



ISO/ASTM Standards and Certification in Additive Manufacturing

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Introduction

The adoption of international standards is one of the key factors accelerating the transition of Additive Manufacturing (AM) from an experimental technology to a mature industrial platform. ISO/ASTM standards play a central role in this evolution: they not only promote methodological and technical alignment but also enable the reliable certification of metal and polymer components produced via additive methods.

At Roboze, the integration of standards occurs on multiple levels. On the one hand, it pertains to the quality management system, implemented not only to meet the requirements of highly regulated sectors such as aerospace (AS9100D:2016 and EN 9100:201 standards) but also to standardize and secure company processes, creating a solid and consistent foundation for operational excellence.

On the other hand, Roboze adopts specific technical standards for additive manufacturing, with the goal of ensuring quality, repeatability, and performance in line with industry specifications.

Roboze applies and extends international and industry best practices, deploying them across all markets in which it operates, an approach that reflects a commitment to responsible, reliable, and industrially scalable innovation.



Fig. 1: ISO Standard

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The regulatory framework for Additive Manufacturing

In recent years, AM has made significant advances: new materials, technologies, and applications have expanded the field's potential. However, to replace traditional supply chains in highly regulated industries (aerospace, automotive, oil & gas), it is essential to rely on globally recognized standards.

ISO (International Organization for Standardization) and ASTM (American Society for Testing and Materials) have developed guidelines and technical specifications covering every phase of the AM process, from material selection to final part qualification. The following technical committees are dedicated to developing standards for additive manufacturing:

- **ISO TC 261 (Additive Manufacturing):** focuses on standardizing AM processes, related process chains (data, materials, processes, hardware and software, applications), test procedures, quality parameters, supply agreements, fundamental principles, and terminology. It coordinates development efforts with ASTM F42 to produce harmonized documents (e.g., ISO/ASTM 52900, 52910) and independent standards like ISO 527 (tensile testing for plastics) and ISO 178 (flexural testing for plastics).
- **ASTM F42 (Additive Manufacturing Technologies):** concentrates on drafting and updating technical standards for both metals and polymers, defining mechanical testing protocols (e.g., ASTM D638 for tensile testing of plastics, ASTM D790 for flexural testing, ASTM D256 for impact testing), acceptance criteria, and supplier qualification guidelines.

The adoption and development of these standards represent a crucial step for additive manufacturing: it is through these that AM is demonstrating, and will continue to demonstrate, its full industrial potential. Alignment with international standards ensures quality, repeatability, and compliance, establishing AM as a mature, reliable technology that can be seamlessly integrated into advanced supply chains.

How ISO/ASTM Standards facilitate component certification

Adopting a standard primarily means defining, in a shared and structured way:

- Process requirements (printing parameters, quality controls, geometric and mechanical verification);
- Test methodologies to assess the mechanical and chemical properties of materials;
- Protocols for traceability and documentation of production phases.

When correctly applied, these elements make it possible to build a component certification workflow that meets even the most stringent regulatory demands. Specifically:

1. Process consistency

Documented specifications reduce the risk of variability between production plants and ensure coherence during the qualification stages.

2. Transparency of results

ISO standards (e.g., ISO 527 for tensile testing of polymer specimens, ISO 178 for flexural testing) and ASTM standards (e.g., ASTM D638 for tensile testing of polymers) define test methods and acceptance criteria, making results reproducible and comparable worldwide.

3. Shorter qualification times

Clear guidelines accelerate the AM process validation phase by providing defined benchmarks for verifying specific properties such as mechanical strength and process repeatability.

4. Safety and reliability

In critical sectors like aerospace, where even a minor failure can have dramatic consequences, certification to recognized standards ensures that every component meets strict specifications.

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Tangible Benefits: certification and quality of AM components

The table below outlines ISO/ASTM standards with their main purpose, application area, and benefits for certification:

Standard Code	Brief Description / Primary Purpose	Application Area	Benefits / Key Certification Advantages
ISO/ASTM 52900	Defines terminology used in additive manufacturing (AM)	All 3D printing processes	Reduces misinterpretation and enhances communication between suppliers and customers
ISO/ASTM 52901	Provides guidelines on data to exchange between client and supplier, including order info, part definition, material requirements, final characteristics, controls, and acceptance criteria	All 3D printing processes	Facilitates communication between part suppliers and customers
ISO/ASTM 52902	Describes standard test geometries (artifacts) and quantitative/qualitative measurements to assess AM system performance	All 3D printing processes	Supports evaluation of AM systems in terms of repeatability and reproducibility
ASTM D638	Tensile test for plastic materials: defines specimen shape, conditions, and test parameters	Tensile testing on “dog-bone” specimens	Provides a consistent protocol for measuring elastic modulus and tensile strength, ensuring comparability between labs
ASTM D790	Flexural testing of plastic materials: specifies specimen geometry and loading speed	Flexural tests on printed rigid polymer specimens (e.g., PEEK)	Provides a consistent testing protocol for finished components, useful for thin parts
ASTM D256	Izod impact test for plastic materials: defines impact conditions, evaluation criteria, and sample geometry	Impact resistance testing of composite polymer specimens	Determines toughness and impact strength—critical parameters for dynamically loaded parts

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The Roboze approach: quality and leadership

Roboze has consistently invested in developing additive manufacturing solutions and materials capable of meeting the strictest industrial standards. Here's how the company positions itself as a leader in the AM landscape:

- **Partnerships with certification bodies:** Roboze collaborates with accredited labs to test materials and components according to ASTM and ISO standards. These partnerships enable customers to benefit from fast, reliable qualification procedures.
- **High-repeatability advanced materials:** Roboze pellets and filaments (PEEK, ULTEM, carbon fiber composites) are certified to ISO/ASTM specifications, ensuring chemical-physical uniformity and consistent mechanical results.
- **Specialized technical support:** The Roboze team works alongside companies to develop tailored qualification plans, offering step-by-step guidelines for validating production processes.

Thanks to this approach, dozens of international customers (in aerospace, defense, oil & gas sectors) have already achieved qualified certifications for their AM components, reducing both time and cost compared to traditional processes.

We have extensively documented this in previous publications: for example, in the paper on outgassing tests performed on Carbon PEEK material.



Fig. 2: Roboze ULTEM™ 9085

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Toward global standardization: outlook and challenges

The evolution of AM standards is moving at a rapid pace. Key challenges include:

1. Harmonization among regulatory bodies

Coordinating the efforts of ISO TC 261 and ASTM F42 to avoid overlaps and ambiguities.

2. Continuous updates

With the emergence of new materials (e.g., nickel alloys, ceramics) and technologies (e.g., 4D laser, multifunctional powders), standards must evolve quickly.

3. Training and adoption by professionals

For certification to drive market timelines, engineers, designers, and quality managers must become familiar with industry standards.

Roboze is committed to spreading knowledge and technical expertise through tailored training courses offered by the Roboze Academy, ensuring direct transfer of best practices and technical guidelines. In this way, the entire AM ecosystem can benefit from a consistent and practical educational approach.



Fig. 3: Roboze Academy



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