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Cooperation for the development of prEN 13455-14
*Unfired pressure vessels – Part 14: Additional requirements for
pressure equipment and pressure components fabricated with
additive manufacturing methods*

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We will very briefly address the following topics:

- Objectives of the presentation
- Standardization Roadmap for Additive manufacturing
- Cooperation between ASTM F42 and ISO/TC 261
- VDA and CEN/TC 438 AM standardization activities
- The EN 13455 series of standards
- CEN/TC 54/WG 11 – Cooperation between CEN/TC 54 and CEN/TC 438
- Structure of prEN 13455-14
- On-going and planned activities of CEN/TC 54/WG 11
- Conclusions

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I am a member of:

ASTM F42 – Additive Manufacturing

ASTM E07 – Nondestructive Testing

ISO/TC 261 and CEN/TC 438 – Additive Manufacturing

Objectives of the presentation

The technical content of this presentation is available as an article included in the proceedings of the Conference that:

- Provides an overview of published standards and standards under development related to Additive Manufacturing, updated to February 2019
- Addresses the on-going cooperation between CEN/TC 438 and CEN/TC 54 Technical Committees for the development of prEN 13455-14
- Informs about the draft structure of the document resulting from the kick-off meeting of CEN/TC 54/WG11 meeting held in Paris on the 20th of February 2019

In June 2018, the America Makes and ANSI Additive Manufacturing Standardization Collaboration (AMSC), published version 2.0 of the: **Standardization Roadmap for Additive Manufacturing** available at:

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

That also provides access to the **AMSC Standards Landscape** that contains the list of some 400 existing standards related to Additive Manufacturing (AM).

The focus is on the industrial AM market, especially for Aerospace, Defense and Medical applications

The Roadmap has identified **93 open gaps** and corresponding recommendation across five topical areas:

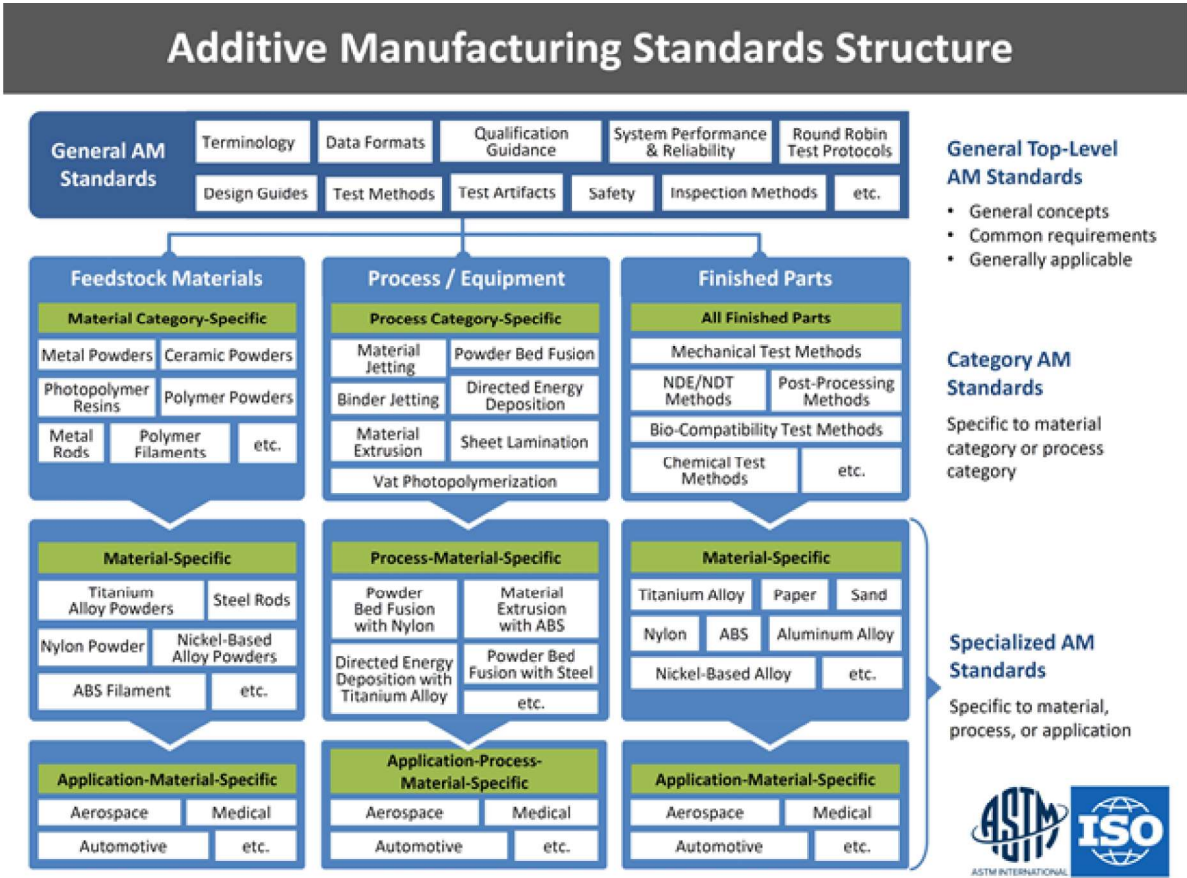
- Design
- Process and Materials (precursor materials, process control, post processing and finished material properties)
- Qualification and certification
- Nondestructive evaluation
- Maintenance

A “gap” means no published standard or specification exists that covers the particular issue.

The AMSC Roadmap is used as “the reference” by all major Standard Development Organizations (SDO)

By end of 2011, ASTM International and ISO have signed a Partner Standards Development Organization agreement (PSDO) to govern the collaborative effort between ASTM Committee F42 on *Additive Manufacturing Technologies* and ISO/TC 261 on Additive Manufacturing.

- The purpose of the PSDO is to eliminate duplication of efforts while maximizing resources allocation.
- It establishes the procedures to be applied for the development of new standards through Joint Groups composed with balanced participation of experts nominated by ASTM F42 and ISO/TC 261
- The two organizations publish dual logo standards related to AM.
- The last joint meeting took place in Auburn, Alabama, between March 26 and March 29 2019.
- Next joint meeting will be held in Paris between September 16 and September 20.



The article provides:

- The list of published standards (9), available at:
<https://www.iso.org/committee/629086/x/catalogue/p/1/u/0/w/0/d/0>
- The list of standards under development (25), 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 the ISO website

- The list of ASTM F42 published standards (18), available at:
<https://www.astm.org/BOOKSTORE/BOS/1004.htm>
- The list of VDI 3405 published guidelines (13), available at:
https://www.vdi.eu/index.php?id=44061&tx_wmdbvdiriliseach_pi1%5brilnr%5d=3405&tx_wmdbvdiriliseach_pi1%5bbblattnr%5d=&tx_wmdbvdiriliseach_pi1%5bCMD%5d=redirect&tx_wmdbvdiriliseach_pi1%5bmode%5d=1
- The list of standards addressed by CEN/TC 438, available at:
https://standards.cen.eu/dyn/www/f?p=204:32:0:::FSP_ORG_ID,FSP_LANG_ID:1961493,25&cs=1DBC499E4A879D8D3D3862EB0C6702EE4

The EN 13455 series of standards

- The drafting and maintenance of EN 13455 series of standards is under the responsibility of CEN/TC 54 – Unfired pressure vessels.
- It provides rules for design, fabrication and inspection of pressure vessels.
- It provides one means of conforming to essential safety requirements of the Pressure Equipment Directive (so called PED).
- Through the publication of its reference in the Official Journal of European Union, it gives presumption of conformity to the essential safety requirements identified in annex ZA of each Part.
- EN 13455 series also provides documents addressing additional requirements for pressure vessels and components made of specific materials or fabricated applying specific processes.

As the application of Additive Manufacturing technologies may provide significant benefits to the manufacturing of Pressure Equipment, the stakeholders of CEN/TC 54 decided to work on the drafting of prEN 13455-14, *Unfired pressure vessels – Part 14: Additional requirements for pressure equipment and pressure components fabricated with additive manufacturing methods*.

- To properly tackle the issue, it was indispensable to seek for competences related to both Pressure Equipment and Additive Manufacturing standardization expertise.
- The natural approach would have been to create a Joint Working Group including experts from CEN/TC 54 – Unfired pressure vessels and CEN/TC 438 – Additive manufacturing.
- As CEN rules do not foresee the creation of Joint Working Groups, the two involved Technical Committees agreed on the creation of a Working Group (WG 11) acting within the framework of CEN/TC 54, where the Chairperson is nominated by CEN/TC 54 and the Secretary is nominated by CEN/TC 438.
- Experts to CEN/TC 54/WG 11 are nominated by CEN National Member Bodies (NMB) that are active within each one of the two concerned Technical Committees.

- The structure of the preliminary working draft (WD) of the document was derived from the structure of EN 13455-10 and it provides requirements in addition to the general requirements for unfired pressure vessels under EN 13445-1:2014, EN 13445-2:2014, EN 13445-3:2014, EN 13445-4:2014 and EN 13445-5:2014.
- The specification of requirements related to the application of different Additive Manufacturing processes is addressed in specific normative Annexes that, for the moment being, concern:
 - Directed Energy Deposition (DED) and
 - Powder Bed Fusion (PBF) technologies related to the fabrication of metallic components.

The kick-off meeting of CEN/TC 54/WG 11 took place in Paris on February 20, 2019 and saw the participation of 10 experts from France, Germany, Great Britain and Italy that worked very effectively and obtained the following preliminary results:

- The drafting of Annex A will be tackled by the German delegation.
It will initially address Wire and Arc Additive Manufacturing (WAAM) applied to aluminum and aluminum alloys to be then extended to other DED technologies and to other metallic materials.
- The drafting of Annex B will be tackled by the French delegation.
It will initially address Laser Powder Bed Fusion of metals to be then extended to Electron Beam Powder Bed Fusion of metals. Later on, the inclusion of PBF processes applied to the fabrication of plastic parts will eventually be envisaged.
- Next scheduled meeting dates and venues are:
 - May 28, 2019 Munich;
 - July 02, 2019 Paris;
 - October 15, 2019 Frankfurt.

Conclusions

- The application of Additive Manufacturing (AM) processes to the fabrication of Pressure Equipment components can be very beneficial.
- The knowledge on published standards and standards under development related to AM technologies is very important.
- The definition of the additional requirements specified in prEN 13455-14 are indispensable for the effective industrial uptake of the referred technologies within the reference field.
- Active participation to the works of CEN/TC 54/WG 11 is warmly recommended.
- Interested stakeholders should contact their National Member Bodies (NMB) to CEN/TC 54 – Unfired pressure vessels or to CEN/TC 438 – Additive manufacturing.
- In Italy, the NMB to CEN/TC 54 is CTI – Comitato Termotecnico Italiano
Contact Mrs. Lucilla LUPPINO, luppino@cti2000.it
- whereas the NMB to CEN/CT 438 is UNINFO
Contact Mrs. Sara GILIO, gilio@uninfo.it

Thank you for your attention!

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