



SLOVENSKI STANDARD
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Additive manufacturing of metals - Finished Part properties - Post-processing, inspection and testing of parts produced by powder bed fusion (ISO/ASTM DIS 52908:2022)

Additive Fertigung von Metallen - Eigenschaften von Fertigteilen - Nachbearbeitung, Inspektion und Prüfung von Bauteilen hergestellt mittels pulverbettbasiertem Schmelzen (ISO/ASTM DIS 52908:2022)

Fabrication additive de métaux - Propriétés des pièces finies - Post-traitement, inspection et essais des pièces produites par fusion sur lit de poudre (ISO/ASTM DIS 52908:2022)

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT), see www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 261, *Additive manufacturing*, in cooperation with ASTM Committee F42, *Additive Manufacturing Technologies*, on the basis of a partnership agreement between ISO and ASTM International with the objective to create a common set of ISO/ASTM standards on Additive Manufacturing.

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

Introduction

This document is designed to complement ISO/ASTM 52900, which describes different additive manufacturing processes using a variety of materials. This standard covers the testing of components manufactured from metallic materials using additive technologies.

As with conventional manufacturing processes (e. g. casting and milling), metallic parts produced by additive manufacturing technologies have critical-to-quality characteristics. These include in particular density, strength, hardness, surface quality, dimensional accuracy, residual stresses, absence of cracks, voids and structural homogeneity, which are typically tested in additively manufactured components. The quality of additively manufactured components is essential if functional components are produced on an industrial scale. Thus, it is necessary to qualify additive manufacturing processes according to uniform criteria and to apply standardised in-process and post-process testing.

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Additive manufacturing of metals — Finished Part properties — Post-processing, inspection and testing of parts produced by powder bed fusion

1 Scope

This document sets requirements for the qualification, quality assurance and post processing for metal parts made by powder bed fusion. This document defines methods and procedures for testing and qualification of various characteristics of additively manufactured metal parts, in accordance with ISO 17296-3, Classes H and M.

This document is intended to be used by part providers and/or customers of parts. This standard is a top-level standard in the hierarchy of additive manufacturing standards in that it is intended to apply to metallic parts made by additive manufacturing. This document defines qualification procedures where appropriate to meet defined quality levels.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO/ASTM 52900, *Additive manufacturing — General principles — Fundamentals and vocabulary*

ISO/ASTM 52920, *Additive manufacturing — Qualification principles — Requirements for industrial additive manufacturing sites*

ISO/ASTM 52927, *Additive manufacturing — General principles — Main characteristics and corresponding test methods*

ISO/ASTM 52928, *Additive manufacturing — Feedstock materials — Powder life cycle management*

ISO/ASTM/TS 52930, *Additive manufacturing — Qualification principles — Installation, operation and performance (IQ/OQ/PQ) of PBF-LB equipment*

ISO 1302, *Geometrical Product Specifications (GPS) — Indication of surface texture in technical product documentation*

ISO 3369, *Impermeable sintered metal materials and hardmetals — Determination of density*

ISO 6892-1, *Metallic materials — Tensile testing — Part 1: Method of test at room temperature*

ASTM E8/E8M, *Standard Test Methods for Tension Testing of Metallic Materials*

DIN 50125, *Testing of metallic materials — Tensile test pieces*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO/ASTM 52900 and the following apply.

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

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

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— IEC Electropedia: available at <https://www.electropedia.org/>

3.1

grain size

powder particle size

particle size

average diameter of powder particles under consideration

3.2

grain size

metallurgical grain size

average grain size in the metallurgical structure when viewed in cross-section

4 Symbols and abbreviations

4.1 Symbols

The symbols listed in [Table 1](#) are used throughout this document.

Table 1 — Symbols

Symbol	Term	Unit
a	specimen thickness (bending test)	mm
b_{pb}	specimen width (bend test)	mm
d_0	specimen diameter	mm
d_1	ISO metric threads	mm
d_b	roller diameter (bend test)	mm
E_V	volume energy density	J/mm ³
F_b	punch force	N
F_{max}	maximum force (bend test)	N
h	head height	mm
h_s	scan line spacing	mm
KU, KV	notch impact energy U:U-notch, V:V-notch	J
L_0	initial gauge length	mm
L_c	test length ($L_c > L_0 + d_0$)	mm
L_t	total length	mm
l_{ab}	roller spacing (bend test)	mm
l_p	specimen length (bend test)	mm
l_z	layer thickness	mm
N	nominal dimension	mm
P_L	laser power	W
R_z	average surface roughness	µm
S_b	punch path (bend test)	mm
T	tolerance	mm
T_T	transition temperature	K, °C
VR	volume rate	mm ³ /s
v_s	scan speed	mm/s
α	angle of bend (bend test)	°(degree)
β	angle of bend (bend test)	°(degree)

4.2 Abbreviations

The abbreviations listed in [Table 2](#) are used throughout this document:

Table 2 — Abbreviations

AM	additive manufacturing
EDX	energy-dispersive X-ray spectroscopy
SEM	scanning electron microscope
CAD	computer aided design
NDT	non-destructive testing
QA	quality assurance
COC	certificate of conformance
ASL	approved supplier list
HIP	hot isostatic pressing
EDM	electrical discharge machining
PBF	powder bed fusion

5 Qualification

5.1 General

The manufacturer shall demonstrate the capability to produce AM parts to the requirements given in the purchase specification. The inspection and testing described in the following clauses is performed and assessed using the methods and acceptance criteria stated in the purchase specification.

NOTE Purchase specification requirements are developed at the design stage, as described in ISO/ASTM 52927, and are in accordance with the relevant standards and regulations that are required for the conformity of that part.

5.2 Part Validation

Validation that the part produced complies with the requirements of the purchase specification shall be captured in a qualification record. A typical 'qualification record', shall consist of:

- Technical documentation relating to part(s) produced;
- Facility documentation;
- Quality assurance (QA) documentation.

5.3 Technical documentation relating to part(s) produced

The technical documentation relating to part(s) produced shall contain:

- Purchase specification in accordance with ISO/ASTM 52927, which includes inspection methods, associated plans, acceptance criteria, and representative quality indicators where applicable;
- Feedstock specification, test results and declaration of conformity with ISO/ASTM 52907;
- Material specification (consolidated product material properties specification);
- Completed manufacturing plan;
- Records of destructive and non-destructive testing;
- Inspection record for the part (in accordance with the purchase specification);

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- Other documentation required by the purchaser, regulation or product standard (e. g. material identification, labelling, product instructions).

NOTE 1 For some materials, there may be a singular specification that controls both feedstock and material properties, such as metallurgical and mechanical properties.

NOTE 2 Technical specifications for metal powders are addressed in ISO /ASTM 52907.

5.4 Facility documentation

5.4.1 Additive manufacturer documentation requirements

Facility documentation requirements for industrial manufacturing sites are addressed in ISO/ASTM 52920.

For the purpose of this document, an outline of the relevant manufacturing plant and equipment shall be provided. The outline shall include the major items of equipment used for post processing, inspection and testing (including details of geographical location).

The following facility documentation shall be provided:

- Records of equipment qualification (addressed in ISO/ASTM TS 52930);
- Records of powder lifecycle management (addressed in ISO/ASTM 52928).

The following quality management documentation shall be provided, where a certified quality management system is not already in place:

- Records (e.g. calibration certificates) of inspection equipment used for measuring and testing;
- Records of equipment used for metallographic examinations, mechanical tests, non-destructive tests, hydraulic and gaseous testing (where appropriate, this is to include details of the testing procedures used);
- Training records of manufacturing and inspection personnel;
- Developments that affect the supply shall be qualified and reported.

The items listed above are acceptable where a quality management system is in place (see [5.5](#)).

5.4.2 Subcontractor documentation requirements

Where the manufacturer subcontracts post-processing and/or testing activities, the manufacturer shall state the conditions under which these activities are subcontracted and shall provide a purchase specification for the operations involved.

The manufacturer shall assess and approve the subcontractors for their capability to perform the subcontracted activity to the required quality level.

5.5 Quality Assurance documentation

General QA documentation requirements are considered to be met when the quality management system (e. g. ISO 9001, ISO 13485) is certified by a recognised inspection body.

Additive manufacturing QA documentation requirements are addressed in ISO/ASTM 52920.