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**Additive manufacturing of metals — Qualification principles — Qualification of coordination personnel**

*Fabrication additive de métaux — Principes de qualification — Qualification du personnel de coordination*

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CP 401 • Ch. de Blandonnet 8 100 Barr Harbor Drive, PO Box C700

CH-1214 Vernier, Geneva West Conshohocken, PA 19428-2959, USA

Phone: +41 22 749 01 11 Phone: +610 832 9634

Fax: +41 22 749 09 47 Fax: +610 832 9635

Email: [copyright@iso.org](mailto:copyright@iso.org) [copyright@iso.org](mailto:copyright@iso.org) Email: [khooper@astm.org](mailto:khooper@astm.org)

Website: [www.iso.org](http://www.iso.org) [www.iso.org](http://www.iso.org) Website: [www.astm.org](http://www.astm.org) [www.astm.org](http://www.astm.org)

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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](http://www.iso.org/directives)).

~~Attention is drawn to the possibility that some of the elements of this document may involve the subject of (a) patent(s). ISO takes no position concerning the evidence, validity or applicability of any claimed patent rights in respect thereof. As of the date of publication of this document, ISO had not received notice of (a) patent(s) which may be required to implement this document. However, implementers are cautioned that this may not represent the latest information, which may be obtained from the patent database available at [www.iso.org/patents](http://www.iso.org/patents). ISO shall not be held responsible for identifying any or all such patent rights. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see [www.iso.org/patents](http://www.iso.org/patents)).~~

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This document was prepared by Technical Committee ISO/TC 261, *Additive manufacturing*, Joint Group JG 74, *Personnel Qualifications* in cooperation with ASTM Committee F42, *Additive manufacturing technologies*, on the basis of a partnership agreement between ISO and ASTM International with the aim to create a common set of ISO/ASTM standards on additive manufacturing, in collaboration with the European Committee for Standardization (CEN) Technical Committee CEN/TC 438, *Additive manufacturing*, in accordance with the Agreement on technical cooperation between ISO and CEN (Vienna Agreement).

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](http://www.iso.org/members.html).

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## Introduction

For many companies, additive manufacturing (AM) represents an interesting alternative to established manufacturing processes. The trend towards complex, customised or consolidated components, in addition to opportunities for reduced lead times and decentralised production allows an economically feasible use for a growing number of areas. This increasingly applies to many series applications, which add further demands on the efficiency and consistency of the processes. In particular, components used in regulated industries (e.g. automotive, rail, aerospace, process and industrial plants, medical) are subject to high demands in terms of quality and safety.

Where industrial components are produced using additive manufacturing processes, these shall satisfy the equivalent quality and safety requirements demanded of conventional processes. To this end, the production chain and environment are designed such that the process quality and resulting product quality are always consistent and reproducible. To achieve consistency and reproducibility, it is of utmost importance to ensure that the involved workforce is adequately qualified for all stages of production.

This document describes the activities and responsibilities of the actors with coordination roles in the field of additive manufacturing for metallic parts.

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# Additive manufacturing of metals - Qualification principles - Qualification of coordination personnel

## 1 Scope

This document specifies qualification requirements for coordination personnel in industrial manufacturing sites responsible for additive manufacturing of metal parts.

This document is applicable to all metallic processes that are described by ISO 17296-2. In this context, the skills, tasks and responsibilities for different levels of AM coordination personnel are typically adapted according to the applicable regulations, depending on the process.

This document is intended to provide guidance and requirements for the qualification of coordination personnel in general-industrial applications. Additional requirements are typically needed for specific industries or applications (e.g. aerospace, medical) or to meet regulatory requirements.

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## 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 — Quality requirements for industrial additive manufacturing sites~~

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

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

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### 3.1 AM coordination personnel AM coordinator

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person or group of people performing defined AM coordination tasks, designated by the company to be responsible for a specific process

Note 1 to entry: The designation can be valid for one specific AM process or covering several process categories as specified in ISO/ASTM 52900 and illustrated in ISO 17296-2.

Note 2 to entry: Different personnel may be appointed by the manufacturer (3.2) for different AM related tasks.

### 3.2 examiner

person with knowledge and experience relevant to the qualification, and acceptable to the customer or examining body or engineering authority

Note 1 to entry: In certain cases, an external independent examining body can be required [ISO 7/IEC 17024].

## 4 Tasks and responsibilities

### 4.1 General

Coordination personnel can have multiple tasks and responsibilities for additive manufacturing of metals. These tasks and responsibilities can have varying levels depending on the companies' needs and the coordination personnel's education and experience. Coordination personnel can have tasks and responsibilities that are at their level of qualification or lower. The company specifies if these tasks, regardless of the level, are assigned to one single staff or to several staff members.

### 4.2 Specification of tasks and responsibilities

Each manufacturer is responsible for appointing their AM coordination personnel and specifying their levels of responsibility for coordination.

The tasks and responsibilities of AM coordination personnel should be selected from Annex B and/or as specified in applicable standards, contracts, and regulations. The level of competence of AM coordination personnel should be determined in accordance with the complexity of the AM and related activities, product type(s), criticality of the application and the quality requirements.

Where more than one person carries out AM coordination, the tasks and responsibilities should be clearly allocated, such that responsibility is clearly specified, and the persons are competent for each specific AM coordination task.

The manufacturer shall appoint at least one person to be responsible for AM coordination tasks.

If AM coordination is subcontracted, the tasks and responsibilities shall be specified and documented. However, compliance with this document remains the responsibility of the manufacturer.

### 4.3 Tasks and responsibilities

The tasks and responsibilities assigned to AM coordination personnel shall be identified in accordance with 4.1, 4.2 and Annex B, and documented per Annex A.

Persons other than the AM coordinator may be designated to perform specific tasks on their behalf. Delegations of this type shall be documented.

### 4.4 Responsibilities and extent of authorization

The responsibilities and extent of authorization assigned to the AM coordination personnel are identified as follows:

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- their position in the manufacturer's organization and their responsibilities;
- the extent of authorization assigned to them to carry out the assigned tasks (see Annex B);
- the extent of authorization assigned to them to accept or validate, by signature, technical administrative documents or contracts, on behalf of the manufacturer, as needed to fulfil the assigned tasks, for example, for procedure specification and supervision reports.

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## 5 Technical knowledge and competence

### 5.1 General

All AM coordination personnel shall be able to demonstrate

- competence in the AM-related tasks allocated to them, and
- technical knowledge in AM technologies relevant to the assigned tasks, defined in Annex B, obtained by a combination of education, training and/or experience.

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Competence includes application of AM and related standards when relevant to the assigned tasks.

Competence shall be documented on the qualification test certificate given in Annex A for each task and responsibility based on:

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- the level of qualification may be different for different categories;
- qualification in every category is not required, if not applicable.

NOTE: For recommendations in terms of training, education and assessment minimum requirements, see [5]References [6] and [67].

AM coordination personnel should be allocated to one of the levels described in 5.2, depending on the nature and/or complexity of the production.

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### 5.2 Competence levels for AM coordination personnel

#### 5.2.1 Level 1 - Basic

At Level 1, AM coordination personnel shall be competent to make decisions in basic work and supervise basic aspects of AM production related topics and activities, apply established procedures, apply variation within strict boundaries and supervise operators.

#### 5.2.2 Level 2 - Standard

At Level 2, AM coordination personnel shall be competent to select and apply established procedures and implement variations in response to technical or economic requirements, select and supervise AM personnel.

Qualification for Level 2 shall include knowledge and skills of Level 1.

#### 5.2.3 Level 3 - Advanced

At Level 3, AM coordination personnel shall be competent to evaluate application, develop, specify and apply procedures, select, instruct and supervise AM personnel and coordination personnel and

implementing AM production, for a specific process and including coordination/supervision of the full manufacturing chain, and related topics and activities

Qualification of Level 3 shall include the knowledge and skills of Level 2.

## 6 Qualification

### 6.1 Assessment of AM coordination personnel

The examination or assessment shall be conducted by personnel with a level of competence or responsibility equal or higher than the person under assessment.

The method applied for assessment shall be recorded in a specific document and contain the acceptance criteria to be applied in examination to assess the capabilities of the candidate against the expected responsibilities and performances described in Annex B.

The examiner or examining body shall certify that the AM coordination personnel have met the criteria specified.

Upon a passing result, the examiner completes the level assessment per task and responsibility on the qualification test certificate.

If the candidate fails to pass the test related to the tasks in Annex B of this standard, no qualification test certificate shall be issued.

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### 6.2 Validity of qualification

The qualification remains valid whilst the AM coordination personnel maintains the appropriate level of knowledge relevant to the processes for which the AM coordination personnel is qualified.

Qualification can be maintained by periodic review to ensure the AM Coordination personnel still has the appropriate level of knowledge.

When the period of validity is not specified by the part manufacturer or by the specific industry sector or application, a maximum validity of 5 years from the last review shall apply.

The qualification can be revoked, and re-qualification required if there is evidence that the AM coordination personnel has not fulfilled the requirements of their qualification.

The qualification is not transferable to other manufacturers.

### 6.3 Re-qualification

The method applied for re-qualification shall be recorded in a specific document and contain the acceptance criteria to be applied in examination to assess the capabilities of the candidate against the expected responsibilities and performances described in Annex B.

The assessment may be adapted to the AM Coordination personnel's professional experience.

If a candidate wishes to raise the levels they are qualified to, then a new test shall be carried out.

Any practical element of the assessment may be undertaken during production.

The examiner or examining body shall certify that the AM coordination personnel have met the criteria specified.

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## 7 Qualification test certificate

The certificate shall contain as a minimum the following:

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- a) name;
- b) unique identifier;
- c) scope of the application;
- d) summary of aspects covered during assessment;
- e) date of issue of the certificate;
- f) name and signature of the examiner;
- g) a reference to this document and its edition, i.e. ISO/ASTM 52935:XXXX; —;
- h) level for each task/responsibility.

The certificate shall be issued under the responsibility of the examiner or examining body. A suggested certificate format is provided in Annex A.

The manufacturer may choose to keep a record of qualifications for the candidate or issue a certificate to the candidate.

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