RESTRITO

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Quality Assurance linked to Certification

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Fundamental Concepts



Qualification

THE HOW (Process)

The process of demonstrating that a facility, equipment or process is capable of comply specified requirements.



Certification

THE WHAT (Final Part)

The procedure by which a third party gives written assurance that a product, process or service conforms to specified requirements.



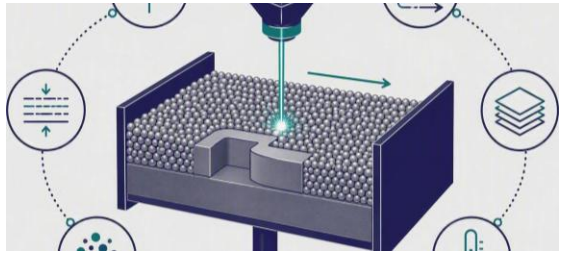
Standardisation

THE RULES (Standards)

The establishment of rules, guidelines or characteristics for common activities, aiming at order in a given context.

Why metal AM certification is different

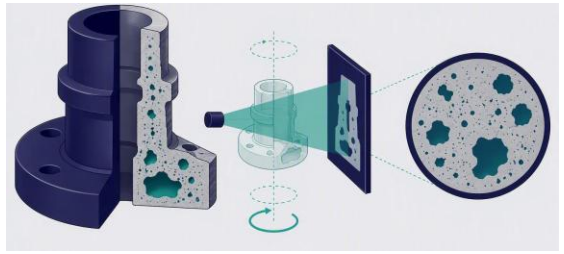
Additive manufacturing process forms the microstructure and the geometry in the same moment, binding material, machine, parameters and part together.



01

Control of feedstock, equipment, process parameters, and build environment

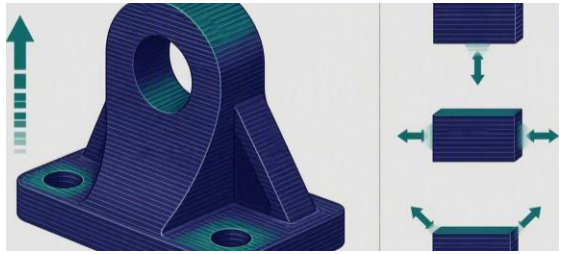
Powder chemistry, laser parameters, build layout and thermal history all shape final properties. Change one and the qualification basis moves.



02

Characterisation and acceptance of process-induced discontinuities

Lack-of-fusion porosity, keyholing and residual stress live inside the part. Surface inspection alone does not find them.



03

Qualification of build orientation and location

Properties differ with build direction. Acceptable must be tied to orientation, location and machine.



04

Process qualification, part validation, and release documentation

Certification is granted against documented, traceable, repeatable control not against a single good part.

Standardization bodies: who writes the rules for metal AM

ISO/TC 261 + ASTM F42

The joint partnership that publishes the ISO/ASTM 529xx family — the common backbone of terminology, feedstock, process and qualification standards.

CEN/TC 438

Adopts the ISO/ASTM texts as EN standards, giving them regulatory standing across the European market.

SAE AMS-AM

Aerospace material and process specifications, including the AMS7000 series for powders, PBF-LB processes and DED.

ASME, AWS and API

Pressure equipment, welding-derived DED rules and oil and gas acceptance criteria for load-bearing metal parts.

Nadcap and accreditation bodies

Audit-based approval of AM special processes, heat treatment and NDT suppliers on behalf of prime contractors.

Sector regulators

EASA and FAA for flight hardware, notified bodies and FDA for medical devices — they accept evidence, they do not generate it.

General & Process

The main collaboration for FA standards (Example: ISO/ASTM 52900).

Aerospace

Specifications for high-criticality materials and standards (Example: MSFC-SPEC-3717).

Welding and Metal

Focused on fusion-based processes (D20.1 is the key reference).

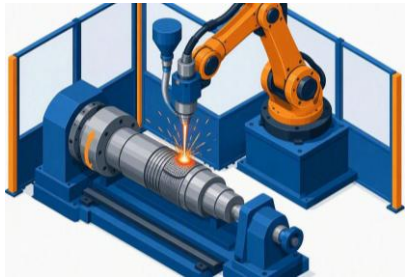
Quality and Audit

Accreditation for special processes.

Worflow: From Raw Material Arrival to Component Certification



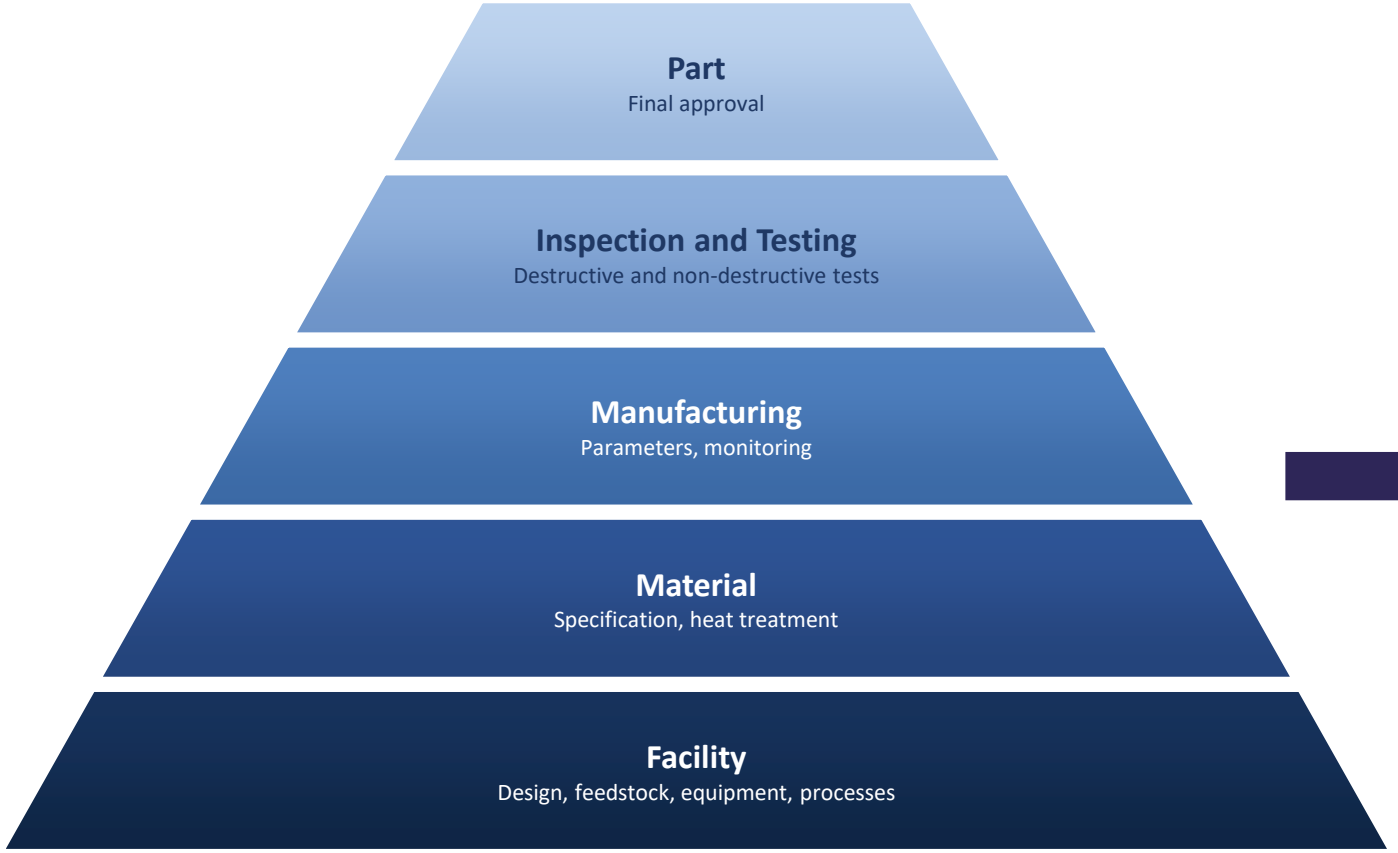






MATERIAL	BUILD PREPARATION	DEPOSITION & POST-PROCESSING	QUALIFICATION & DELIVERY
1 Raw Material Arrival (powder / wire lot)	4 Design Review & CAD / CAM Model	7 Deposition with In-Situ Monitoring	11 Dimensional & CMM Inspection
2 Incoming Inspection & Certificate Review	5 Toolpath & Process Parameter Planning	8 Stress Relief / Heat Treatment (HIP)	12 Non-Destructive Testing (CT / UT / PT)
3 Qualified Storage & Lot Traceability	6 Machine Setup, Calibration & Gas Check	9 Substrate Removal & CNC Machining	13 Mechanical & Metallurgical Coupon Tests
		10 Surface Finishing & Cleaning	14 Documentation, Certification & Delivery

The Compliance Hierarchy





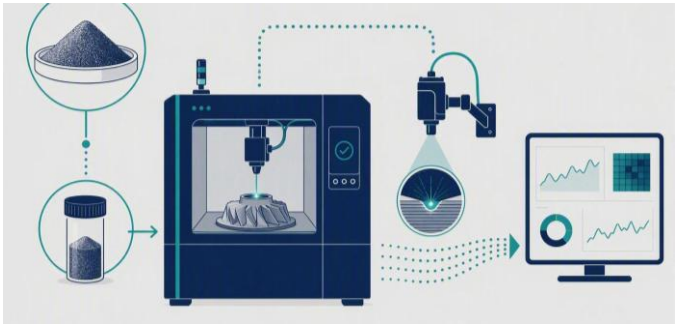
Part approval depends on the stability of every layer above it.

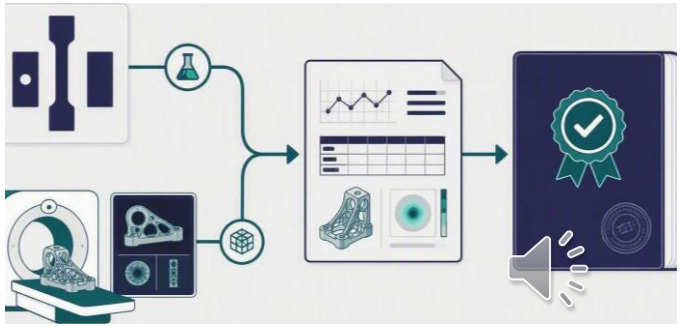
THE LINK
How quality assurance becomes certification evidence

Every control on the left exists because something on the right must be proven.

Quality assurance is not a parallel activity to certification, it is the mechanism that produces it.

Quality control activity	Certification claim it supports
Powder lot control and reuse records	The material is the material that was qualified
Machine acceptance and calibration	The equipment performs within its qualified
Frozen parameters and build monitoring	The process that ran is the process that was approved
Witness coupons and data	The part meets the design properties it was sized against
CT and NDT to defined criteria	Defects above the critical size would have been found
FAI, traceability and audit records	The claim is verifiable and repeatable across production





Quality assurance as the road to certification

Certification depends on evidence 01

A certificate is the visible end of a controlled chain. What is certified is the proof that every step was governed, measured and recorded.

Control the feedstock 02

Powder and wire lots are characterised, traced and released to ISO/ASTM 52907, so each part ties back to a known material condition.

Freeze the process 03

Machine qualification and a locked parameter set make the build repeatable, in metal AM the process creates the material itself.

Prove the part 04

Non-destructive and destructive testing on representative coupons turn process control into measured, defensible material properties.

Record the thread 05

Build logs, monitoring data, inspection records and certificates form the digital thread that lets any claim be reconstructed later.

Then certify 06

With the chain governed by a quality system and qualified personnel, the certificate of conformity confirms what the evidence already shows.

Quality assurance is not a gate at the end, it is the sequence of controlled steps that makes certification possible.

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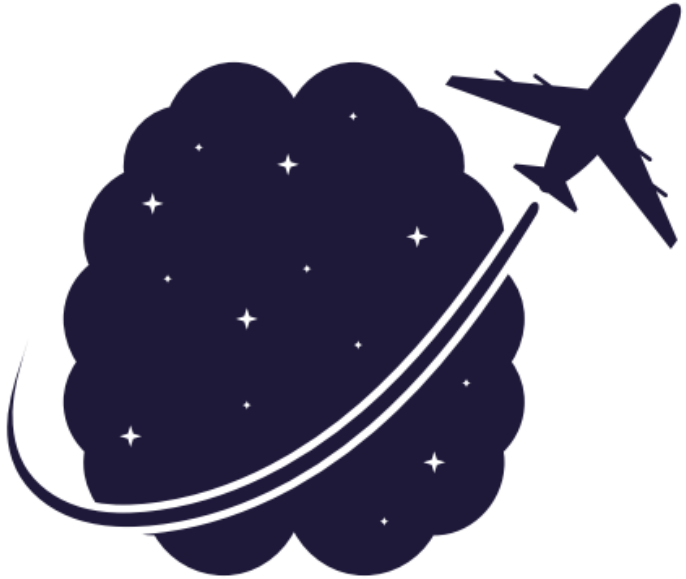

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