



PARADDISE

“A Productive, Affordable and Reliable solution for large scale manufacturing of metallic components by combining laser-based ADDitive and Subtractive processes with high Efficiency”

Contract No: 723440

Thematic Priority: FOF-13-2016. Photonics Laser-based production

D6.5 Report on proposed extensions to existing standards that are relevant to AM including the opportunity of developing IWA(s)

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1.0	27-09-2018	Renato OTTONE	GAN	Draft submitted to WP6 leader and Project Coordinator
1.02	28-09-2018	Renato OTTONE	GAN	Second draft including received contributions from project stakeholders
2.0	29-09-2018	Renato OTTONE	GAN	Final Draft

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1. INTRODUCTION

1.1. BACKGROUND

This document extends and updates the content and the scope of Deliverable D6.3 – Report on the business plan of ISO/TC 261 as well as on standards of other ISO and CEN TCs that are relevant for AM technology.

In conformance with the commitment of the Description of Activities, PARADDISE project representatives are very actively participating to the work ISO/TC 261 Technical Committee including all its Working Groups and including a significant number of Joint ISO/TC 261 – ASTM F42 Groups.

The PARADDISE project maintains a liaison with CEN/TC 438 *Additive Manufacturing* and is very actively participating to its works. The minutes of the 4th meeting of CEN/TC 438 propose the adoption of the PARADDISE project (and of the KRAKEN project) activities (outlined in Figure 1 of Chapter 3. of this document) as a valid approach to be applied by other EC co-founded research projects related to Additive Manufacturing.

1.2. SCOPE OF THE DOCUMENT

This document has the following objectives:

1. To update, in Chapter 2, about on-going worldwide standardization activities, including overviews and the identification of the links to access relevant documents related to:
 - a. The AMSC Standardization Roadmap for Additive Manufacturing.
 - b. Published standards and standard under development that are the direct responsibility of ISO/TC 261 Additive manufacturing.
 - c. Published standards and future works of CEN/TC 438
2. To list and to elaborate, in Chapter 3, on currently identified PARADDISE project standardization priorities as presented to CEN/TC 438.
3. To recall, in Chapter 4, on the procedures for the generation of ISO deliverable including due consideration to discard the opportunity to pursue the development of an International Workshop Agreement (IWA) that would lead to generate conflicts with on-going participation to the works of ISO/TC261, ASTM F42 and CEN/TC 438.
4. To provide, in Chapter 5, conclusions and planned subsequent actions, including due consideration to activities that might need to be executed after the termination of the project.

The content of this document will be discussed during the PARADDISE project M24 meeting.

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2. ON-GOING WORLDWIDE AM STANDARDIZATION ACTIVITIES

The availability of standards is identified as one of the major enablers for the generalized acceptance of parts produced by Additive Manufacturing processes. All major Standard Development Organizations (SDO) throughout the world are planning, in a very competitive way, to work on the publication of standards related to AM.

As AM applications span over a wide range of technological fields, even within the International Organization for Standardization (ISO) there is an ongoing struggle to avoid the attribution of relevant standardization activities to different Technical Committees (TCs). ISO/TC 261 – *Additive Manufacturing* is trying hard to defend, within the ISO community, the primacy on standardization activities relevant to different AM topics in order to avoid possible improper approaches to the publication of relevant standards that otherwise could provide dangerous duplication or even possibly conflicting information and prescriptions. In this respect, the on-going cooperation between ISO/TC 261 and ASTM F42 Technical Committees is proving to be very effective.

2.1. STANDARDIZATION ROADMAP FOR ADDITIVE MANUFACTURING

In June 2018, the America Makes and ANSI Additive Manufacturing Standardization Collaboration (AMSC) published Version 2.0 of the *Standardization Roadmap for Additive Manufacturing*. The document can be downloaded at:

https://www.ansi.org/standards_activities/standards_boards_panels/amsc/

that also provides access to download the *AMSC Standards Landscape* that contains the list some 400 existing standards on AM, sorted by the alphabetic list of the publishing SDO.

An outline of the information contained in the AMSC Roadmap, that is extracted from the document executive summary, is provided here for the convenience of the reader.

“The *Standardization Roadmap for Additive Manufacturing*, Version 2.0 is an update to version 1.0 of the document published in February 2017. It identifies existing standards and standards in development, assesses gaps, and makes recommendations for priority areas where there is a perceived need for additional standardization and/or pre-standardization research and development. The focus is the industrial additive manufacturing market, especially for aerospace, defense, and medical applications.

The roadmap has identified a total of 93 open gaps and corresponding recommendations across five topical areas: 1) design; 2) process and materials (precursor materials, process control, post-processing, and finished material properties); 3) qualification and certification; 4) nondestructive evaluation; and 5) maintenance. Of that total, 18 gaps/recommendations have been identified as high priority, 51 as medium priority, and 24 as low priority. A “gap” means no published standard or specification exists that covers the particular issue in question. In 65 cases, additional research and development (R&D) is needed.

As with the earlier version of the document, the hope is that the roadmap will be broadly adopted by the standards community and that it will facilitate a more coherent and coordinated approach to the future development of standards and specifications for AM.”

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The document is indeed referred to by major SDOs (including ISO/TC 261 and ASTM F42 Technical Committees) as the main source to define priorities for the development of standards related to AM technologies.

 PARADDISE project stakeholders that are, or will be involved, with standards development issues should spend some time to overview the content of the *Standardization Roadmap for Additive Manufacturing*.

2.2. UPDATE ON ISO/TC 261 ACTIVITIES

The author of this document actively participated (sponsored by the KRAKEN project) to the 12th meeting of ISO/TC 261 and of its relevant Working Groups (WGs) and Joint Groups with ASTM F42 (JGs) meetings that were held in Singapore between the 18th and the 21st of September 2018.

A comprehensive overview on the current status of individual AM standards is included the Secretariat's Report that is identified as: ISO-TC261_N0484 whereas the Resolutions adopted at the 12th ISO/TC 261 plenary meeting are listed in the document ISO-TC261_0528.

 These documents can be made available to PARADDISE project partners by requesting them to Renato OTTONE (RO) (ottone360@gmail.com).

The list of published ISO/TC 261 standards (8) is available on-line at:

<https://www.iso.org/committee/629086/x/catalogue/p/1/u/0/w/0/d/0>

which also provides the possibility to preview the table of content and the scope of the document.

Table 1 – List of standards published by ISO/TC 261

Document	Title	Observations
ISO 17296-2:2015	Additive manufacturing -- General principles -- Part 2: Overview of process categories and feedstock	Will undergo Systematic Review (SR) and will probably be merged to future revisions of ISO/ASTM 52900
ISO 17296-3:2014	Additive manufacturing -- General principles -- Part 3: Main characteristics and corresponding test methods	Is undergoing SR. Discussion is ongoing to define how to merge it to an ISO/ASTM document
ISO 17296-4:2014	Additive manufacturing -- General principles -- Part 4: Overview of data processing	Is undergoing SR. Discussion is ongoing to define how to merge it to an ISO/ASTM document
ISO/ASTM 52900:2015	Additive manufacturing -- General principles -- Terminology	Is undergoing SR as ISO/ASTM DIS 52900
ISO/ASTM 52901:2017	Additive manufacturing -- General principles -- Requirements for purchased AM parts	
ISO/ASTM 52910:2018	Additive manufacturing -- Design -- Requirements, guidelines and recommendations	

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Document	Title	Observations
ISO/ASTM 52915:2016	Specification for additive manufacturing file format (AMF) Version 1.2	Now under revision as ISO/ASTM DIS 52195
ISO/ASTM 52921:2013	Standard terminology for additive manufacturing -- Coordinate systems and test methodologies	Now under revision as ISO/ASTM CD 52921

The list of standards under development is available at:
<https://www.iso.org/committee/629086/x/catalogue/p/0/u/1/w/0/d/0>



Documents at DIS or FDIS level can be acquired through this link
 Documents at Preliminary Work Item (PWI) level are not listed

Table 2 – List of standards under development by ISO/TC 261

Document	Title	Observations
ISO/ASTM DIS 52900	Additive manufacturing -- General principles -- Terminology	Will replace ISO/ASTM 52900:2015
ISO/ASTM DIS 52902	Additive manufacturing -- Test artefacts -- Standard guideline for geometric capability assessment of additive manufacturing systems	
ISO/ASTM DIS 52903-1	Additive manufacturing -- Standard specification for material extrusion based additive manufacturing of plastic materials -- Part 1: Feedstock materials	
ISO/ASTM DIS 52903-2	Additive manufacturing -- Standard specification for material extrusion based additive manufacturing of plastic materials -- Part 2: Process -- Equipment	
ISO/ASTM AWI 52903-3	Additive Manufacturing -- Standard Specification for Material Extrusion Based Additive Manufacturing of Plastic Materials -- Part 3: Final parts	Clarification: AWI (approved work item), stage 10.99
ISO/ASTM DIS 52904	Additive manufacturing -- Process characteristics and performance -- Standard practice for metal powder bed fusion process to meet critical applications	
ISO/ASTM CD 52905	Additive manufacturing -- General principles -- Non-destructive testing of additive manufactured products	Will probably become a Technical Report
ISO/ASTM CD TR 52906	Additive manufacturing -- Non-destructive testing and evaluation -- Standard guideline for intentionally seeding flaws in additively manufactured (AM) parts	
ISO/ASTM DIS 52907	Additive manufacturing -- Technical specifications on metal powders	
ISO/ASTM DIS 52911-1	Additive manufacturing -- Technical design guideline for powder bed fusion -- Part 1: Laser-based powder bed fusion of metals	
ISO/ASTM DIS 52911-2	Additive manufacturing -- Technical design guideline for powder bed fusion -- Part 2: Laser-based powder bed fusion of polymers	

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Document	Title	Observations
ISO/ASTM CD TR 52912	Additive manufacturing - Design - Functionally graded additive manufacturing	Publication is expected toward the end of 2018
ISO/ASTM DIS 52915	Specification for additive manufacturing file format (AMF) Version 1.2	Will replace ISO/ASTM 52915:2016
ISO/ASTM WD 52916	Additive manufacturing -- Data formats -- Standard specification for optimized medical image data	
ISO/ASTM CD 52921	Standard terminology for additive manufacturing -- Coordinate systems and test methodologies	Will replace ISO/ASTM 52921:2013
ISO/ASTM WD 52932	Additive manufacturing -- Environmental health and safety - - Standard test method for determination of particle emission rates from desktop 3D printers using material extrusion	
ISO/ASTM WD 52941	Additive manufacturing -- System performance and reliability -- Standard test method for acceptance of powder-bed fusion machines for metallic materials for aerospace application	
ISO/ASTM WD 52942	Additive manufacturing -- Qualification principles -- Standard guideline for qualifying machine operators of powder-bed based laser beam machines in aerospace applications	

2.3. ON-GOING ACTIVITIES WITHIN CEN/TC 438

 CEN/TC 438 – *Additive Manufacturing* activities are summarized in the Secretariat's Report identified as CEN-TC438_N0101 (available on request to RO).

The progress of works is summarized here in Table 3, whereas Table 4 lists ISO/ASTM standards that will be adopted as EN documents after publication at ISO level.

Table 3 – Progress of CEN/TC 438 works

Project reference	Title	Status
EN ISO/ASTM 52921:2016	Standard terminology for additive manufacturing — Coordinate systems and test methodologies (ISO/ASTM 52921:2013)	Published
EN ISO 17296-2:2016	Additive manufacturing — General principles - Part 2: Overview of process categories and feedstock (ISO 17296-2:2015)	Published
EN ISO 17296-3:2016	Additive manufacturing — General principles — Part 3: Main characteristics and corresponding test methods (ISO 17296-3:2014)	Published
EN ISO 17296-4:2016	Additive manufacturing — General principles — Part 4: Overview of data processing (ISO 17296-4:2014)	Published
EN ISO/ASTM 52900:2017	Additive manufacturing — General principles — Terminology (ISO/ASTM 52900:2015)	Published
EN ISO/ASTM 52915:2017	Specification for Additive Manufacturing File Format (AMF) Version 1.2 (ISO/ASTM 52915:2016)	Published
prEN ISO/ASTM 52902	Additive manufacturing — General principles — Standard test artifacts	Registered

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Project reference	Title	Status
prEN ISO/ASTM 52903-2	Additive Manufacturing — Standard Specification for Material Extrusion Based Additive Manufacturing of Plastic Materials — Part 2 Process - equipment	Registered
prEN ISO/ASTM 52905	Additive manufacturing — General principles — Non-destructive testing of additive manufactured products	Registered
prEN ISO/ASTM 52903-3	Additive Manufacturing — Standard Specification for Material Extrusion Based Additive Manufacturing of Plastic Materials — Part 3: Final parts	Registered
prEN ISO/ASTM 52911-2	Additive manufacturing — Technical Design Guideline for Powder Bed Fusion — Part 2: Laser based Powder Bed Fusion of Polymers	Registered
prEN ISO/ASTM 52911-1	Additive manufacturing — Technical Design Guideline for Powder Bed Fusion — Part 1: Laser based Powder Bed Fusion of Metals	Registered
prEN ISO/ASTM 52907	Additive manufacturing — Technical specifications on metal powder	Registered
prEN ISO/ASTM 52900	Additive manufacturing - General principles - Terminology (ISO/ASTM DIS 52900:2018)	Registered
prEN ISO/ASTM 52915 rev	Specification for additive manufacturing file format (AMF) Version 1.2	Registered
prEN/ISO/ASTM TR 52912	Technical Report for the Design of Functionally Graded Additive Manufactured Parts	Registered
prEN ISO/ASTM 52901	Additive manufacturing — General principles - Requirements for purchased AM parts (ISO/ASTM 52901:2017)	Registered
prEN ISO/ASTM 52942	Additive manufacturing — Qualification principles — Standard guideline for qualifying machine operators of powder bed-based laser beam machines in aerospace applications	Registered
prEN ISO/ASTM 52941	Additive manufacturing — System performance and reliability — Standard test method for acceptance of powder-bed fusion machines for metallic materials for aerospace application	Registered
prEN ISO/ASTM 52916	Additive manufacturing -- Data formats --Standard specification for optimized medical image data	To be registered
prEN ISO/ASTM 52932	Additive manufacturing – Environment, health and safety – Standard test method for determination of particle emission rates from desktop 3D printers using metal extrusion	To be registered

Table 4 – Standards to be adopted as EN after publication at ISO level

Project reference	Title	Next stage
prEN ISO 52903-1	Additive manufacturing — Standard specification for material extrusion based additive manufacturing of plastic materials — Part 1: Feedstock materials	A CEN enquiry was launched for comments during DIS (closed on 2016-08-03)
prEN ISO 52901	Additive manufacturing — General principles — Requirements for purchased AM parts	CEN enquiry and Publication
prEN ISO 52910	Standard practices — Guidelines for design for additive manufacturing	CEN enquiry and Publication

3. IDENTIFIED PARADDISE PROJECT STANDARDIZATION PRIORITIES

The PARRADISE project was represented by the author during the 4th CEN/TC 438 meeting that was held in Gijon, Spain on the 7th of September 2018.

 The minutes of the meeting are identified as document CEN-TC438_N0116 (available on request to RO).

Section 7 of such documents includes the standardization priorities that were identified by the KRAKEN project and by the PARADDISE project.

The document also reports, as an example to be possibly considered by other on-going EC founded research projects on AM, the outline of standardization activities that are currently being applied in the KRAKEN project and in the PARADDISE project. Such outline is reported here for the convenience of the reader.

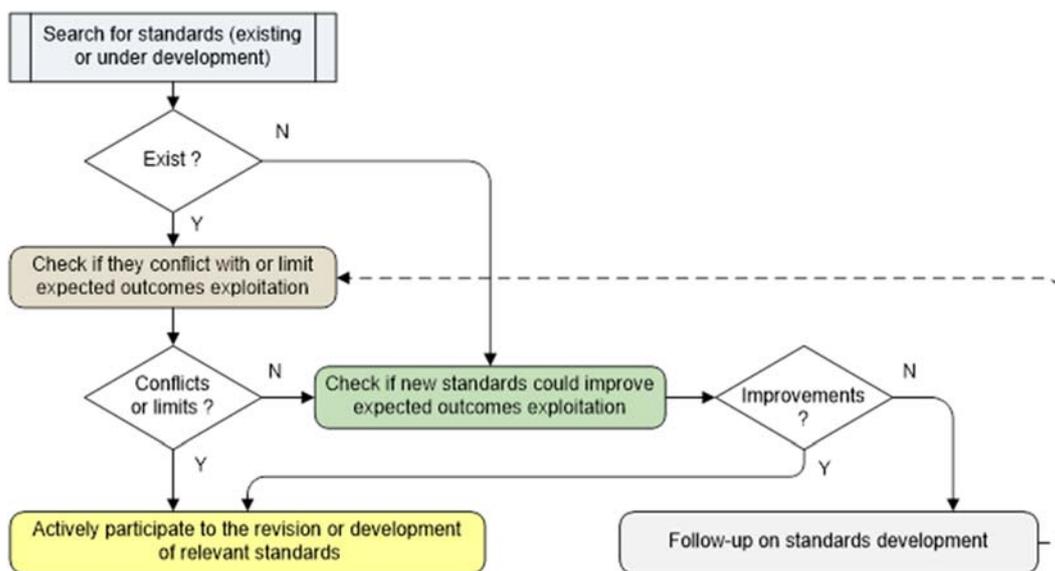


Figure 1 – Outline of standardization activities to be applied to each expected exploitable result

3.1. STANDARDIZATION PRIORITIES TRANSMITTED TO CEN/TC 438

The reported currently identified PARADDISE project standardization priorities are addressed in the subsequent sub-sections.

3.1.1. Design guidelines for Additive and Hybrid Manufacturing

It is felt that the presence of an ISO/ASTM document on this subject would be very beneficial for the exploitation of PARADDISE project results.

The planned course of action that shall be associated to this topic is addressed in Chapter 5 of this document, with due consideration of the complexities of the procedures for the generation of standards, that are detailed in Chapter 4.

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3.1.2. Health and safety issues

The identified issues include the following topics:

a. Operator exposure to metal powders

The subject is being addressed within the activities of ISO JG 69 (RO is a member of it) that is working on the development of ISO/ASTM 52931, *Additive manufacturing – Environment, health and safety – Standard guideline for the use of metallic feedstock*. The document (currently at the Preliminary Work Item (PWI) stage) will be soon balloted to become a New Work Item (NP) and will benefit from possible improvements deriving also from the availability of the following documents:

- VDI 3405 6.1: *Additive manufacturing processes, User safety on operating the manufacturing machines, Laser beam melting of metal parts*; currently only available in German at: http://www.vdi.eu/nc/guidelines/entwurf_vdi_3405_blat_61-additive_fertigungsverfahren_anwendersicherheit_beim_betrieb_der_fertigungsanla/
- UL 3400, *Outline of Investigation for Additive Manufacturing Facility Safety Management*; available at: https://standardscatalog.ul.com/standards/en/outline_3400_1



A copy of the current version of ISO/ASTM PWI 52931 can be made available on request to RO.

b. Hybrid machine tool safety

It is considered that it would be very beneficial to have a type C standard on the subject that would simplify the risk analysis as, if fulfilled, could constitute presumption of conformity.

c. Laser reflection issues

This subject is already individually addressed in EN ISO 11553-1:2005 *Safety of machinery -- Laser processing machines -- Part 1: General safety requirements* (currently undergoing Systematic Review (SR), at DIS stage). The document is a type B standard as stated in ISO 12100-1.

3.1.3. Qualification of Equipment, Operators and Processes in AM for aerospace applications

The referred topics are being addressed by ISO/TC 261 and ISO/TC 44/SC 14 JWG 5 (RO is a member of it). The work of this JWG currently include the following items of direct or indirect interest to the PARRADISE project as the attainment of their objectives could be extended to Directed Energy Deposition using laser beam and powder feedstock.

- a. ISO/ASTM WD 52941, *Additive manufacturing -- System performance and reliability -- Standard test method for acceptance of powder-bed fusion machines for metallic materials for aerospace application*.

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- b. ISO/ASTM WD 52942, *Additive manufacturing -- Qualification principles -- Standard guideline for qualifying machine operators of powder bed-based laser beam machines in aerospace applications*
- c. ISO/ASTM PWI 52943-1, *Additive manufacturing – Process characteristics and performance Part 1: Standard specification for Directed energy deposition using wire and arc in aerospace applications*
- d. ISO/ASTM PWI 52943-2, *Additive manufacturing – Process characteristics and performance Part 2: Standard specification for Directed energy deposition using wire and beam in aerospace applications*
- e. ISO/ASTM PWI 52943-3, *Additive manufacturing -- Process characteristics and performance -- Part 3: Standard specification for directed energy deposition using laser blown powder in aerospace applications*
- f. ISO/ASTM PWI 52944 *Additive manufacturing -- Process characteristics and performance -- Standard specification for powder bed processes in aerospace applications.*

3.2. PLANNED UPDATING OF PARADDISE PROJECT STANDARDIZATION NEEDS

This subject will be addressed in the PARRADISE project M24 meeting where preliminary identified standardization priorities will be confirmed / updated.

Relevant activities will be prioritized and carefully planned with due consideration to the fact that many of such activities would need to be executed / completed after the termination of the PARADDISE project.

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4. RECALL ON THE PROCEDURES FOR THE GENERATION OF ISO DELIVERABLES

This Chapter provides information that is considered to be indispensable for planning to propose extension to existing standards.

General information on the active participation to the development of ISO deliverables can be gathered at:

https://www.iso.org/files/live/sites/isoorg/files/archive/pdf/en/my_iso_job.pdf

4.1. ISO DELIVERABLES

There are different deliverables that can be developed by an ISO Technical Committee (TC). They are elicited here together with their concise description.

Additional information is available at: <https://www.iso.org/deliverables-all.html>

Official procedures to be followed when developing and maintaining an International Standard and procedures specific to ISO are available at:

<https://isotc.iso.org/livelink/livelink?func=ll&objId=4230452&objAction=browse&sort=subtype>

Principles to structure and draft documents intended to become International Standards, Technical Specifications or Publicly Available Specifications are available at:

<https://isotc.iso.org/livelink/livelink?func=ll&objId=4230456&objAction=browse&sort=subtype>

The different ISO deliverables are elicited here together with their concise description.

a. ISO Standards

An International Standard provides rules, guidelines or characteristics for activities or for their results, aimed at achieving the optimum degree of order in a given context. It can take many forms. Apart from product standards, other examples include: test methods, codes of practice, guideline standards and management systems standards.

b. ISO/TS Technical Specifications

A Technical Specification addresses work still under technical development, or where it is believed that there will be a future, but not immediate, possibility of agreement on an International Standard. A Technical Specification is published for immediate use, but it also provides a means to obtain feedback. The aim is that it will eventually be transformed and republished as an International Standard.

c. ISO/TR Technical Reports

A Technical Report contains information of a different kind from that of the previous two publications. It may include data obtained from a survey, for example, or from an informative report, or information of the perceived “state of the art”.

d. ISO/PAS Publicly Available Specifications

A Publicly Available Specification is published to respond to an urgent market need,

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representing either the consensus of the experts within a working group, or a consensus in an organization external to ISO. As with Technical Specifications, Publicly Available Specifications are published for immediate use and also serve as a means to obtain feedback for an eventual transformation into an International Standard. Publicly Available Specifications have a maximum life of six years, after which they can be transformed into an International Standard or withdrawn.

e. IWA International Workshop Agreements

Are addressed in section 4.4 of this Chapter

f. ISO Guides

Guides are just that. They help readers understand more about the main areas where standards add value. Some Guides talk about how, and why, ISO standards can make it work better, safer, and more efficiently.

Additional information on ISO guides is available at: <https://www.iso.org/iso-guides.html>

4.2. STAGES FOR DEVELOPING ISO STANDARDS

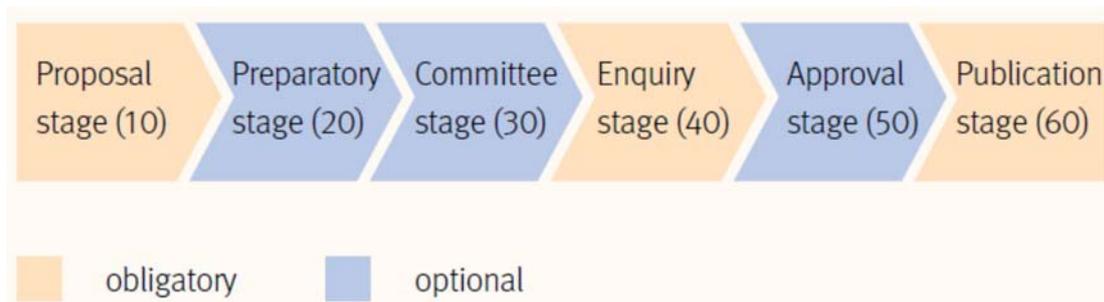


Figure 2 – Outline of stages for developing ISO standards

Abbreviations used for the ISO stages:

- (00) Preliminary Work Item
- (10) NWIP New Work Item Proposal
- (20) WD Working Draft
- (30) CD Committee Draft
- (40) DIS Draft International Standard
- (50) FDIS Final Draft International Standard
- (60) ISO International Standard

Registration of a Preliminary Work Item (00)

The registration of a PWI shall consider the following steps:

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- Identification of possible interested ISO Member Bodies
- Obtention of preliminary manifestation of interest by an ISO WG convener
- Identification of possible inclusion of the PWI within an existing JG portfolio
- Submission of the PWI to ISO/TC 261
- Registration of the PWI within ISO Global Directory

Proposal stage (10) (ISO/NP stage)

A New Work Item Proposal (NP) is submitted to the committee for vote using Form 4. The submission is performed by an ISO national member body therefore it needs the consensus and the support of the relevant national mirror committee to ISO/TC 261.

Main elements to be clarified when proposing a new work item shall include:

- Indication(s) of the preferred type or types of deliverable(s) to be produced
- Affected stakeholders
- Leadership commitment. *The proposer shall nominate a project leader*
- Purpose and justification including:
 - A simple and concise statement describing the business, technological, societal or environmental issue that the proposal seeks to address
 - Documentation on relevant global metrics that demonstrate the extent or magnitude of the economic, technological, societal or environmental issue, or the new market
 - Technological benefit — a simple and concise statement describing the technological impact of the proposal to support coherence in systems and emerging technologies, convergence of merging technologies, interoperability, resolution of competing technologies, future innovation, etc.
 - Economic benefit — a simple and concise statement describing the potential of the proposal to remove barriers to trade, improve international market access, support public procurement, improve business efficiency for a broad range of enterprises including small and medium sized ones, and/or result in a flexible, cost-effective means of complying with international and regional rules/conventions, etc.
 - Societal benefit(s) — a simple and concise statement describing any societal benefits expected from the proposed deliverable(s).
 - Environmental benefit(s) — a simple and concise statement describing any environmental or wider sustainability benefits expected from the proposed deliverable(s).
 - A simple and concise statement clearly describing the intended use(s) of the proposed deliverable(s), for example, whether the deliverable is intended as requirements to support conformity assessment or only as guidance or recommended best practices;

Main acceptance requirements for a New Work Item Proposal

- a. approval of the work item by a 2/3 majority of the P members of the technical committees or subcommittees voting — abstentions are excluded when the votes are counted; and

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- b. a commitment to participate actively in the development of the project, i.e. to make an effective contribution at the preparatory stage, by nominating technical experts and by commenting on working drafts, by at least 4 P members in committees with 16 or fewer P members, and at least 5 P members in committees with 17 or more P members; only P members having also approved the inclusion of the work item in the programme of work [see a)] will be taken into account when making this tally. If experts are not nominated on the form accompanying an approval vote, then the National Body's commitment to active participation will not be registered and considered when determining if the approval criteria have been met on this ballot.



In practical terms, before submitting a New Work Item Proposal it is necessary to ensure the proposal will get the support of at least four other ISO member bodies.

Preparatory stage (20) (ISO/WD stage)

Usually ASTM F 42 and ISO/TC 261 set up a joint working group to prepare the Working Draft (WD). The working group is made up of experts and a Convener (who is either nominated by ASTM F 42 or ISO/TC 261). Successive WDs can be circulated until the JG experts are satisfied that they have developed the best solution they can. The draft is then forwarded to ASTM F 42 and ISO/TC 261. ISO/TC 261 will decide which stage is to go to next (Committee stage or Enquiry stage).

Committee stage (30) (ISO/CD stage)

This stage is optional. During this stage, the draft from the working group is shared with the members of the parent committee. If the committee uses this stage, the Committee Draft (CD) is circulated to the members of the committee who then comment and/or vote using the electronic balloting portal. Successive CDs can be circulated until consensus is reached on the technical content. As the ISO/CD stage is optional it can be skipped. However, the launch of an ISO/DIS ballot skipping the ISO/CD stage requires a ISO/TC 261 Resolution (4 weeks electronic ballot).

Enquiry stage (40) (ISO/DIS stage)

The Draft International Standard (DIS) is submitted to the ISO Central Secretariat (ISO/CS) by the committee Secretary. It is then circulated to all ISO members who get 12 weeks to vote and comment on it. The DIS is approved if two-thirds of the P-members of the committee are in favor and not more than one-quarter of the total number of votes cast are negative.

Approval stage (50) (ISO/FDIS stage)

If this stage is used, the Final Draft International Standard (FDIS) is circulated to all ISO members for a two-month vote to decide whether a standard is suitable for publication. The standard is approved if two-thirds of the P-members of the committee are in favor and not more than one quarter of the total number of votes cast are negative.

Publication stage (60) (ISO)

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After the FDIS, only editorial corrections are made to the final text. It is published by the ISO Central Secretariat as an International Standard.

4.3. OVERVIEW OF STAGES FOR DEVELOPING OTHER ISO DELIVERABLES

The subject matter is addressed in the ISO/IEC Directives Part 1, Annex F. An extract of its item F.1 is reported here for the convenience of the reader.

F.1 Extract of the simplified diagram of options

Project stage	Normal procedure	Draft submitted with proposal	"Fast-track procedure" ^a	Technical Specification ^b	Technical Report ^c	Publicly Available Specification ^d
Proposal stage (see 2.3)	Acceptance of proposal	Acceptance of proposal	Acceptance of proposal ^a	Acceptance of proposal		Acceptance of proposal ^e
Preparatory stage (see 2.4)	Preparation of working draft	<i>Study by working group ^e</i>		Preparation of draft		Approval of draft PAS
Committee stage (see 2.5)	Development and acceptance of committee draft	<i>Development and acceptance of committee draft ^e</i>		Acceptance of draft	Acceptance of draft	
Enquiry stage (see 2.6)	Development and acceptance of enquiry draft	Development and acceptance of enquiry draft	Acceptance of enquiry draft			
Approval stage (see 2.7)	<i>Approval of FDIS ^f</i>	<i>Approval of FDIS ^f</i>	<i>Approval of FDIS ^f</i>			
Publication stage (see 2.8)	Publication of International Standard	Publication of International Standard	Publication of International Standard	Publication of Technical Specification	Publication of Technical Report	Publication of PAS

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4.4. INTERNATIONAL WORKSHOP AGREEMENT (IWA)

An International Workshop Agreement is a document developed outside the normal ISO committee system to enable market players to negotiate in an “open workshop” environment. International Workshop Agreements are typically administratively supported by a member body. The published agreement includes an indication of the participating organizations involved in its development. An International Workshop Agreement has a maximum lifespan of six years, after which it can be either transformed into another ISO deliverable or is automatically withdrawn.

4.4.1. Process for the development of an IWA

The subject matter is addressed by ISO/IEC Directives Part 1, Annex SI (Normative), see: https://www.iso.org/files/live/sites/isoorg/files/developing_standards/docs/en/iwa.pdf

The content of the presentation is extracted and reported here for the convenience of the reader.

IWA process steps 1, 2 and 3

Step 1	Step 2	Step 3
Make the proposal	Get ISO/TMB approval	ISO/CS circulates the details of the workshop
Approach ISO Central Secretariat or any ISO member with your proposal. Your proposal should include: <ul style="list-style-type: none"> ✓ Purpose and justification ✓ Relevant documents ✓ Lists of organizations that may be interested ✓ Indications of any ISO member body willing to act as Secretariat ✓ An estimate of the number of meetings if more than one is envisaged ✓ Details of any proposed special arrangements for distribution of the IWA 	<ul style="list-style-type: none"> • ISO/CS then circulates your proposal to the ISO/TMB for approval (checking any proposed distribution arrangements with the ISO/Sec-Gen). • The TMB will also formally assign / confirm the ISO member body who will be your secretariat for the project. • The ISO member body works with the proposer to decide full details of the Workshop: <ul style="list-style-type: none"> ✓ Price (if any fee) ✓ Time/Date/Venue ✓ Format ✓ Background ✓ Doc supply ✓ Process ✓ Chair 	<ul style="list-style-type: none"> • A notification – with the full details agreed at Step 2 – is circulated to all ISO members (by ISO/CS) • ISO member bodies can then circulate the proposal as widely as possible in order to publicize it to potentially interested parties. <p>Note: Any organization or company or individual is allowed to attend.</p>
Start - ISO/CS will normally take less than one month to process your proposal	Maximum of three months	Three months (90 days) advance notice is required before holding the workshop.

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IWA process steps 4 and 5

Step 4	Step 5
Hold the workshop and agree the document	Publish the IWA
<ul style="list-style-type: none"> At the meeting the Chair (nominated in advance) will be confirmed. During the whole IWA process, the Chair must be impartial and seek to ensure the maximum amount of consensus possible has been achieved. Document is drafted and circulated to the workshop participants. This can be repeated until the Chair believes that the best possible consensus has been obtained. <p>Note: One possible mechanism is that the workshop participants work online on a dedicated Web site.</p> <p>Note: Multiple meetings can take place if necessary.</p>	<ul style="list-style-type: none"> The final draft of the IWA is sent by the secretariat to ISO/CS. ISO/CS formats the document – giving it the relevant ISO cover page / logo. ISO/CS then supplies the document to all its member bodies who can supply it as they see fit. Any special arrangements for the distribution of the IWA should be put in place here.
This stage depends on the scope of the IWA. However, aim to finish in three months or less	One month

What is an IWA?

An IWA is an ISO document produced through a workshop meeting rather than through the full ISO technical committee process. Market players and other stakeholders directly participate in developing an IWA and do not have to go through a national delegation.

What subjects do they cover?

An IWA can be produced on any subject

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Why should I choose the IWA?

An IWA will:

- Involve the main players from your target sector (public or private) and allow a sector to develop clear rules on an issue.
- Give visibility to your professional practices or reference documents (ISO is a highly recognized international body).
- Help you shape the future direction of the subject and influence any future ISO standard.
- Allow you to develop relationships within a profession or sector.
- Create understanding and co-ordination amongst your various stakeholders.
- Share best practice in a sector.
- Improve quality and interoperability.
- Lead to worldwide visibility due to ISO members' distribution networks.
- Help you to develop a members-only forum to communicate using, for example, a dedicated Web site.

Who will be involved?

Anyone can propose an IWA and anyone can participate in developing one. An ISO member body will be assigned to help you organize and run the workshop. This gives the project credibility by ensuring that the basic principles of international standardization (transparency, fairness and consensus) are applied.

How much will it cost?

There are different ways of financing the costs of the IWA – in particular the workshop meeting(s). In some cases, the participants are charged a fee to attend; in others, a charge is made for the resulting document. You can also cover the costs yourself as an organization. Whatever the mechanism, the costs can be decided by you and the ISO member body that acts as your secretariat.

How do I start?

The process of developing an IWA is detailed on the preceding page in five-steps. To start, you can approach ISO/CS or an ISO member body for an informal discussion of your proposal.

- E-mail tmb@iso.org to contact ISO Central Secretariat directly, or click on the URL below to find an ISO member body <http://www.iso.org/isomembers>

4.4.2. Major drawbacks

Pursuing the development of an IWA could jeopardize possible future participation to the

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works of ISO/TC 261 and to its Working Groups as documented in the Resolution 9 (Stuttgart 2016) taken by Technical Committee ISO/TC 39, *Machine tools*, Subcommittee SC 2, *Test conditions for metal cutting machine tools*, that is contained in document ISO/TC39/SC2 N2288, and is textually reproduced here:

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RESOLUTION 9 (STUTT GART 2016) DISCUSSION ON “RELIABILITY OF MACHINE TOOLS BASED ON LIFE DATA ANALYSIS” PROJECT WORK AND INTEREST OF ISO/TC39/SC2 IN THIS SUBJECT AND FUTURE NWIP.

ISO/TC39/SC2 was informed that a European research group was working on a project dealing with machine tool reliability, a topic of ISO/TC39/SC2, and the research group suggested a CEN Workshop Agreement (CWA) as one of the research project’s deliverables.

As CEN/TC143 only deals with machine tool safety, the research group applied for an International Workshop Agreement (IWA); due to time constraints on the side of the research group, the application for an IWA has been withdrawn.

ISO/TC39/SC2 reviewed project findings, presented in documents N2236, and N2237 and considered relevance to ISO/TC39/SC2 scope of interest and its suitability for implementation as an ISO standard. The project was discussed at length. The committee recognized that there are many variables that will make the standardization of the projects findings impractical and would carry significant consequences for machine tool manufacturers and users alike. ISO/TC39/SC2 unanimously regarded the standardization of the results at the current stage as not suitable for industry.

ISO/TC39/SC2 appreciates that representatives of the research group were actively seeking contact with ISO/TC39/SC2 as the worldwide active expert group on machine tools. However, in course of dealing with the IWA subject, ISO/TC39/SC2 realized that an IWA could have been started without consultation with ISO/TC39/SC2.

ISO/TC39/SC2 has no possibility to veto an IWA, although stakeholders are well represented in ISO/TC39/SC2.



General apprehensions of ISO/TC39/SC2 in relation to any IWA development are that IWAs could be used to avoid discussion of a relevant topic within standing expert committees, such as ISO/TC39/SC2, and therefore circumventing the stakeholders represented in such committees.

ISO/TC39/SC2 requests ISO/TMB to reconsider the procedures for initiating an IWA and to include the possibility for TC or SC to veto an IWA if the topic is already covered by the scope of any ISO/TC and its subcommittees.

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As mentioned at the PARADDISE project kick-off meeting, it is strongly recommended to avoid getting involved in the development of an IWA related to Additive Manufacturing technologies of our interest.

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5. CONCLUSION AND PLANNED SUBSEQUENT ACTIONS

The content of this document will be discussed at the PARADDISE M24 meeting and the following resulting course of action is planned:

1. Clarification of issues related to the content of this document.
 2. Definition of actions deriving from the updated information provided by this document.
 3. Revision of expected project results.
 4. Revision of PARADDISE project partners' involvement in standardization works as originally defined in section 5.3 of Deliverable D6.3 including the identification of the need to increase the presence of partners in national committees.
 5. Revision and identification of PARADDISE project standardization priorities with due attention to the gaps already identified in the AMSC *Standardization Roadmap for Additive Manufacturing* as those will probably be addressed, in the near future, either by ISO/TC 261 or by ASTM F42.
 6. Decision on the possible need to propose New Work Items, remembering that such a move will need to identify a Project Leader willing to work and maintain his commitments for a significant time after the termination of the PARADDISE project.
 7. Decision on the opportunity to check, with the Project Officer, on the availability of schemes to support needed standardization activities that will be extending after the project termination. This subject could possibly be addressed in cooperation with CEN/TC 438 representatives as such Technical Committee was created on the mandate of the European Commission.
 8. Consideration on the feasibility, for German PARADDISE project partners, to possibly support the development of a VDI guideline, as a viable alternative to a New Work Item Proposal within the ISO/ASTM framework.
 9. Confirmation of the decision to avoid applying for the development of an International Workshop Agreement.
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