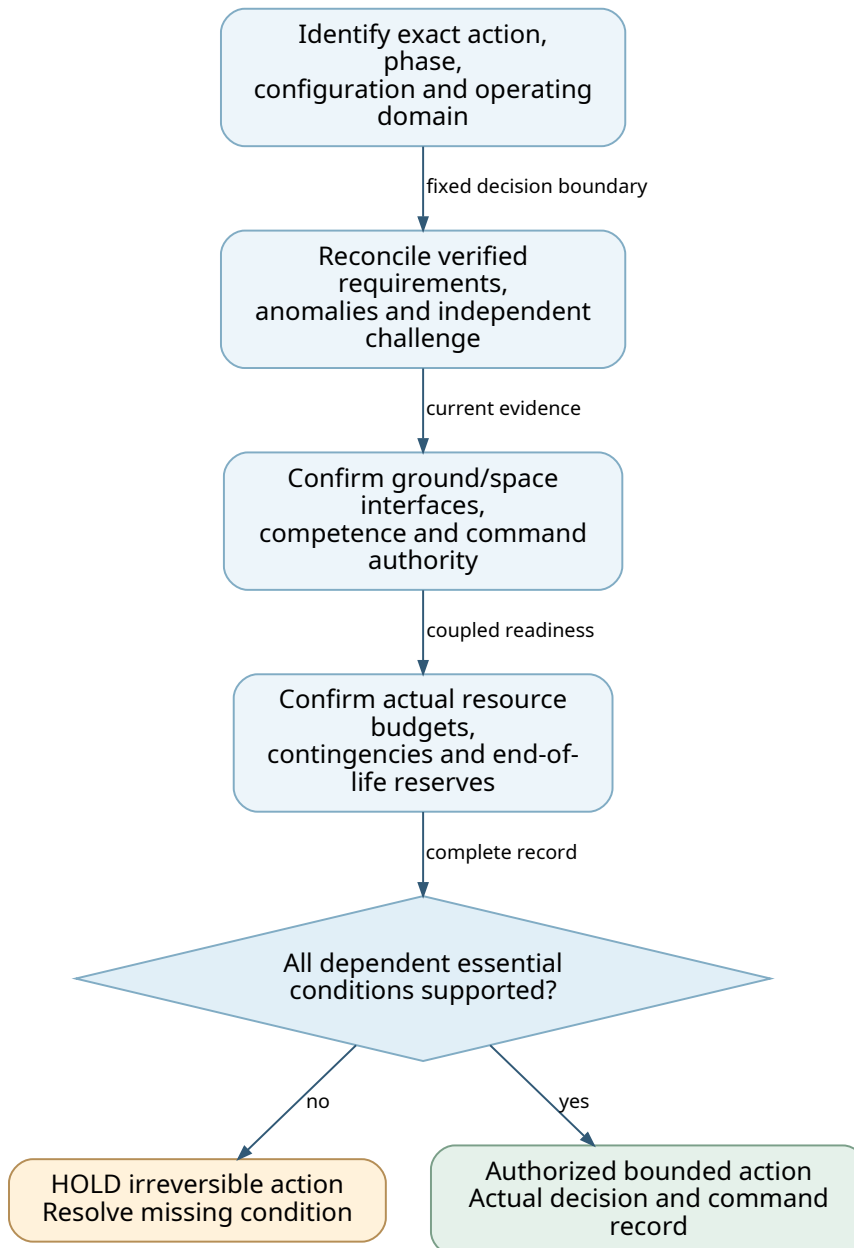


Figure AV.11 — Explanatory workflow. The linked normative requirements and their exceptions control.

1. Mission urgency does not turn missing evidence into success.
2. A favourable nominal budget cannot consume a protected contingency or disposal reserve without an authorized reassessment.
3. Human intervention shall not be credited when unavoidable delay exceeds the protective response time.

AV.12 Recovery requires both service and evidence integrity

Controlling provisions: 13.7; O; AS.10; AY.5

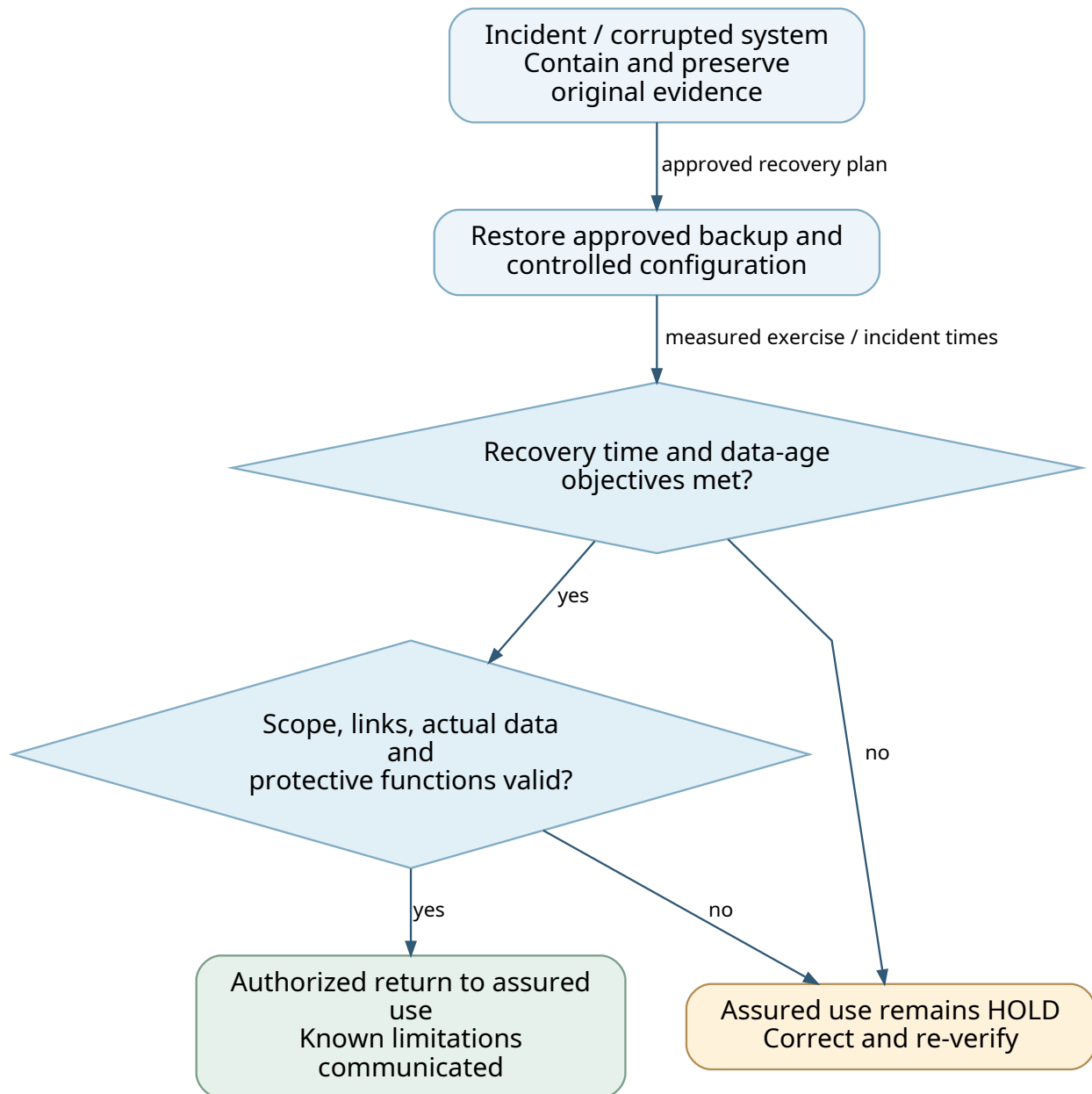


Figure AV.12 — Explanatory workflow. The linked normative requirements and their exceptions control.

1. A functioning application is not necessarily a trustworthy engineering evidence system.
2. Restoration shall verify relationships between requirements, configurations, measurements and decisions, not file count alone.
3. Passing recovery-time objectives does not close an unresolved data-integrity failure.

ANNEX AW / INFORMATIVE

Comparison matrices and prevention of false equivalence

The comparisons in this annex distinguish engineering and assurance concepts inside AF 9100. They are not equivalence claims about another publisher, scheme or regulatory approval. The distinctions support consistent interpretation but do not replace the controlling requirements.

Linked provisions: 1-3; 7.7; 8.3.4; 8.6; 11; 22-28; E-I; AA; AD; AE; AG; AK; AT

AW.1 Quality-system assurance and technical product evidence

a) Use the distinctions below when defining criteria, interpreting evidence and approving the related claim. The comparison does not permit substitution of one mandatory decision for another.

Table AW-1 — Quality-system assurance and technical product evidence

Question	Organizational system	Product or mission evidence	Decision consequence
Object	Defined organization, processes and sites.	Actual configuration, family, lot, serial or mission scope.	Record separate ORG and PRD boundaries.
Core question	Are responsibilities and controls implemented effectively?	Does the stated output satisfy its approved technical criteria?	One answer does not automatically supply the other.
Evidence	Actual process trails, audits, reviews and outcomes.	Qualification, unit/lot results, interfaces and life/condition.	A certificate alone does not close missing product tests.
Continuity	System changes and surveillance.	Configuration, ongoing production, field changes and instance history.	Preserve separate scope and status records.

Required evidence / record: Read the controlling source provisions and retain the actual scope, assumptions and approval record.

AW.2 Verification, validation and qualification

a) Use the distinctions below when defining criteria, interpreting evidence and approving the related claim. The comparison does not permit substitution of one mandatory decision for another.

Table AW-2 — Verification, validation and qualification

Concept	Primary question	Evidence focus	Not a substitute for
Verification	Does the output satisfy specified inputs?	Requirement-linked inspection, analysis, demonstration or test.	Suitability of the requirement for intended use.
Validation	Is the realized output suitable in the intended context?	Representative users, interfaces, environment and outcomes.	Every separately applicable verification condition.

Concept	Primary question	Evidence focus	Not a substitute for
Design qualification	Has the design demonstrated required properties under defined conditions?	Representative configuration and justified bounding cases.	Routine acceptance of each delivered article.
Process qualification	Can this process produce the required output in its qualified envelope?	Essential variables, repeatability and representative properties.	Conformity of every process output.
Routine acceptance	Does this unit, lot or service event meet its acceptance plan?	Actual identity, measurements, authorized dispositions and release.	Design or process qualification where separately required.

Required evidence / record: Read the controlling source provisions and retain the actual scope, assumptions and approval record.

AW.3 Decision rules for measured values

a) Use the distinctions below when defining criteria, interpreting evidence and approving the related claim. The comparison does not permit substitution of one mandatory decision for another.

Table AW-3 — Decision rules for measured values

Rule	Numerical approach	Conditions and limitations	Near a limit
DR-A	Full stated interval within specification.	Default for triggered C2/C3 characteristics unless approved alternative.	Overlap produces indeterminate/HOLD.
DR-B	Corrected nominal result within specification.	Prior agreement, suitable uncertainty/risk review and permitted criticality.	False acceptance/rejection risk remains and is disclosed.
DR-C	Approved risk-targeted or other justified model.	Specified risks, assumptions, validation, sensitivity and required authority.	Outcome depends on the exact pre-approved acceptance region.
Invalid computation	Missing/invalid values, units or model.	No valid decision model exists for the actual result.	HOLD; do not coerce into zero, N/A or a favourable rule.

Required evidence / record: Read the controlling source provisions and retain the actual scope, assumptions and approval record.

AW.4 Specification, control and acceptance limits

a) Use the distinctions below when defining criteria, interpreting evidence and approving the related claim. The comparison does not permit substitution of one mandatory decision for another.

Table AW-4 — Specification, control and acceptance limits

Quantity	Purpose	Derived from	Common error
Specification limit	Defines the required product or service property.	Approved technical/customer/obligation basis.	Moving the limit after observing a result.
Control limit	Signals unusual process behaviour.	Appropriate stable baseline and statistical model.	Treating a stable process as necessarily capable.
Acceptance limit	Determines result acceptance under the chosen rule.	Specification plus declared uncertainty/risk treatment.	Assuming it always equals the specification.
Instrument resolution	Defines reported or sensed increment.	Instrument/design and operating mode.	Treating resolution as total uncertainty.
Expanded uncertainty	Expresses a stated coverage interval under a model.	Standard uncertainty and justified coverage method.	Treating it as known bias or guaranteed physical bounds.

Required evidence / record: Read the controlling source provisions and retain the actual scope, assumptions and approval record.

AW.5 Statistical statements that answer different questions

a) Use the distinctions below when defining criteria, interpreting evidence and approving the related claim. The comparison does not permit substitution of one mandatory decision for another.

Table AW-5 — Statistical statements that answer different questions

Statement	Meaning	Necessary context	Cannot conclude
Point estimate	Estimate under the selected model.	Population, data, estimator and assumptions.	Guaranteed future performance.
Confidence interval	Procedure with stated long-run coverage under its model.	Sampling design, confidence level and estimator.	A posterior probability without a prior/likelihood model.
Prediction interval	Range for a future observation under a model.	Future conditions and residual variation.	Population-wide conformance.
Tolerance interval	Interval covering a stated population fraction with specified confidence.	Distribution, sample and coverage method.	Equivalent to a confidence interval for the mean.
OC curve	Chance a sampling plan accepts at a hypothetical quality level.	n, c, lot/sampling model and classifier capability.	Probability a particular accepted lot is conforming.
Detection probability	Chance of observing an issue under specified assumptions.	Issue rate, independence, method detection and sample size.	Percentage of the system that conforms.

Required evidence / record: Read the controlling source provisions and retain the actual scope, assumptions and approval record.

AW.6 Reliability, availability and service life

a) Use the distinctions below when defining criteria, interpreting evidence and approving the related claim. The comparison does not permit substitution of one mandatory decision for another.

Table AW-6 — Reliability, availability and service life

Measure	Boundary	Additional evidence	Incorrect shortcut
Mission reliability	Probability of modeled success over stated exposure.	Failure definition, conditions, dependence and uncertainty.	Using the value without mission duration.
Intrinsic availability	Ideal failure/active-repair cycle.	MTBF and active repair boundary.	Claiming it includes logistics and administration.
Operational availability	Observed available time within a defined window.	All included/excluded downtime and service dependencies.	Assuming available output is correct or safe.
Qualified life	Authorized usable time/cycles/condition.	Mechanisms, scatter, actual history and independent authority.	Resetting life after a bench test or ownership change.
Remaining resource	Available resource after actual consumption and degradation.	Condition, uncertainty and separately protected reserves.	Counting one reserve in several budgets.

Required evidence / record: Read the controlling source provisions and retain the actual scope, assumptions and approval record.

AW.7 Independent evidence, review and decision

a) Use the distinctions below when defining criteria, interpreting evidence and approving the related claim. The comparison does not permit substitution of one mandatory decision for another.

Table AW-7 — Independent evidence, review and decision

Activity	Responsible function	Separation	Required boundary
Execute/evaluate	Competent operator, tester, inspector or assessor.	Technical independence as specified by consequence.	Actual task, method and configuration.
Technical review	Competent reviewer of validity and sufficiency.	Required freedom from own contested critical work.	Evidence reviewed and limitations.
Third-party decision	Authorized independent decision maker.	Not evaluator or relevant consultant for that case.	Exact attestation scope and reasoned outcome.
Appeal	Competent independent appeal authority.	Separate from original evaluation, review and decision.	Original facts versus genuinely new later evidence.
Commercial administration	Scheduling, billing or resources.	Cannot control findings or buy a favourable decision.	Fees and administration separate from technical outcome.

Required evidence / record: Read the controlling source provisions and retain the actual scope, assumptions and approval record.

AW.8 Credential, authorization and provider competence

a) Use the distinctions below when defining criteria, interpreting evidence and approving the related claim. The comparison does not permit substitution of one mandatory decision for another.

Table AW-8 — Credential, authorization and provider competence

Record	What it establishes	What it does not establish
Training attendance	Participation in a stated learning activity.	Demonstrated competence or task release authority.
Personnel credential	Assessed competence within a defined profile.	Every employer task, product configuration or professional privilege.
Employer task authorization	Permission for stated work under verified conditions.	A general third-party certification or unrelated legal licence.
ORG attestation	Defined organizational system conformity.	Laboratory or certification-body accreditation.
CAB competence decision	Specific methods, ranges, functions and sites under actual authority.	Correctness of every report or recognition beyond evidenced scope.

Required evidence / record: Read the controlling source provisions and retain the actual scope, assumptions and approval record.

AW.9 Observed, modelled and generated evidence

a) Use the distinctions below when defining criteria, interpreting evidence and approving the related claim. The comparison does not permit substitution of one mandatory decision for another.

Table AW-9 — Observed, modelled and generated evidence

Type	Permitted reliance	Verification requirement
Actual observation	Supports the identified object and conditions.	Identity, method, raw data, competence and integrity.
Simulation	Supports a stated model-based conclusion.	Implementation, validation, domain, sensitivity and uncertainty.
Prior qualified evidence	May reduce repeated work after applicability review.	Configuration/mechanism differences and bounding argument.
Synthetic worked example	Explains a method and its arithmetic.	Clear label; not copied as a real result.
Generated text or image	May support drafting, explanation or design communication.	Competent verification; never relabeled as witnessed evidence.
Cryptographic hash	Checks equality/integrity of bytes.	Does not establish truth or technical validity of original content.

Required evidence / record: Read the controlling source provisions and retain the actual scope, assumptions and approval record.

AW.10 Technical progression and conformity status

a) Use the distinctions below when defining criteria, interpreting evidence and approving the related claim. The comparison does not permit substitution of one mandatory decision for another.

Table AW-10 — Technical progression and conformity status

Outcome	Permitted interpretation	Prohibited interpretation
PASS	Applicable criterion demonstrated with valid evidence.	Everything in the organization is conforming.
HOLD	Necessary basis or evidence is unresolved.	Administrative inconvenience that may be ignored.
Conditional progression	Bounded non-dependent work with controlled conditions.	Conditional conformity certificate with open required criteria.
Concession	Authorized lawful bounded departure where permitted.	Original specification fulfilled or mandatory approval waived.
Restricted scope	Independently evaluated unaffected boundary.	Hiding a systemic failure by removing a visible failing item.
Restoration	Current basis re-established after protection.	Suspended interval retrospectively valid or expiry automatically extended.

Required evidence / record: Read the controlling source provisions and retain the actual scope, assumptions and approval record.

AW.11 Cross-domain evidence transfer

a) Use the distinctions below when defining criteria, interpreting evidence and approving the related claim. The comparison does not permit substitution of one mandatory decision for another.

Table AW-11 — Cross-domain evidence transfer

Transfer	Potentially reusable evidence	Additional demonstration
Terrestrial to space	A material or component mechanism under equivalent conditions.	Vacuum, radiation, dust, thermal, inaccessible repair and mission exposure.
Component to installation	Qualified component characteristics.	Mounting, power, grounding, cooling, interfaces, software and human effects.
One site to another	Approved design or process concept.	Actual receiving equipment, people, utilities, environment and execution.
Prototype to production	Design feasibility and identified test results.	Production-representative variation, control, traceability and acceptance.
Aircraft to maritime/land	A justified shared characteristic.	Different duty, corrosion, load, environment and approval basis.

Transfer	Potentially reusable evidence	Additional demonstration
Prior model to new domain	Verified implementation and validated portions.	New inputs, mechanisms, uncertainty and independent suitability review.

Required evidence / record: Read the controlling source provisions and retain the actual scope, assumptions and approval record.

AW.12 Environmental improvement and technical suitability

a) Use the distinctions below when defining criteria, interpreting evidence and approving the related claim. The comparison does not permit substitution of one mandatory decision for another.

Table AW-12 — Environmental improvement and technical suitability

Claim	Required basis	Separate question
Lower resource intensity	Same declared functional output and comparable boundary.	Does the changed output still satisfy technical requirements?
Recycled content	Actual chain of custody and quantified input composition.	Does the material meet qualification and provenance needs?
Avoided emissions	Explicit counterfactual with uncertainty and separate reporting.	What is the actual inventory, without hidden subtraction?
Reusable component	Verified condition, consumed life and qualified new use.	Is every protected life and safety criterion still fulfilled?
Resilient service	Demonstrated continuity and trustworthy recovery.	Are accuracy, safety and customer-protection criteria met?

Required evidence / record: Read the controlling source provisions and retain the actual scope, assumptions and approval record.

ANNEX AX / NORMATIVE

Personnel, assessment providers and scheme execution

This annex applies the AB-AI controls with their specified numeric minima, authority boundaries or time limits. It preserves the distinction among learning, competence, employer permission and independent attestation.

Linked provisions: 7.2; 9.3; 22; 26-28; AA-AI; AJ

This annex forms part of the approved edition. Requirements apply within its stated scope. Numerical examples and explanatory diagrams remain informative.

AX.1 Role-specific competence and technical coverage

- a)** Competence shall be defined and evaluated separately for application reviewer, auditor, lead auditor, technical expert, technical reviewer, decision maker and appeal reviewer. The authorization shall state route, technical sector, methods, criticality, language, access and supervision limits.
- b)** The assignment review shall verify current evidence against those limits and the actual task. A technical expert shall participate in the work they are assigned to cover; listing a name without contribution is insufficient. No person shall be presumed competent for every space, aviation, maritime or industrial discipline.
- c)** Entry experience and activity counts in Annex AB shall be verified from traceable records. They support rather than replace examination and witnessed competence. A training certificate, degree or membership cannot create independent authority.

Required evidence / record: Role profiles; verified history; witnessed demonstrations; current scope authorization; assignment coverage.

AX.2 Knowledge, practical and essential-step gates

- a)** For the PER and third-party auditor routes, knowledge performance shall be at least 80%, practical performance at least 85%, and every predefined essential safety, integrity and independence step shall pass. Profiles may set justified stronger criteria but shall not weaken the specified minima.
- b)** The practical rubric shall define observable actions, allowable variation, record quality, recognition of limits and protective escalation before assessment. Critical practical competence shall be directly demonstrated through valid actual or controlled simulated work, not only written questions.
- c)** Failure of an essential step shall block the affected competence decision regardless of total score. Reassessment shall follow evidenced remediation using equivalent controlled tasks and shall preserve all prior attempts. The independent decision maker shall not have performed the candidate's examination.

Required evidence / record: Blueprint; component scores; essential-step observations; remediation; independent decision.

Decision control: PASS = knowledge gate AND practical gate AND every essential step AND valid eligibility/evidence AND authorized independent decision.

AX.3 Fair assessment, exam security and initial development

a) Eligibility and accommodation decisions shall relate to actual task competence and preserve essential conditions. Candidates shall receive scope, methods, rules, duties, permitted claims and remedies before enrollment. Purchasing particular training shall not be a condition where verified equivalent preparation satisfies the profile.

b) Examination identity, questions, scoring and remote/on-site security shall be controlled. Constructed-response alternatives to the specified minimum of 40 scored written items require independently approved equivalent rigor. Content validity shall not be inferred solely from score consistency.

c) Initial assessor development shall use at least two independent competent professionals where the relevant route applies. Their competence and conflicts shall be documented. Reciprocal self-approval or honorary status is not a valid development mechanism.

Required evidence / record: Candidate information; fair-access rationale; secured assessment; equivalent-rigor approval; initial-panel evidence.

AX.4 Continuing competence and inactivity

a) All relevant assessment-role personnel shall complete at least 16 hours of continuing development in each 12-month period. Independent auditors shall additionally complete at least four auditor-days across two assignments; lead auditors shall lead at least two complete assignments in 24 months. Reviewers/decision makers require at least three substantive files or decisions in 12 months.

b) Independent auditor witnessing shall occur at least every 24 months and more frequently when triggered. Failure to meet applicable activity minima shall suspend independent role use until reviewed supervised reactivation. More than 12 months without relevant audit practice requires updated learning and satisfactory witnessed work.

c) For employer tasks, C2/C3 inactivity exceeding six months and C0/C1 inactivity exceeding 12 months trigger observed competence before independent work resumes. The stricter triggered rule applies when roles overlap. Attendance hours shall not substitute for actual current competence.

Required evidence / record: Development/practice log; witnessed work; activity calculation; inactivity restriction and reactivation.

AX.5 Audit planning, productive time and sites

a) Organizational assessment resources shall follow Annex AC, including effective-personnel rounding, criticality, complexity, site/shift additions, stage floors and additional time where necessary. Product tests and individual examinations shall use their actual profiles rather than an organizational headcount formula.

b) Initial and renewal ORG assessment shall cover every included physical operating site, central management and relevant remote activities. Only eligible homogeneous C0/C1 surveillance sites may enter the reduced sample. Mandatory critical or unique sites and central functions are additional, not deducted from that pool.

c) Actual productive evaluation shall exclude travel, breaks, sales, final-report preparation, interpretation delays and independent review/decision. Team elapsed time and total auditor-days shall not be confused. Trainees and simultaneous duplicated work shall not be counted as fully productive coverage.

Required evidence / record: AC calculation; eligibility/rotation; site and shift plan; actual time logs; separate independent resources.

AX.6 Provider competence, witnessing and truthful claims

- a)** A provider shall demonstrate method/function-specific competence, equipment, uncertainty where relevant, sample integrity, independent reporting and decision capability for its requested scope. CAB evaluation shall include representative witnessed activities for each distinct method family or route, with grouping justified technically.
- b)** The assessment shall trace complete cases from application through execution, reporting, review, decision and continuing control. It shall include failed work, amended reports, complaints and changes. ORG conformity does not establish CAB competence or accreditation.
- c)** An accreditation or AF-authorized claim requires actual written authority, completed scope-specific competence evaluation and an independent decision. A body shall not accredit itself or imply that every report it produces is correct or accepted by every customer or authority.

Required evidence / record: Detailed provider scope; method validity; complete witnessed cases; independent competence decision; exact written authority.

AX.7 Findings, continuing status and deadline protection

- a)** Initial grant, renewal and extension require closure of all in-scope nonconformities. Existing localized minor findings may permit bounded continuation only under AD.8; major breakdown requires immediate assessment and affected suspension or a genuinely independent unaffected-scope restriction.
- b)** Annex AG controls the timetable: corrective plan within 30 days, major closure within 60 days, minor closure within 90 days; immediate critical protection with applicable 24-hour notifications/actions; status register update within two days; suspension resolved within 90 days without rolling reset.
- c)** Ongoing attestations and PER credentials have a maximum 24-month period from actual decision, subject to continuing conditions. Surveillance is completed within 12 months for C0/C1 and six months for C2/C3. Instance results do not acquire an automatic 24-month technical life. Missed surveillance and expiry shall remain visible and trigger required status action.

Required evidence / record: Original notification clocks; findings/closure; actual status decisions; current/historical register; instance versus ongoing classification.

AX.8 Appeals, confidentiality, retention and closure

- a)** Complaint/appeal receipt shall be acknowledged within five calendar days. An ordinary case shall be determined within 60 days; necessary exceptional extensions shall have reasons and progress communication at least every 30 days. The ordinary appeal-submission window is 30 days after decision notice, with documented justified exceptions under Annex AI.
- b)** Appeal reviewers shall be independent of the original evaluation, review and decision and cover the relevant technical scope. Both supporting and contrary evidence shall be examined. An appeal shall not automatically remove protection, revive an expired claim or validate a suspended period.
- c)** Assessment and decision records shall be retained at least seven years after the last relevant decision, or longer where obligations, product life or investigations require, with lawful privacy handling. Provider closure shall preserve records, unresolved cases, surveillance responsibilities and truthful status; transfer of files does not transfer operating authority.

Required evidence / record: Case clocks; independent review; fair evidence record; interim protection; retention and closure/transfer arrangements.

ANNEX AY / NORMATIVE

Mandatory parameter schedules and complete record payloads

This annex defines the information to be completed in the actual application. Blank templates, catalogued domains and example values do not establish readiness. Equivalent secure digital records are permitted when required identity, relationships, history and accountable decisions are preserved.

Linked provisions: 2.2; 3.1; 7.10–7.12; 11; 22–28; A; D; M; AA; AJ; AK; AN–AT

This annex forms part of the approved edition. Requirements apply within its stated scope. Numerical examples and explanatory diagrams remain informative.

AY.1 Technical parameter schedule: no undefined essentials

- a)** The owner shall assign a unique schedule to each evaluated object/configuration and operational domain. Every essential numerical quantity shall identify units, nominal or reference value where needed, range, tolerances, limit inclusivity, uncertainty, conditions, derivation rationale and approving authority.
- b)** Each parameter shall link to source obligation or derived requirement, associated hazard, method, equipment, evidence and acceptance rule. The schedule shall state whether a value is an input assumption, design target, qualified limit, acceptance criterion or measured result. These categories shall not be interchangeable.
- c)** Undefined essential values shall be marked unresolved with owner and dependent hold. Templates shall not prepopulate synthetic figures as actual approved criteria. Review shall precede evaluation and shall be reopened when configuration, environment, model or obligations change.

Required evidence / record: Approved parameter schedule; type/units; rationale; method/hazard links; unresolved-value controls.

AY.2 Eighteen parameter groups and applicability record

- a)** The profile shall evaluate each group below for applicability. Grouping organizes the schedule; it does not impose irrelevant values or allow omission of an essential unlisted parameter. For every selected group, the owner shall complete the field requirements in AY.1 and link the governing technical annex.

Table AY-1 — Eighteen parameter groups and applicability record

ID	Parameter group	Minimum domain-specific content
AY-PS01	Scope and environment	Object; configuration; phase/mode; coordinate frame; time basis; duty; environment; uncertainty; excluded domain.
AY-PS02	Loads and structural response	Load/constraint basis; geometry/material; combinations; response; scatter; damage and independent review.
AY-PS03	Thermal and vacuum	Article temperatures; gradients; pressure; interfaces; dissipations; radiative properties; stabilization and model validity.

ID	Parameter group	Minimum domain-specific content
AY-PS04	Vibration, acoustic and shock	Spectrum/pulse; frequency; axis; duration; response; sensor/fixture; notching; achieved exposure and accumulated damage.
AY-PS05	Radiation and charging	Mechanism; dose/fluence/spectrum; units; bias/temperature; shielding assumptions; susceptibility; uncertainty and authorized test scope.
AY-PS06	Electrical power and storage	Mode demand; capacity; conversion losses; aging; protection; transient; protected reserve and coupled thermal effects.
AY-PS07	Communications and timing	Interface; bandwidth/rate; loss/capacity; latency; staleness; reference time; integrity; outage and fallback.
AY-PS08	Contamination and materials	Species/particle definition; material condition; sampling/collection; blanks; detection; compatibility; custody and preservation.
AY-PS09	Critical processes	Material/geometry; site/equipment; essential variables/interactions; qualified window; monitoring; excursion and requalification.
AY-PS10	Measurement and decisions	Measurand; correction; uncertainty/covariance; coverage; specification; acceptance rule; precision and repeat plan.
AY-PS11	Software and programmable hardware	Build/target; dependencies; timing/resources; coverage; anomalies; safe states; update and support.
AY-PS12	AI and autonomy	Use case/domain; data/model; partitions; scenario/subgroup metrics; uncertainty; critical steps; drift and enforced fallback.
AY-PS13	Human-system interfaces	Users/tasks; workload; visibility/access; language; response time; foreseeable misuse; essential resources and validation.
AY-PS14	Maintenance and remaining life	Identity; history; time/cycles/exposure; condition; life limit; inspection capability; repair authority and next review.
AY-PS15	Service and continuity	Scope/window; accuracy/timeliness; uptime/downtime; exclusions; RTO/RPO; critical dependencies; integrity after recovery.

ID	Parameter group	Minimum domain-specific content
AY-PS16	Environment and resource claims	Functional unit; boundary; activity/factors; allocation; uncertainty/correlation; exclusions; comparison and claim class.
AY-PS17	Personnel and assessment	Role/profile; prerequisites; knowledge/practical/essential gates; observed work; independence; activity and validity.
AY-PS18	Status, time and retention	Route; ongoing/instance; actual decisions; expiry; surveillance; original finding clocks; restrictions; privacy and retention.

Required evidence / record: Group-by-group applicability; completed schedules and approved exclusions.

AY.3 Common record identity and provenance

- a)** Every record shall identify its unique record ID, form/module, version, object and configuration, scope/profile, actual creation and decision times, author, reviewer, approver, status, evidence links, access class and retention basis. A typed name without authenticated action shall not be treated as proof of approval.
- b)** Relations among requirements, samples, raw data, processed results, equipment, competence, findings and releases shall remain resolvable. Imported records shall be checked for units, field mapping, truncated precision, broken references and incompatible status meanings.
- c)** Corrections shall preserve the original value, reason and actor. Public status shall be separated from protected technical and personal data. Exports shall carry enough context to reconstruct decisions without revealing information outside authorized access.

Required evidence / record: Common data dictionary; provenance; correction history; relation integrity; protected/public export definitions.

AY.4 F01-F12 record modules and required payload

- a)** Form aliases F01-F12 identify the required record modules. They are record modules, not the similarly numbered program families in any other AF document. Combined forms are permissible only when every applicable payload and its required independent approval remain identifiable.
- b)** An F07 decision shall reconcile with F01/F02 scope and F04/F05 evaluated evidence, F06 findings and F08 status. F10 employer authorization shall remain separate from personnel credentials. F12 scope shall constrain every claim of provider competence.

Table AY-2 — F01-F12 record modules and required payload

Alias	Purpose	Required content beyond common identity
F01	Application and scope	Route; legal/holder identity; sites/remote functions; exact product/service/process/person/provider; responsibility; criticality; exclusions; authority; access.

Alias	Purpose	Required content beyond common identity
F02	Application profile	Domain; requirements/limits; essential controls; methods/conditions; samples; uncertainty/scoring; passing/failure rules; surveillance; changes; technical owners.
F03	Competence and assignment	Role; verified prerequisites/history; learning; exams/practical/essential steps; witnessing; scope; conflicts; development; expiry/restriction.
F04	Evaluation plan	Objectives; route/scope; criteria; sites/shifts; method; team coverage; time; samples; access/security; witnesses; departures and actual coverage.
F05	Technical result and decision	Actual configuration; characteristic; specification; method/equipment; raw/corrected result; uncertainty; rule; conclusion; limitation and disposition.
F06	Finding and corrective action	Requirement/evidence/gap; grade; population; protection; original notification; occurrence/escape causes; actions; clocks; effectiveness and closure.
F07	Review and attestation decision	Scope/profile; evidence package; competence/independence; findings/closure; limitations; exact decision; reasons; actual dates and authority.
F08	Surveillance and status	Attestation; scope; criticality; due/completed activities; findings; changes; current/history status; restrictions; restoration/withdrawal; registry update.
F09	Supplier and transfer	Actual performer/sub-tiers; work package; instructions; acknowledgements; approval; changes; verification; custody; escape and exit.
F10	Credential and task authority	Identity/profile; component/essential results; independent decision; credential boundary; separate employer task/site/equipment; supervision/practice; expiry.
F11	Complaint or appeal	Party/object; issue/grounds; clocks; admissibility; conflicts/reviewers; submissions/evidence; interim protection; outcome/communication; corrective effects.

Alias	Purpose	Required content beyond common identity
F12	CAB technical competence scope	Legal provider; activity; method family; ranges/conditions; uncertainty capability; sites; competence; witnessing; findings; independent authority; exact claim.

Required evidence / record: Complete module payload; actual approvals; cross-record reconciliation.

AY.5 Additional technical record relationships

- a)** Technical-domain schedules shall extend, not silently replace, the record modules in Annex AJ. A mission-domain matrix shall link to F02; a test specification and actual result to F04/F05; a process envelope and run record to F05/F09; an irreversible-action gate to the relevant technical release and F07 where an attestation is sought.
- b)** For digital work, the build/model/data manifest shall link to the actual deployed instance and test evidence. For maintenance, the work package shall reconcile removed/installed parts, life history and release. For environmental statements, the inventory and claim boundary shall remain distinct from technical product acceptance.
- c)** A missing relationship essential to understanding the result shall be a record-integrity gap. A readable PDF or successful file-count comparison is not a complete transferable dossier when the necessary source evidence cannot be resolved.

Required evidence / record: Technical record links; actual-instance mapping; claim separation; relationship validation and gap resolution.

AY.6 Completeness and final dossier reconciliation

- a)** Before a positive consequential decision, the reviewer shall reconcile object identity, criteria, actual execution, raw and processed evidence, competence, configuration, findings, limitations and the exact authority. Every applicable essential record field and relationship shall be demonstrated, not merely marked complete.
- b)** The dossier shall list missing or inaccessible material and explain its effect on the requested conclusion. All-scope completeness shall not be claimed from an incomplete checklist, small sample, software success message or collection of file titles.
- c)** Export and recovery tests shall demonstrate usable relationships, current status and truthful history. New evidence obtained later may support a new decision, but shall not be backdated to make an unsupported earlier decision appear valid.

Required evidence / record: Dossier reconciliation; missing-evidence impact; independent decision; tested complete export and recovery.

Decision control: Only the evaluated and independently supported scope may be released or attested.

ANNEX AZ / NORMATIVE CONTROLS; INFORMATIVE CASE SCENARIOS

Boundary and adverse-case challenge suite

The organization shall define and execute tests for the applicable permitted and prohibited transitions of its real process or digital workflow. The 60 scenarios below are a baseline challenge design, not a record of tests performed on an actual organization. Expected outcomes apply under the stated AF rules; the actual test log shall retain observed results, deviations and corrections.

Linked provisions: 2.6; 7.12; 9.3; 22; 26; 28; AB-AJ; AK; AS; AT; AY

This annex forms part of the approved edition. Requirements apply within its stated scope. Numerical examples and explanatory diagrams remain informative.

AZ.1 Test execution and local acceptance

- a)** The owner shall select all relevant scenarios, add application-specific hazards and define actual test inputs, roles, permissions, evidence and expected state. Test data shall be separated from operational records and contain no fabricated live approval or signature.
- b)** An essential prohibited transition shall be blocked and attributable. The execution record shall identify expected and observed result, logs, configuration, tester, reviewer and corrective action. A failed challenge shall remain open until the affected control is corrected and an appropriate regression set passes.
- c)** Passing these scenarios demonstrates only the tested implementation and cases. It does not prove the absence of every defect or validate the physical engineering model. Technical and independent adoption reviews remain separate.

Required evidence / record: Local challenge plan; actual logs; expected/observed comparison; regression and independent review.

Table AZ-1 — Sixty controlled adverse-case specifications

Case	Challenge input / event	Expected controlled response	Source
AZ-T01	Application has no defined object/configuration	HOLD admission; complete scope tuple.	1.3; AA.1; AK.1
AZ-T02	Outsourced critical work marked not applicable	Reject N/A rationale; retain responsibility.	1.3; A.2; AK.2
AZ-T03	Two sites claimed, evidence from headquarters only	HOLD unassessed site; establish local evidence.	AC.5; AK.2
AZ-T04	Numerical criterion says only aerospace grade	HOLD profile; approve measurable criterion.	2.2; AA.2; AK.1
AZ-T05	Mandatory data missing but empty cell becomes zero	HOLD calculation; invalid-input control.	7.12; AK.5; AT.1
AZ-T06	One requirement atom passes, second is untested	Parent requirement remains HOLD.	2.4; AK.1; AK.4
AZ-T07	Uncertainty interval wholly inside inclusive limits	DR-A conformity demonstrated for that criterion.	AD.3; AK.5

Case	Challenge input / event	Expected controlled response	Source
AZ-T08	Nominal result inside, uncertainty overlaps limit	DR-A indeterminate; HOLD acceptance.	AD.3; AD.6
AZ-T09	Interval wholly above upper specification	DR-A nonconformity demonstrated.	AD.3
AZ-T10	Coverage endpoint exactly equals inclusive limit	Inside boundary using unrounded stated inputs.	AD.2; AD.3
AZ-T11	Reported rounding would change the decision	Use unrounded result; preserve original outcome.	AD.2; AK.5
AZ-T12	Expanded uncertainty is negative or non-finite	Invalid computation; HOLD.	7.12; AK.5
AZ-T13	Guard band leaves no acceptance region	Method cannot demonstrate conformity under rule.	AD.6; AK.5
AZ-T14	Decision rule changed after a failed observation	Reject retrospective rule selection.	AD.1; AD.4; AT.7
AZ-T15	Repeat measurement until one reading passes	Reject uncontrolled retesting; retain all results.	AD.6; AT.4
AZ-T16	Different units combined without conversion	HOLD result; repair and verify unit mapping.	D.2; AT.2
AZ-T17	Copied uncertainty from unrelated calibration scope	HOLD method/result suitability.	7.7; AD.2; AT.3
AZ-T18	Correlation matrix is not mathematically valid	HOLD uncertainty model; correct justified dependence.	AT.3
AZ-T19	Accepted evidence belongs to another lot	Reject reliance for this object; trace source.	8.4.2; D; AJ.2
AZ-T20	Hash matches a fabricated original observation	Integrity equality does not prove truth; investigate.	D.3; AS.11
AZ-T21	Critical feature missing, overall checklist 99%	Block positive dependent decision.	B.2; AD.1; AK.4
AZ-T22	Initial grant proposed with one open minor	Block grant until verified closure.	AA.5; AD.8; AG.4
AZ-T23	Existing local minor with protected output and accepted plan	Continuation only after reasoned bounded AD.8 decision.	AD.8; AG.4
AZ-T24	Existing major undermines continuing conformity	Suspend affected scope or independently restrict unaffected scope.	AD.7; AD.8
AZ-T25	Critical concern awaits the final report	Protect immediately; AF clocks remain active.	AG.1; AG.4
AZ-T26	Same finding renumbered to reset deadline	Retain original clock; overdue action still applies.	AG.4
AZ-T27	Suspension reissued on day 90 to extend period	No rolling reset; restore, validly restrict or withdraw.	AG.5

Case	Challenge input / event	Expected controlled response	Source
AZ-T28	Renewal completed after actual expiry	New decision no earlier than actual date; preserve gap.	AG.6
AZ-T29	Restoration proposed with a new later expiry but no renewal	Restore only with original expiry.	AG.5
AZ-T30	Routine surveillance booked but not completed by deadline	Apply affected suspension; booking is not completion.	AG.3
AZ-T31	Ongoing attestation treated as instance to avoid surveillance	Reject misclassification of continuing claim.	AA.6; AG.2
AZ-T32	Single test result claimed to authorize future production	Restrict to evaluated instance; evaluate ongoing family separately.	AA.4; AG.2
AZ-T33	Evaluator assigned as own third-party decision maker	Reject assignment; independent authorized decision required.	22.2; AB.5; AD.9
AZ-T34	Reviewer has disqualifying recent relevant consultancy	Reassign and assess residual conflicts.	AB.5
AZ-T35	Technical specialist named but did not participate	HOLD claimed technical coverage.	AB.1; AB.4
AZ-T36	Auditor activity below applicable annual minimum	Suspend independent role use pending valid reactivation.	AB.6; AB.7
AZ-T37	Knowledge 86%, practical 92%, essential step failed	Fail competence decision despite total scores.	AB.2; AE.4
AZ-T38	Written test passes but required practical not performed	HOLD credential; practical evidence required.	AE.3; AE.4
AZ-T39	Employer accepts credential as blanket task permission	Issue separate task-specific authorization after suitability review.	26.4; AE.7
AZ-T40	C2 task resumed after more than six months inactivity	Observed competence demonstration before independent work.	AE.8
AZ-T41	CAB claims accreditation from its own QMS statement	Reject claim; separate authorized competence route.	28.7; AH.8
AZ-T42	Laboratory requests range outside demonstrated capability	Restrict or HOLD scope pending technical demonstration.	AH.3; AH.4
AZ-T43	Remote observation loses essential setup stage	Repeat/supplement; do not mark witness complete.	AC.6; AH.7
AZ-T44	Surveillance site pool includes unique C2 operation	Remove from reduced pool and add mandatory coverage.	AC.5
AZ-T45	Five sites sampled, none selected randomly when required	Correct plan to satisfy minimum random selection.	AC.5
AZ-T46	Travel and independent decision included as audit evaluation time	Recalculate actual productive evaluation resource.	AC.3
AZ-T47	Readiness allocation leaves implementation below 1.5 days	Increase total time and satisfy both stage minima.	AC.3

Case	Challenge input / event	Expected controlled response	Source
AZ-T48	First article uses nominal pass but no required numeric values	Keep characteristic open; obtain actual evidence.	K.2
AZ-T49	Cure excursion closed by final visual inspection only	HOLD population where hidden effect is not detectable.	L.2; AQ.1
AZ-T50	Transferred work accepted from sending-site records alone	HOLD unrestricted receiving-site use.	8.1.5; AM.10
AZ-T51	As-tested hardware/software differs from delivered baseline	Reconcile and re-evaluate affected requirements.	8.1.2; 23.5
AZ-T52	AI final evaluation contains training duplicates	Invalidate unsupported inference; redesign independent evaluation.	12.5; AS.3
AZ-T53	Aggregate AI metric passes while critical subgroup fails	Block affected domain release or validly restrict it.	N.3; AS.4
AZ-T54	Model update occurs outside authorized adaptation envelope	HOLD changed use pending renewed assurance.	12.6; AS.5
AZ-T55	Backup restored within RTO/RPO but configuration links fail	Assured use held until integrity is verified.	O.4; AS.10
AZ-T56	Human intervention requires less than unavoidable link delay	Do not credit infeasible oversight; validate alternative protection.	12.4; 16.5; AN.3
AZ-T57	Mission extension consumes protected disposal reserve	HOLD extension until resource and obligation basis resolved.	14.5; P.4; AN-D31
AZ-T58	Life history unknown but overhaul labelled as new	No life reset; obtain authorized condition/life disposition.	21.3; T.2
AZ-T59	Appeal submitted, protective suspension automatically removed	Reject automatic reinstatement; independent evidence-based decision.	AI.6
AZ-T60	Export has all files but broken requirement/result relationships	Not a complete transferable dossier; correct and retest relations.	AJ.7; AY.5

These are prescribed local validation cases, not claims of completed organizational testing. Record actual observed behaviour, tester, evidence and independent disposition for each applicable case.

ANNEX BA / INFORMATIVE

Requirement coverage and application crosswalk

This crosswalk connects the clauses and annexes used to assemble an application-specific requirement set. A mapping identifies where to read; it is not evidence of conformity. Every applicable lettered condition and normative record requirement remains part of the evaluation.

Linked provisions: 0–28; A–AJ; AK–AZ

BA.1 Integrated requirement architecture

a) AF 9100:2026 comprises Clauses 0–28 and Annexes A–BB. The ORG, PRD, SVC, PRC, PER, SUB and CAB routes retain separate evaluation boundaries. Core, technical and scheme provisions are applied together according to actual activity and responsibility.

b) Domain profiles and verification categories organize technical completion within the route architecture; they do not create separate certificate types. Form aliases F01–F12 identify record purposes, not program families.

c) Annex V provides the main-clause evidence index. Table BA-1 links related provisions for technical scope, quality-management implementation, parameter definition, calculations and adverse-case evaluation.

Required evidence / record: Read every applicable provision identified by the crosswalk. A short mapping entry is not a substitute for the full normative text.

Table BA-1 — Clause and annex relationships

Ref. ID	Subject	Related provisions
0	0 Introduction and application principles	AK; BA; BB
1	1 Scope, boundaries and conformity model	AK; AN; AO; AP; AY
2	2 AF normative framework, application and precedence	AK; AT; BB
3	3 Terms, definitions and conventions	AK; AW; AY
4	4 Organizational context and management-system design	AL.1–AL.2; AL.5; AY
5	5 Leadership, quality culture and accountable decisions	AL.3–AL.4; AK.4; AX
6	6 Planning, risks, opportunities and controlled change	AL.6–AL.9; AL.15; AT
7	7 People, infrastructure, knowledge and documented evidence	AL.9–AL.10; AS; AT; AX; AY
8	8 Operational planning and product or service realization	AM; AQ; AR; AS; AT
9	9 Performance evaluation, audit and management review	AL.11–AL.13; AX; AZ
10	10 Correction, learning and continual improvement	AL.14; AM.12; AZ
11	11 Systems engineering, lifecycle gates and mission assurance	AM.3–AM.4; AN; AT; AV

Ref. ID	Subject	Related provisions
12	12 Software, programmable hardware, AI and digital engineering	AS; AU.14-AU.15; AO; AN
13	13 Cybersecurity, OT resilience and trusted evidence	AS.7-AS.12; AV.12; AY.5
14	14 Space systems, operations and long-duration missions	AN; AR; AT; AU.18-AU.29
15	15 Aviation, unmanned systems and advanced air mobility	AO; AR; AQ; AM
16	16 Defense systems and mission-specific land and maritime mobility	AP; AO; AN; AS
17	17 Heavy industry, critical plant and industrial infrastructure	AP; AQ; AR; AT
18	18 Materials, advanced manufacturing and special technologies	AQ; AR; AM.7-AM.9
19	19 Propulsion, energy storage and hazardous-energy assurance	AN; AO; AP; AR; AU.18-AU.22
20	20 Sustainability, human factors and responsible lifecycle stewardship	AL; AW.12; AU.31; AY
21	21 Maintenance, distribution, logistics and end-of-life services	AM.12; AO; AP; AY
22	22 Conformity evidence, independent decisions and authorized claims	AK; AW.1; AX; AZ
23	23 Product and integrated-system assurance	AM; AN; AO; AP; AQ; AR
24	24 Service assurance and service continuity	AO; AP; AS; AM.12
25	25 Process qualification, capability and controlled use	AQ; AT; AU.11-AU.13
26	26 Personnel competence, qualification and task authorization	AX.1-AX.3; AU.36; AY
27	27 Subcontractor and multi-tier delivery assurance	AM.5; AQ; AV.6; AY
28	28 Assessment-provider competence and impartial operation	AX.4-AX.8; AR; AS; AT
A	Annex A — Scope and activity-based applicability matrix	AK.2; AN-AR; AY.1
B	Annex B — Criticality classification and assurance tailoring	AK.4; AT; AX; AW.7
C	Annex C — Lifecycle-gate evidence and transition decisions	AM; AN; AV.3; AV.11
D	Annex D — Requirements, configuration and digital evidence data model	AS.11; AY; AV.2
E	Annex E — Risk methods, hazard records and uncertainty	AT.1; AU.9; AW.6
F	Annex F — Reliability, availability and demonstration calculations	AU.6-AU.10; AW.6
G	Annex G — Process capability and statistical process-control example	AT.6; AU.11-AU.13
H	Annex H — Measurement uncertainty and conformity decision rules	AT.3; AU.1-AU.3; AW.3

Ref. ID	Subject	Related provisions
I	Annex I — Acceptance sampling and operating-characteristic calculations	AT.4; AU.4-AU.6; AU.38
J	Annex J — Supplier qualification, surveillance and flow-down package	AM.5; AV.6; AY
K	Annex K — First article and production-readiness verification	AM.8; AQ; AY
L	Annex L — Special-process qualification and requalification dossier	AQ; AV.7; AR
M	Annex M — Verification, environmental testing and qualification records	AR; AT; AN-AP
N	Annex N — Software and AI assurance cards with worked metrics	AS.1-AS.6; AU.14-AU.15; AV.8
O	Annex O — Cybersecurity, update and recovery evidence pack	AS.7-AS.12; AV.12
P	Annex P — Space mission and space-purpose mobility assurance matrix	AN; AU.18-AU.29; AV.11
Q	Annex Q — Aviation and advanced-air-mobility assurance matrix	AO; AR; AW.11
R	Annex R — Defense, maritime and mission-vehicle assurance matrix	AP; AR; AW.11
S	Annex S — Heavy-industry commissioning and asset-integrity matrix	AP; AQ; AR
T	Annex T — Maintenance, distribution and authorized service-release records	AM.12; AO; AY
U	Annex U — Lifecycle inventory, resource efficiency and quantitative claims	AU.31; AW.12
V	Annex V — Assessment method and complete main-clause evidence index	AK; BA; AZ
W	Annex W — Nonconformity and corrective-action record with completed example	AL.14; AM.12; AZ
X	Annex X — Implementation, transition and continual-assurance roadmap	AL; AM; AY; BB
Y	Annex Y — AF interpretation, amendment and publication control	AK.6; BB
Z	Annex Z — Metric dictionary, engineering budgets and integrated worked case	AU.18; AU.32; AW
AA	Annex AA — Assessment scheme architecture and object-specific conformity routes	AK; AW.1; AX; AY
AB	Annex AB — Auditor, technical expert, reviewer and decision-maker competence	AX.1-AX.3; AU.36; AV.9

Ref. ID	Subject	Related provisions
AC	Annex AC — Audit planning, audit time, multisite coverage and remote methods	AX.5; AU.33–AU.35
AD	Annex AD — Conformity decision rules, findings and release controls	AK; AU.2; AU.36–AU.38; AV.5
AE	Annex AE — Personnel assessment, examinations and task authorization	AX.1–AX.3; AU.36; AY
AF	Annex AF — Subcontracting, outsourced work and flow-down control package	AM.5; AV.6; AY
AG	Annex AG — Surveillance, renewal, status and mandatory time limits	AX.7; AU.35; AV.10
AH	Annex AH — Assessment-body, laboratory and competence-attestation controls	AX.1; AX.6; AR
AI	Annex AI — Complaints, appeals, impartial review and case administration	AX.8; AV.9; AZ
AJ	Annex AJ — Controlled forms, record dictionary and consistency matrix	AK; AY; AZ

Table BA-2 — Domain-card counts and interpretation

Grouping	Cards	Boundary
All-space mission domains	32	AN-D01–AN-D32; within the existing object-route architecture.
Aviation domains	12	AO-D01–AO-D12; no blanket airworthiness permission.
Defense and critical industry	10	AP-D01–AP-D10; lawful quality and safety assurance.
Critical process domains	22	AQ-P01–AQ-P22; no universal process recipes.
Test and verification domains	38	AR-V01–AR-V38; methods and levels require actual approval.
Total technical cards	114	Planning and evidence groups, not 114 new accreditation programs.

ANNEX BB / INFORMATIVE

Publication status and edition maintenance

This annex explains the identity, applicability and maintenance of the approved edition. The publication record on page 2 identifies the release status and dates. Annex Y governs interpretations, corrections and technical amendments.

Linked provisions: 0.5; 2.1-2.6; 7.10-7.12; Y; AJ; AT; AY

BB.1 Publisher approval and effectivity

AF 9100:2026, **Aerospace Quality Management System**, is approved for publication by **Aerospace Federation**. The publisher-declared approval date, publication date and effective date are **29 September 2026**. The edition designation is **FIRST EDITION**.

The approval scope is the complete publication, including Clauses 0-28 and Annexes A-BB. Normative provisions belong to the same edition; no annex marked normative is presented as a separate pending supplement. Their application depends on the actual activity, responsibility and assessment route.

Publication approval is distinct from independent technical validation, statutory permissions and an individual conformity decision. It does not grant a product, person, organization or assessment provider an approval or a recognition beyond a separately evidenced decision.

BB.2 Reading the requirement set

Clauses 0.5 and 2.4 control the distinction between requirements and guidance. Normative text is applied with its conditions, exceptions, required fields and decision controls. The mixed-status portions of Annexes N, AJ and AZ remain separately identified; a filled example is not a normative acceptance threshold.

Technical profiles define the evaluated object, configuration, domain, methods, parameters and evidence required by Clauses 1-3 and Annex AY. Tables, calculations and diagrams are read with their stated assumptions and status. A checklist, summary or attractive numerical result does not replace a required condition.

BB.3 Interpretations and subsequent changes

An interpretation explains an existing provision without creating or removing a duty. Editorial corrections preserve technical intent. Changes to requirements, decision rules, thresholds, scope or essential competence are technical amendments and follow Annex Y, including its applicable review and consultation requirements.

Approved changes have a controlled identity, affected provisions and an explicit effective date. Proposals do not alter the current requirement set. Users retain the exact basis of earlier decisions; later evidence or amendments do not retrospectively validate an unsupported result.

Publication status and edition maintenance

BB.4 Implementation and record continuity

Implementing organizations select the applicable requirements and complete their actual profiles, methods, responsibilities, competence, equipment, protective controls and evidence records. Annex AZ challenges the relevant implementation; its scenarios are not records of tests already performed on an applicant.

Supporting manuals, procedures, forms and digital workflows are aligned with the applicable edition before use. Their title, file count or availability does not establish complete coverage. Required evidence links, independent decisions and record-history controls remain intact when documents are combined or transferred.

The edition effective date does not become the date of a later test, task authorization, assessment or conformity decision. Individual events use their actual dates. Publication changes, local adoption and applicant status remain distinct records under Clauses 2.5, 7.10–7.12 and Annexes AG, AJ and AY.

Table BB-1 — Publication and change record

Entry	Date	Scope and effect
FIRST EDITION approval	29 September 2026	Publisher-declared approval for publication of AF 9100:2026, Clauses 0–28 and Annexes A–BB.
Publication and effectivity	29 September 2026	One edition; normative, informative and mixed-status content applies as identified on page 2 and at the annex headings.
Editorial presentation	10 October 2026	Publication status and applicability clarified; quick-start guide and navigation aligned. Technical criteria, numerical examples and acceptance thresholds unchanged.

Using this record

The approval and effective dates above reproduce the publisher’s declared release particulars. The separate editorial-entry date identifies this presentation without changing the FIRST EDITION identity or attributing the editorial work to an earlier date.

The English master text is the reference edition. Controlled copies preserve the publication identifier, clause and annex identities, tables, mathematical signs and status distinctions. Authorized interpretations and later effective changes are maintained through the publication-control process in Annex Y.

Publisher approval does not imply an outside endorsement, full equivalence to another scheme, or completion of a particular applicant’s qualification. Required operating permissions and scope-specific evidence remain separate.