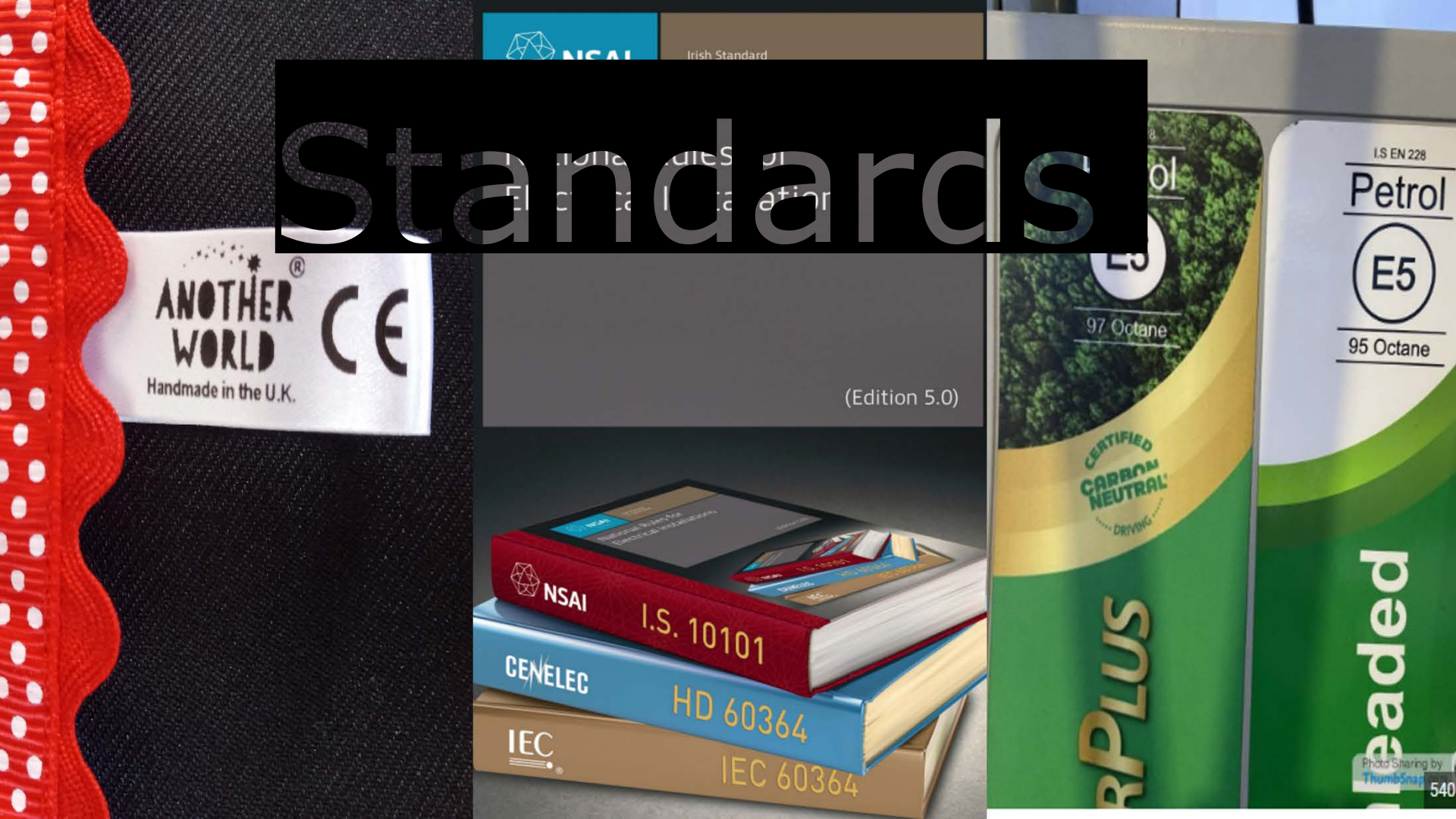
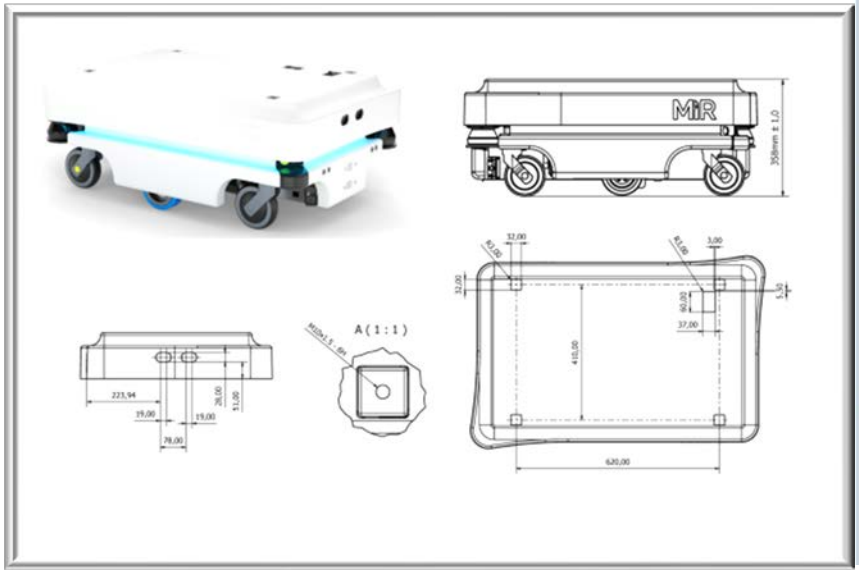
The AM Standards Powering Innovation

Standards


ANOTHER WORLD
Handmade in the U.K.
CE
Irish Standard
(Edition 5.0)
NSAI
I.S. 10101
CENELEC
HD 60364
IEC
IEC 60364
I.S EN 228
Petrol
E5
95 Octane
97 Octane
CERTIFIED
CARBON NEUTRAL
DRIVING
Photo Sharing by
ThumbSnap

Declaration of Conformity



CE

MiR

EU declaration of Conformity

according to the EU Machinery Directive 2006/42/EC, Annex II 1.A

Manufacturer
Mobile Industrial Robots ApS
Emil Neckelmanns Vej 15 F
DK-5220 Odense SØ

Person established in the Community authorized to compile the technical file
Flemming Thinggaard
Mobile Industrial Robots ApS
Emil Neckelmanns Vej 15F
DK - 5220 Odense SØ

Description and identification of the machinery

Product	MiR100 2.1 - Serial no. 180100002100850 and higher
Commercial name	MiR100
Function	MiR100: self-propelled vehicle (battery)
	MiR100 is an automatic vehicle that can transport materials internally within factories, warehouses, hospitals and a host of other industrial locations.
	The user provides the destination of product delivery via a web interface. MiR100 can be up to run a fixed route or be called on demand besides more special operations.
	MiR100 has a map that can be programmed the first time the vehicle is used. While operating, the MiR100 automatically avoids obstacles (people, furniture) that are not mapped.
	MiR100's internal map contains specific locations (office, hall, John's room etc.) which can be used for logistical planning.
	Each vehicle has its own network.
	The vehicle is controlled from a website (HTML5), which is accessed via a browser on a PC, tablet or smartphone.

It is expressly declared that the machinery fulfills all relevant provisions of the following EU Directives or Regulations:

2006/42/EC	Directive 2006/42/EC of the European Parliament and of the Council of 17 May 2006 on machinery, and amending Directive 95/16/EC (recast) (1)

Reference to the harmonized standards used:

EN 60204-1:2006+A1:2009	Safety of machinery – Electrical equipment of machines – Part 1: General requirements
EN ISO 12100:2010	Safety of machinery – General principles for design – Risk assessment and risk reduction (ISO 12100:2010)
EN ISO 13849-1:2015	Safety of machinery – Safety related parts of control systems – Part 1: General principles for design (ISO 13849-1:2015)
EN ISO 13849-2:2012	Safety of machinery – Safety related parts of control systems – Part 2: Validation (ISO 13849-2:2012)
EN ISO 13850:2015	Safety of machinery – Emergency stop function – Principles for design (ISO 13850:2015)
EN 1175-1:1998+A1:2010	Safety of industrial trucks – Electrical requirements – Part 1: General requirements for battery powered trucks

Reference of the other technical standards and specifications used:

EN 1525:1997-09	Safety of industrial trucks – Driverless trucks and their systems

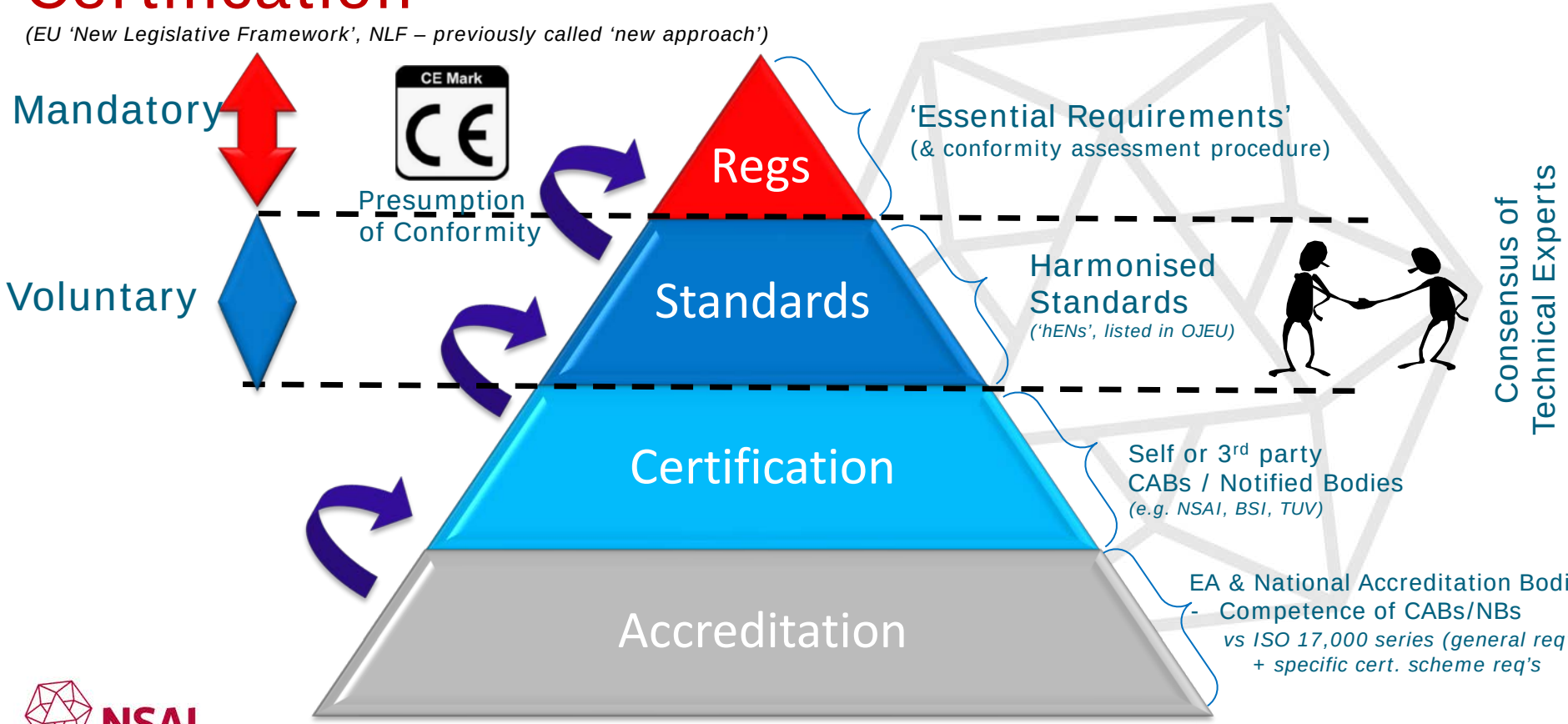
Odense SØ, 18 June 2018

Signature
Søren E. Nielsen
CTO

NSAI GUARDED

Links between Regulations, Standards & Certification

(EU 'New Legislative Framework', NLF – previously called 'new approach')



Market Surveillance @ MS level *(e.g. HPRA is 'Market Surveillance Authority' for Ireland for Medical Devices)*

Additive Manufacturing Standards

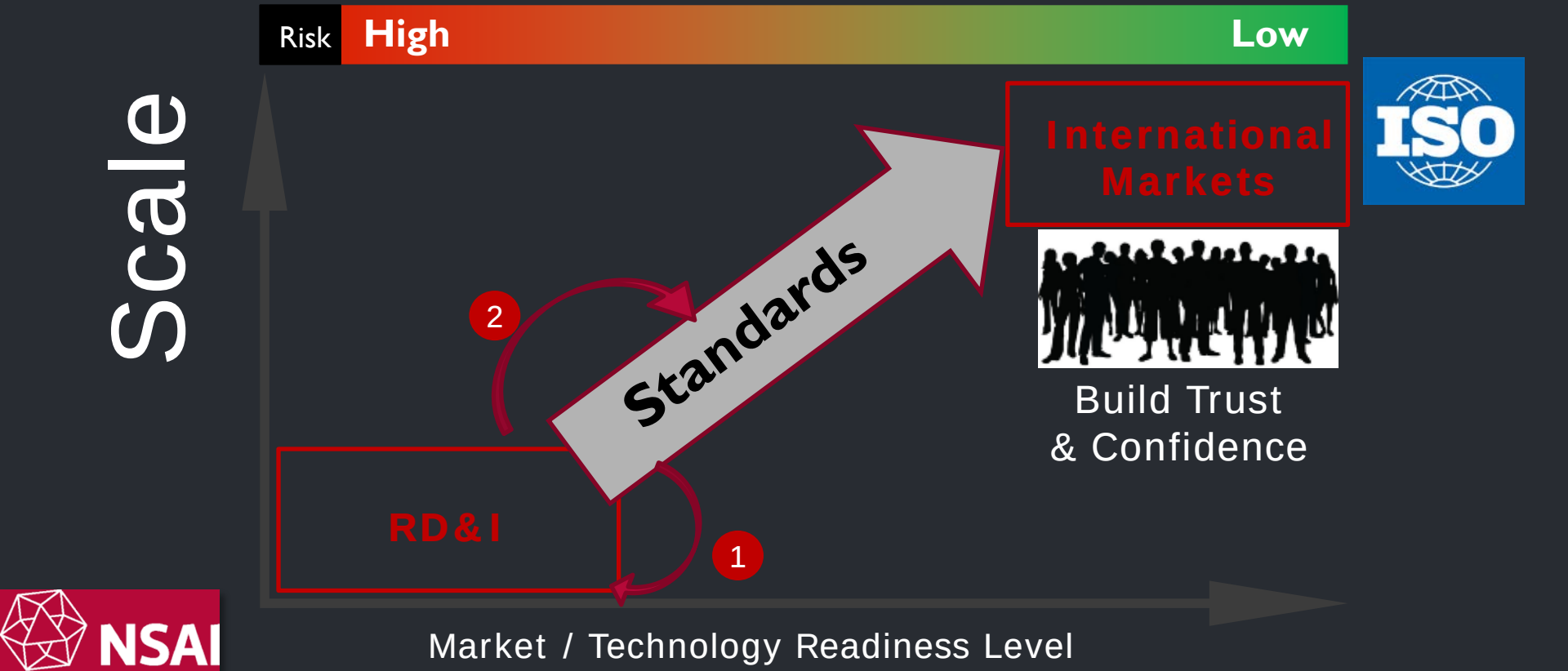
Guiding principles in AM Standardization

- One set of AM standards – to be used globally "One world – One Standard"
- Work on a common roadmap and organizational structure for AM standard
- Use and elaborate upon existing standards, modified for AM purposes when necessary to increase efficiency and effectiveness
- ISO/TC 261, ASTM F42 and CEN/TC 438 work together and in the same direction with an emphasis on joint standards development

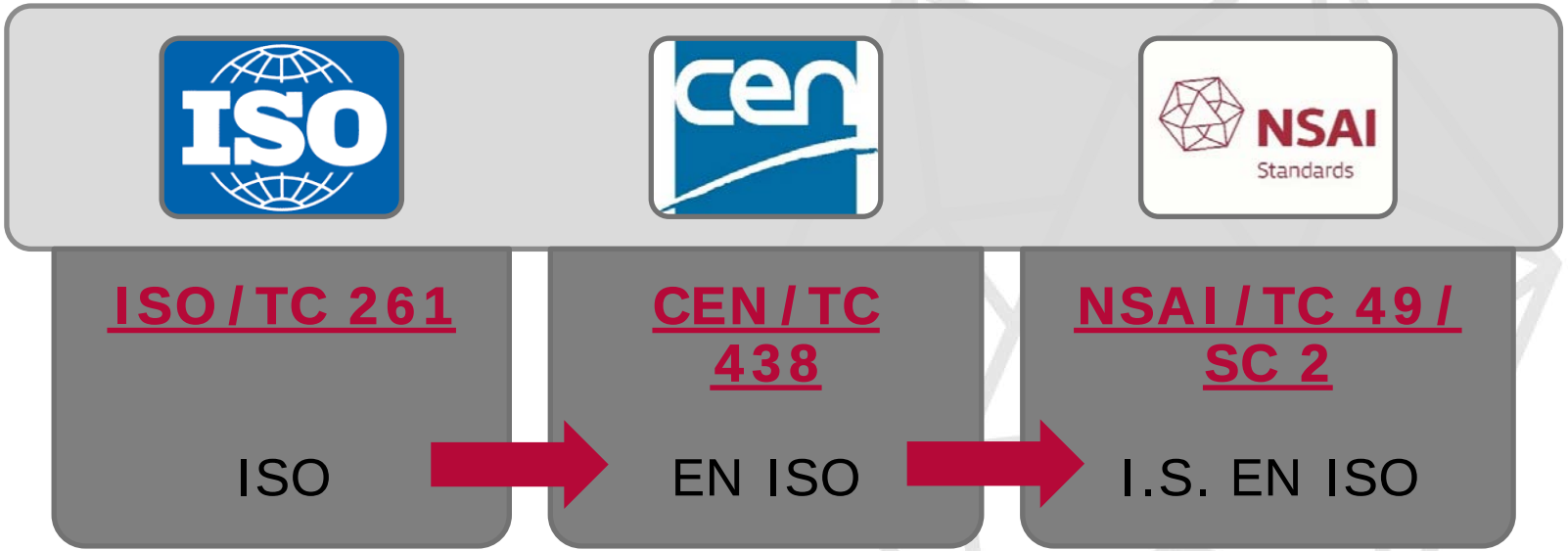
Global Standards used locally worldwide

Why Standards - Help Bridge the Innovation Gap for Impact @ Global Scale

De-risk & Accelerate Technology-Product-Service Development, Adoption & Scaling via International Standards

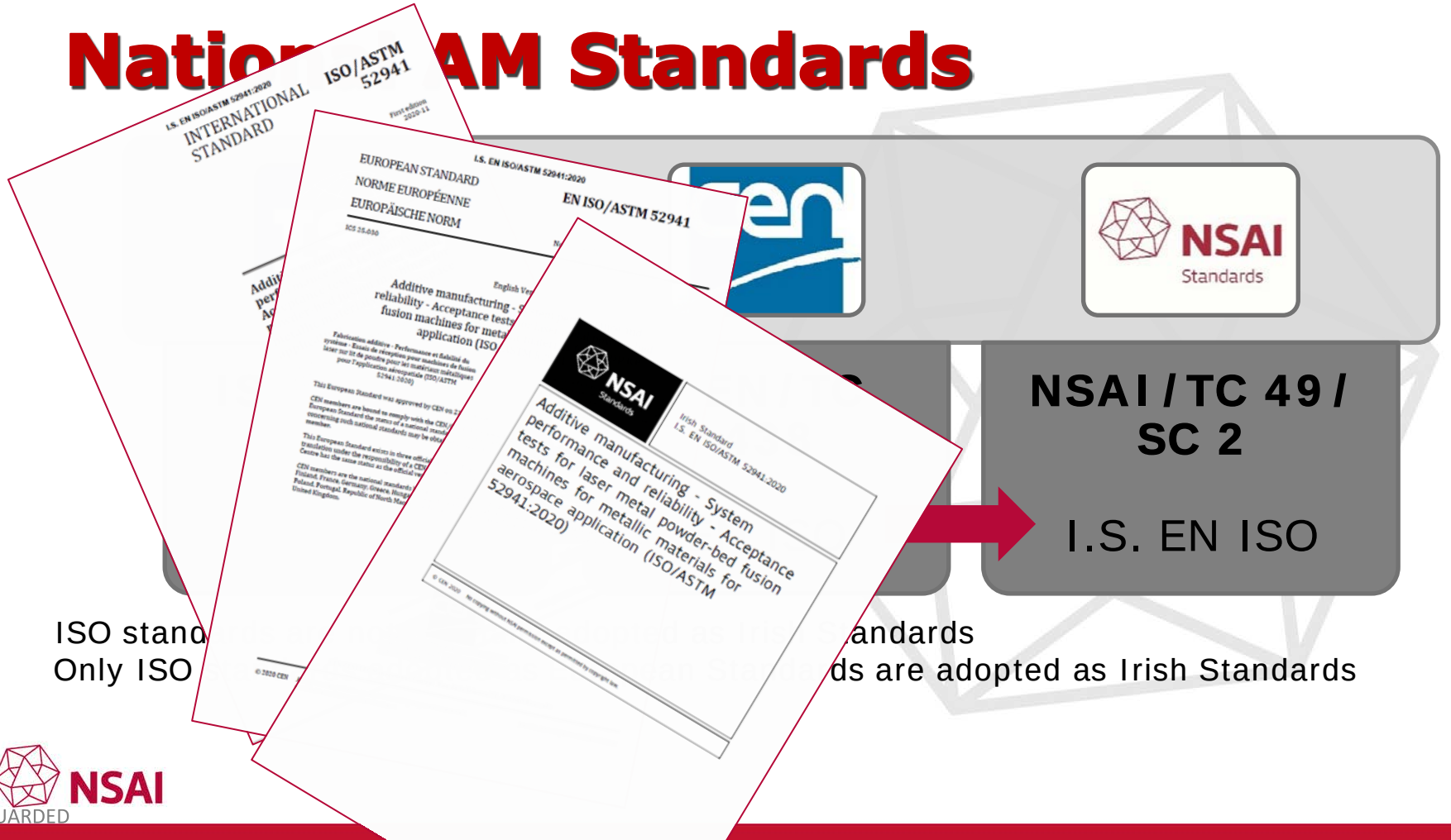


National AM Standards



ISO standards are not normally adopted as Irish Standards
Only ISO standards adopted as European Standards are adopted as Irish Standards

Nation AM Standards



ISO stand andards
Only ISO ds are adopted as Irish Standards

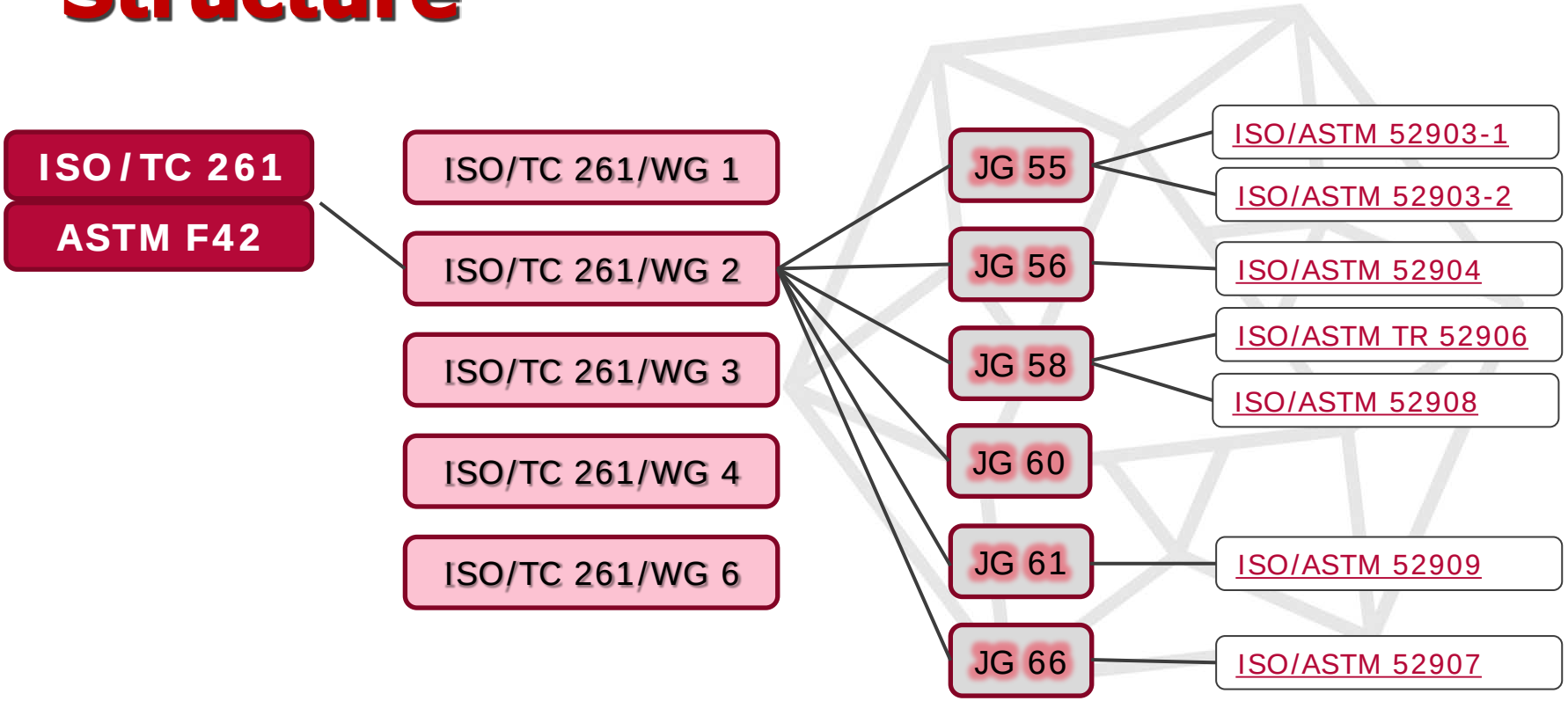
ISO/TC 261 – Additive Manufacturing

Secretariat – DIN (Germany)
28 P-members (including IRELAND)

46 Published Standards
21 Standards under development

WG 1	Terminology
WG 2	Methods, processes and materials
WG 3	Test methods
WG 4	Data & design
WG 6	Environment, health & safety
JWG 10	Aerospace

Structure



Terminology

ISO/ASTM 52900:2021
General principles — Fundamentals and vocabulary

Materials

Personnel

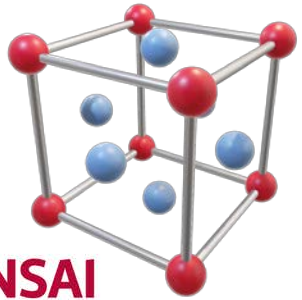
Process

Testing, QA

Standards in Additive Manufacturing

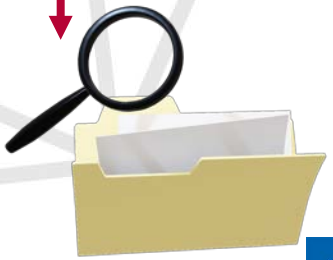
Data & Design

Process



Materials

Personnel



Testing, QA

NSAI

GUARDED

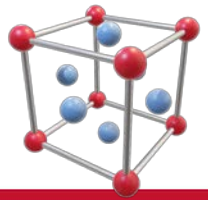
ISO

Standards in Additive Manufacturing

Data & Design

Process

Materials



Personnel

Testing, QA

NSAI

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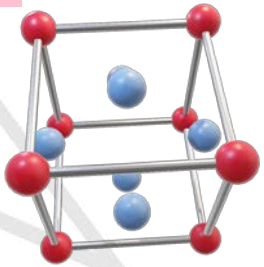
ISO

Data & Design

ISO/ASTM 52912:2022
Additive manufacturing — Design — Functionally graded additive manufacturing



ISO/ASTM 52910:2018
Design — Requirements, guidelines and recommendations

ISO/ASTM TR 52912:2020
Design — Functionally graded additive manufacturing

ISO/ASTM 52911-1:2019
Design — Part 1: Laser-based powder bed fusion of metals

ISO/ASTM 52911-2:2019
Design — Part 2: Laser-based powder bed fusion of polymers

ISO/ASTM 52915:2020
Specification for additive manufacturing file format (AMF) Version 1.2

ISO/ASTM 52916:2022
Additive manufacturing for medical — Data — Optimized medical image data

ISO/ASTM 52950:2021
General principles — Overview of data processing

ISO/ASTM 52911-3:2023
Additive manufacturing — Design — Part 3: PBF-EB of metallic materials

ISO/ASTM 52911-3:2023
Additive manufacturing — Design — Part 3: PBF-EB of metallic materials

Materials

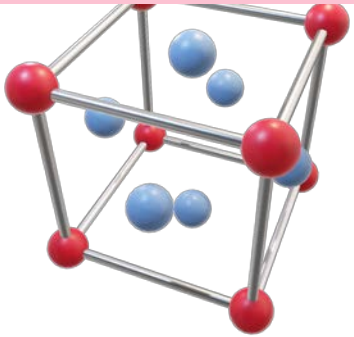
ISO/ASTM 52931:2023 Additive manufacturing of metals — Environment, health and safety — General principles for use of metallic materials

ISO/ASTM 52903-1:2020
Material extrusion-based additive manufacturing of plastic materials — Part 1: Feedstock materials

ISO/ASTM 52928:2024
Additive manufacturing of metals— Feedstock materials — Powder life cycle management

ISO/ASTM 52903-2:2020
Material extrusion-based additive manufacturing of plastic materials — Part 2: Process equipment

ISO/ASTM 52928:2024
Additive manufacturing of metals— Feedstock materials — Powder life cycle management



ISO/ASTM 52907:2019
Feedstock materials — Methods to characterize metal powders

ISO ASTM 52925:2022
Additive manufacturing of polymers — Feedstock materials — Qualification of materials for laser-based powder bed fusion of parts

Personnel

ISO/ASTM 52935:2023
Additive manufacturing of metals — Qualification principles — Qualification of coordination personnel

ISO/ASTM 52926-1:2023
Qualification principles — Part 1: General qualification of operators

ISO/ASTM 52930:2021
Additive manufacturing — Qualification principles — Installation, operation and performance (IQ/OQ/PQ) of PBF-LB equipment

ISO/ASTM 52945:2023
Additive manufacturing for automotive — Qualification principles — Generic machine evaluation and specification of key performance indicators for PBF-LB/M processes

Personnel Testing, QA

Process

ISO 17296-2:2015
Additive manufacturing — General principles — Part 2: Overview of process categories and feedstock

ISO/ASTM 52903-2:2020
Material extrusion-based additive manufacturing of plastic materials — Part 2: Process equipment

ISO/ASTM 52904:2019
Process characteristics and performance — Practice for metal powder bed fusion process to meet critical applications

ISO/ASTM 52908:2023
System performance and reliability — Acceptance tests for laser metal powder-bed fusion machines for metallic materials for **aerospace** application

ISO/ASTM 52904:2024 Process characteristics and performance — Metal powder bed fusion process to meet critical applications

ISO/ASTM 52920:2023
Additive manufacturing — Qualification principles — Requirements for industrial additive manufacturing processes and production sites

Testing & Inspection

Data & Design

Process

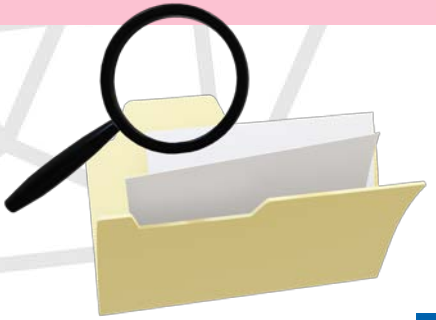
ISO/ASTM TR 52905:2023
Additive manufacturing of metals — Non-destructive testing and evaluation — Defect detection in parts

ISO/ASTM 52902:2019
Test artifacts — Geometric capability assessment of additive manufacturing systems

ISO/ASTM TR 52906:2022
Additive manufacturing — Non-destructive testing — Intentionally seeding flaws in metallic parts

ISO/ASTM 52901:2017
General principles — Requirements for purchased AM parts

ISO/ASTM TR 52917:2022
Additive manufacturing — Round robin testing — General guidelines



ISO/ASTM 52908:2023
Additive manufacturing of metals — Finished part properties — Post-processing, inspection and testing of parts produced by powder bed fusion

Testing, QA

In development

Design — Directed energy deposition of metals

metals — Qualification principles — Tasks and related skills for AM

Registration of data acquired from process monitoring and for quality control

ceramics — Design — Design guidelines

Non-destructive testing and evaluation — Classification of imperfections in DED parts

Data capturing and structure for PBF-LB/M machine log

File format support, ecosystem and evolutions

Tasks and related skills for AM

Data packages for AM part

Safety requirements for PBF-LB machines

Compression validation coupons for lattice designs

Manufacturing Standards supporting Business

3D scanning of patient limb
– point cloud data

IRISH MANUFACTURING RESEARCH

Prescription and rectification
– CAD data

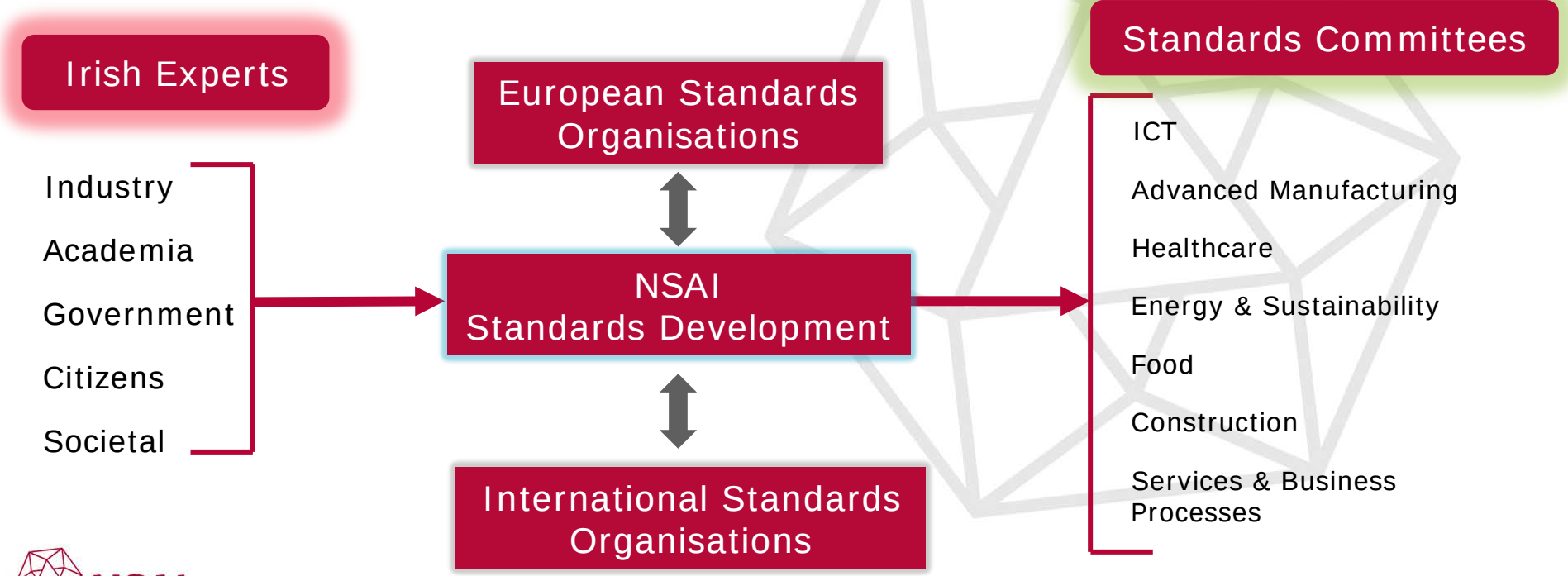
APOS
Atlantic Prosthetic Orthotic Service

Additive Manufacture
– physical part

ISO /ASTM 52950:2021 – Overview of data processing. This Standard supported identification of best practice for data handling	ISO/ASTM 52902:2019 – Geometric accuracy of a Manufacturing Process. This Standard supported qualification of machines used to build test coupons and product, and provided useful tools for ongoing process control	ISO/ASTM 52901:2017 – General requirements of AM parts. This standard supported risk control activities during design development and process validation	ISO/ASTM 52921:2013 - Standard terminology for additive manufacturing — Coordinate systems and test methodologies. This standard supported communication and documentation of best practice clearly and unambiguously

Standards were identified and leveraged to determine, measurables Critical to Quality design, that enabled this innovation

NSAI role – Connect & Facilitate



Preliminary Work Items

Reference	Document title	Developing committee
ISO/ASTM PWI 52956	Additive Manufacturing - Additive Manufacturing for Spaceflight — General principles — Requirements for metal laser beam powder bed fusion additive systems	ISO/TC 261/JG 72
ISO/ASTM PWI 52900	Additive manufacturing — General principles — Fundamentals and vocabulary	ISO/TC 261/JG 51
ISO/ASTM PWI 52973	Additive manufacturing — Design — Vat Photopolymerization	ISO/TC 261/JG 54
ISO/ASTM PWI 52971	Additive manufacturing - NDT - Dimensional measurements on XCT images	ISO/TC 261/JG 59
ISO/ASTM PWI 52968	Additive Manufacturing of Metals — Test Artifacts — Load bearing cross section area determination for small/medium size as deposited specimens for mechanical properties determination	ISO/TC 261/JG 76
ISO/ASTM PWI 52964	Additive manufacturing – Environment, health and safety – Qualification principles for life cycle assessment of parts and processes	ISO/TC 261/WG 6
ISO/ASTM PWI 52963	Additive manufacturing for construction – General Principles – Evaluation of Structural Printed Elements	ISO/TC 261/JG 80
ISO/ASTM PWI 52962	Additive manufacturing for construction – General Principles – Design Process of Additively Manufactured Construction Elements	ISO/TC 261/JG 80
ISO/ASTM PWI 52960	ISO/TC 261Additive manufacturing — Qualification principles — Optical properties of fixed resolution UV engine	ISO/TC 261
ISO/ASTM PWI 52954-2	Additive manufacturing — Qualification principles — Part 2: Specific PBF-LB/M failure modes used for risk mapping	ISO/TC 261/JG 75
ISO/ASTM PWI 52947	Additive Manufacturing — Feedstock materials — Nickel alloy UNS N06625 for Powder bed fusion	ISO/TC 261/JG 81

Approved Work Items

Reference	Document title	Developing committee
ISO/ASTM NP 52972	Additive manufacturing — Qualification principles — Test method for the gas permeability of sand moulds and cores designed with a property control structure	ISO/TC 261/JG 77
ISO/ASTM NP 52961	Additive manufacturing of polymers — Environment, health and safety — General principles for use of polymers with material extrusion	ISO/TC 261/JG 69

Published Standards

- ISO 17295:2023 Additive manufacturing — General principles — Part positioning, coordinates and orientation
- ISO 17296-2:2015 Additive manufacturing — General principles — Part 2: Overview of process categories and feedstock
- ISO 27548:2024 Additive manufacturing of plastics — Environment, health, and safety — Test method for determination of particle and chemical emission rates from desktop material extrusion 3D printer
- ISO/ASTM 52900:2021 Additive manufacturing — General principles — Fundamentals and vocabulary
- ISO/ASTM 52901:2017 Additive manufacturing — General principles — Requirements for purchased AM parts
- ISO/ASTM 52902:2023 Additive manufacturing — Test artefacts — Geometric capability assessment of additive manufacturing systems
- ISO/ASTM 52903-1:2020 Additive manufacturing — Material extrusion-based additive manufacturing of plastic materials — Part 1: Feedstock materials
- ISO/ASTM 52903-2:2020 Additive manufacturing — Material extrusion-based additive manufacturing of plastic materials — Part 2: Process equipment
- ISO/ASTM 52904:2024 Additive manufacturing of metals — Process characteristics and performance — Metal powder bed fusion process to meet critical applications

Published Standards

- ISO/ASTM TR 52905:2023 Additive manufacturing of metals — Non-destructive testing and evaluation — Defect detection in parts
- ISO/ASTM TR 52906:2022Additive manufacturing — Non-destructive testing — Intentionally seeding flaws in metallic parts
- ISO/ASTM 52907:2019 Additive manufacturing — Feedstock materials — Methods to characterize metal powders
- ISO/ASTM 52908:2023 Additive manufacturing of metals — Finished part properties — Post-processing, inspection and testing of parts produced by powder bed fusion
- ISO/ASTM 52909:2024 Additive manufacturing of metals — Finished part properties — Orientation and location dependence of mechanical properties for metal parts
- ISO/ASTM 52910:2018 Additive manufacturing — Design — Requirements, guidelines and recommendations
- ISO/ASTM 52911-1:2019 Additive manufacturing — Design — Part 1: Laser-based powder bed fusion of metals
- ISO/ASTM 52911-2:2019 Additive manufacturing — Design — Part 2: Laser-based powder bed fusion of polymers
- ISO/ASTM 52911-3:2023 Additive manufacturing — Design — Part 3: PBF-EB of metallic materials

Published Standards

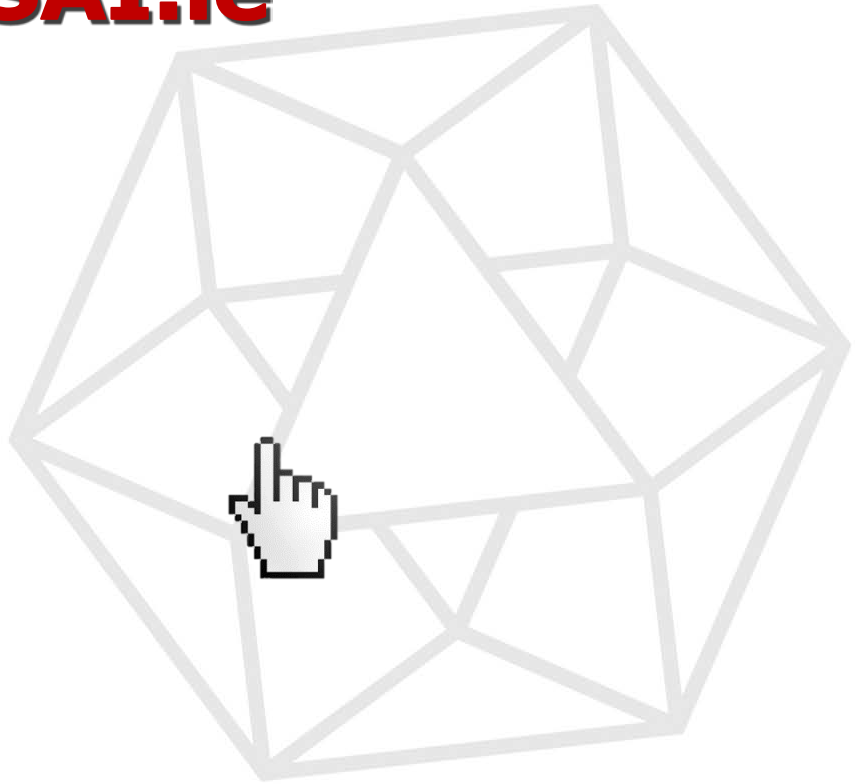
- ISO/ASTM TR 52912:2020 Additive manufacturing — Design — Functionally graded additive manufacturing
- ISO/ASTM 52915:2020 Specification for additive manufacturing file format (AMF) Version 1.2
- ISO/ASTM TR 52916:2022 Additive manufacturing for medical — Data — Optimized medical image data
- ISO/ASTM TR 52917:2022 Additive manufacturing — Round robin testing — General guidelines
- ISO/ASTM 52920:2023 Additive manufacturing — Qualification principles — Requirements for industrial additive manufacturing processes and production sites
- ISO/ASTM 52924:2023 Additive manufacturing of polymers — Qualification principles — Classification of part properties
- ISO/ASTM 52925:2022 Additive manufacturing of polymers — Feedstock materials — Qualification of materials for laser-based powder bed fusion of parts
- ISO/ASTM 52926-1:2023 Additive manufacturing of metals — Qualification principles — Part 1: General qualification of operators
- ISO/ASTM 52926-2:2023Additive manufacturing of metals — Qualification principles — Part 2: Qualification of operators for PBF-LB

Published Standards

- ISO/ASTM 52926-3:2023 Additive manufacturing of metals — Qualification principles — Part 3: Qualification of operators for PBF-EB
- ISO/ASTM 52926-4:2023 Additive manufacturing of metals — Qualification principles — Part 4: Qualification of operators for DED-LB
- ISO/ASTM 52926-5:2023 Additive manufacturing of metals — Qualification principles — Part 5: Qualification of operators for DED-Arc
- ISO/ASTM 52927:2024 Additive manufacturing — General principles — Main characteristics and corresponding test methods
- ISO/ASTM 52928:2024 Additive manufacturing of metals — Feedstock materials — Powder life cycle management
- ISO/ASTM TS 52930:2021 Additive manufacturing — Qualification principles — Installation, operation and performance (IQ/OQ/PQ) of PBF-LB equipment
- ISO/ASTM 52931:2023 Additive manufacturing of metals — Environment, health and safety — General principles for use of metallic materials
- ISO/ASTM 52933:2024 Additive manufacturing — Environment, health and safety — Test method for the hazardous substances emitted from material extrusion type 3D printers in the non-industrial places
- ISO/ASTM 52935:2023 Additive manufacturing of metals — Qualification principles — Qualification of coordination personnel

Slides Available on website

Get involved – NSAI.ie

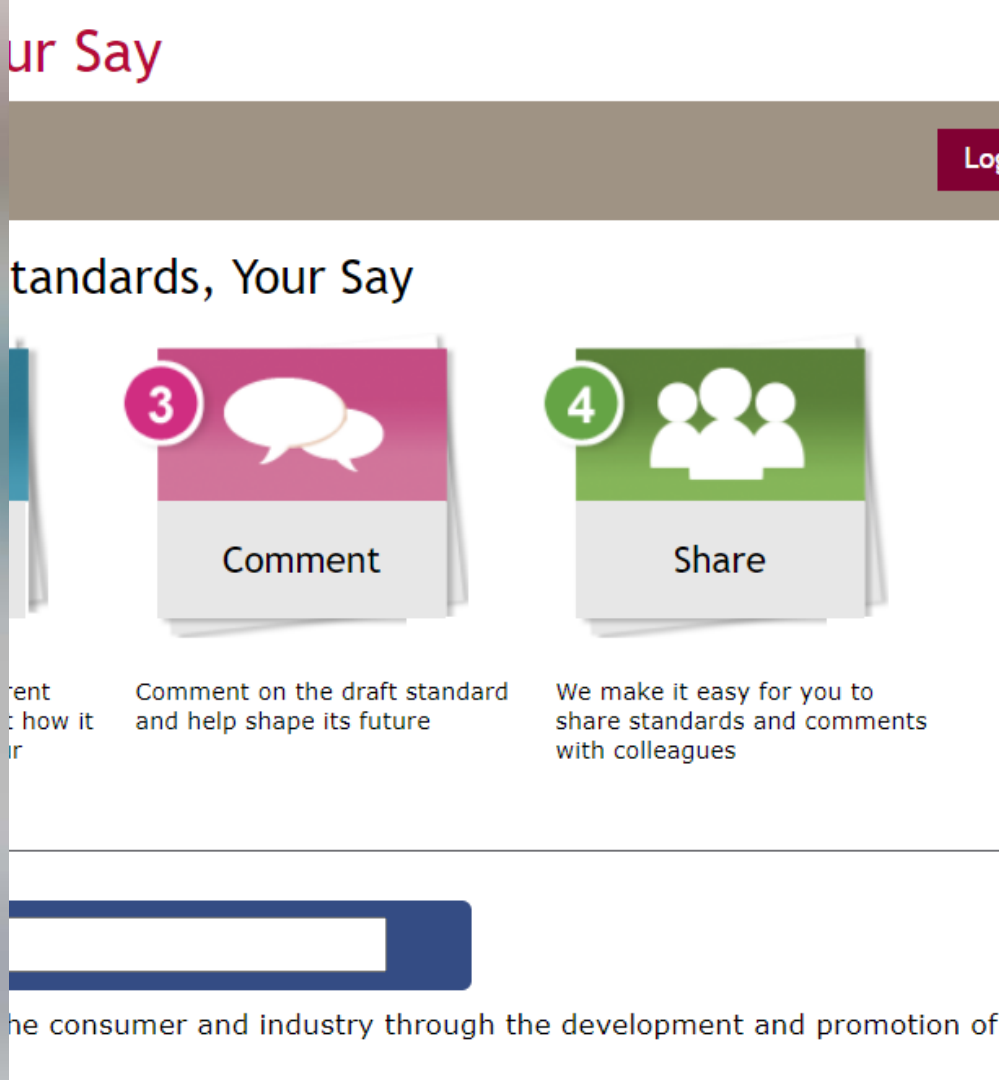


Input to draft Standards

Your Standards, Your Say

Review, Read & Comment on drafts

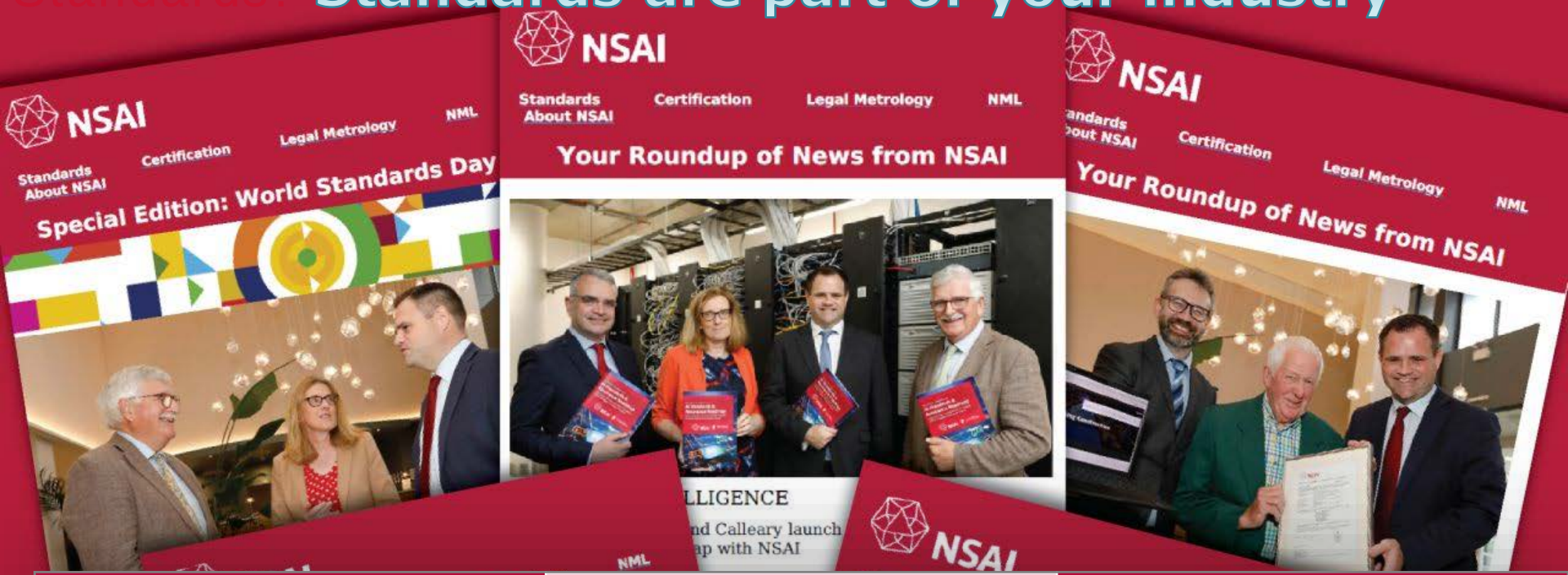
www.nsainep.ie



NSAI.ie/ezine

Standards?

Standards are part of your industry



You can see the Standards as they develop

You can be part of the Standard as it develops

National Standard Bodies are here to help you

Standards?

Standards are part of your industry

You can see the Standards as they develop

You can be part of the Standard as it develops

NSAI is here to help you

Thank you.

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Barry.Cox@nsai.ie

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