

MEDIA RELEASE

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New Technical Reference for local SMEs to seize opportunities in growing additive manufacturing sector

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1. To equip local additive manufacturing (AM) companies, especially new entrants, with industry best practices on the safe setup, operations and maintenance of AM facilities in Singapore, Second Minister for Trade and Industry Dr Tan See Leng launched a new technical reference (TR) 87 on “Safety of Additive Manufacturing Facilities” today. The TR was developed by a Working Group¹ appointed by the Singapore Standards Council (SSC) overseen by Enterprise Singapore (ESG).
2. TR 87 enables companies in AM to take advantage of Singapore’s robust quality and standards ecosystem to seize new opportunities in supporting the high value operations of global manufacturing companies anchored in Singapore. The TR promotes the use of a safety framework for AM facilities and to manage hazardous materials. Hazardous materials such as fine metal powders, a key ingredient in the AM process that are typically microscopic in size (<100um), can pose a health hazard to workers, and be toxic to the environment. Risk management systems recommended in the TR will further support the safe use, handling and storage of metal powders and AM equipment in a controlled environment. The TR also details the necessary safety measures to protect workers from direct exposure to metal powders, high-power and high-heat energy sources and systems.
3. **Ms Choy Sauw Kook, Director-General (Quality & Excellence), Enterprise Singapore**, said, “Singapore’s robust quality and standards infrastructure has been a key pillar in attracting cutting edge manufacturing operations which place a

¹ Key stakeholders in the Working Group comprise the Advanced Remanufacturing and Technology Centre, Institute of Chemical and Engineering Sciences, JTC, Ministry of Manpower, Nanyang Polytechnic, Nanyang Technological University, National Environment Agency, Singapore Civil Defence Force, ST Engineering and TÜV SÜD Asia Pacific

premium on safety and quality. TR 87's guidelines which are aligned to industry best practices and local regulatory requirements will provide greater business certainty to companies keen to enter into the growing additive manufacturing sector. Local SMEs should take advantage of Singapore's trusted reputation and provide global manufacturers the added assurance that our products and services deliver on quality and safety."

4. **Dr Gary Ng, Convenor of the Working Group on Safety of AM Facilities and Acting Deputy Director of the Research Liaison Office at the Advanced Remanufacturing and Technology Centre (ARTC), a unit of the Agency for Science, Technology and Research (A*STAR)**, said, "The TR will help additive manufacturing companies in Singapore design and operate equipment and facilities in a way that creates a safe working environment. Developed in collaboration with players across the local ecosystem, the framework will enable companies to safely set up operations they need to seize new opportunities. Researchers and engineers with knowledge of and experience in safety practices in a manufacturing environment have contributed to making the TR very relevant to the industry."
5. The TR 87 can be purchased from the Singapore Standards eShop at www.singaporestandardseshop.sg. Companies can also sign up for a workshop on the TR 87 on 29 April through the eShop² after purchasing the TR.

ANNEX A: Factsheet on the TR 87: 2021 Safety of Additive Manufacturing Facilities

ANNEX B: Information on standards that support Singapore's advance manufacturing sector

ANNEX C: Distinctions between standards and technical references

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About Enterprise Singapore

Enterprise Singapore is the government agency championing enterprise development. We work with committed companies to build capabilities, innovate and internationalise.

We also support the growth of Singapore as a hub for global trading and startups, and build trust in Singapore's products and services through quality and standards.

Visit www.enterprisesg.gov.sg for more information.

About Singapore Standards Council

The Singapore Standards Council (SSC) facilitates the development, promotion and review of Standards and Technical References in Singapore. This work is done through partnerships with the industry, academia and government organisations, under the national standardisation programme overseen by Enterprise Singapore.

About Singapore Manufacturing Federation

Established since 1932, the Singapore Manufacturing Federation (SMF) represents the interest of the manufacturing community in Singapore, driving its competitiveness and sustainable growth through serving industry-specific needs. Supported by 10 industry groups and its Centres of Excellence, the SMF enhances the competitiveness of the manufacturing community by encouraging capacity development and capability building, innovation and productivity. SMF provides opportunities for companies to collaborate, network and to grow and expand both locally and internationally. Current membership stands at about 3,000 corporate members ranging from SMEs to MNCs. For more information, please visit www.smfederation.org.sg.

Singapore Manufacturing Federation – Standards Development Organisation is supported by Enterprise Singapore and endorsed by the Singapore Standards Council to manage the development of standards and facilitate the promotion of these standards for four Standards Committees under the Singapore Standards Council. These Standards Committees are as follows:

Biomedical & Health Standards Committee (BHSC)
Food Standards Committee (FSC)
Manufacturing Standards Committee (MSC)
Quality & Safety Standards Committee (QSSC)

ANNEX A – Factsheet on the new TR 87: 2021 Safety of Additive Manufacturing Facilities

The TR 87 is the latest standard developed by ESG and the SSC, with support from the Singapore Manufacturing Federation – Standards Development Organisation (SMF-SDO), and in partnership with the Advanced Remanufacturing and Technology Centre (ARTC), TÜV SÜD, JTC and key stakeholders³.

Key considerations on the safety requirements needed for AM facilities, which the TR 87 provides in detail, are:

a) Risk assessment

The identification and evaluation of potential hazards associated with the processes in the AM facility, and the implementation of necessary risk control measures. Areas for assessment where potential hazards may exist include technology, instrumentation, materials, utilities, human performance and external factors (such as natural phenomena).

b) Materials

TR87 provides guidelines on the storage of flammable, reactive or hazardous AM material. It details the Maximum Allowable Quantity (MAQ) to be stored in the facility at any point in time, and recommends provisions for the safe handling of flammable, reactive or hazardous AM materials as well. These measures include the:

- i. Avoidance of any condition that will suspend metal powder in the air creating a dust cloud;
- ii. Elimination of potential sources of ignition, such as the generation of static electricity, from the powder handling area;
- iii. Segregation of chemical wastes to prevent inadvertent mixing that can lead to undesired chemical reactions; and
- iv. Need to maintain good house-keeping practices

³ The other key stakeholders include the Ministry of Manpower, National Environment Agency, Singapore Civil Defence Force, Institute of Chemical and Engineering Sciences, Nanyang Technological University, Nanyang Polytechnic and ST Engineering.

c) Equipment

Primary AM machines should have closed and in-built compartments to hold and contain raw feedstock metal powders. The TR 87 requires AM facilities to minimise operators' direct exposure to the powder and meet general requirements for shielding operators from high-power and high-heat energy sources and systems. The guidelines also recommends that machines that employ laser as an energy source, meet the general safety guidelines for laser products.

d) Facility

The AM machine room and powder storage room should be a controlled environment as recommended by the Original Equipment Manufacturer (OEM) and powder feedstock manufacturer. The design of the AM facility should include provisions to segregate the occupants from sources of pollutants, for instance.

Provisions to assure electrical, gas and fire safety measures, such as portable fire extinguishers for metal powder fires, should be in place to address risks arising from material, equipment and facility hazards.

e) Workplace operations

TR 87 provides guidelines on safe workplace operations in the AM Facility, including the proper usage and maintenance of Personal Protective Equipment (PPE), the safe handling of material and powder, and the requirement for trained personnel to operate specific equipment and processes.

f) Hazardous Waste Management

Hazardous wastes should be carefully handled in a manner that prevents environmental pollution and protects the workers and general public from being exposed to potential safety and health hazards.

Quotes from organisations involved in the development of the TR 87

Mr Richard Hong, Chief Executive Officer, TÜV SÜD ASEAN, said, "The Singapore Technical Reference TR 87 is one of the first that standardises safe practices to safeguard health and safety of Additive Manufacturing (AM) facilities in Singapore. TÜV SÜD is proud to have contributed to the establishment of the TR, and will be incorporating the TR into our global Health & Safety certification programs. We look forward to the collaboration with ESG to provide TR training for local AM stakeholders as it is an important step in enabling safe adoption of AM technology."

Mr Douglas Foo, President, Singapore Manufacturing Federation (SMF), said, “The SMF has identified that advanced manufacturing, including additive manufacturing, will quickly take on more and more importance as Singapore’s manufacturing community strives to remain competitive on the global stage. It is therefore timely that through the SMF-SDO, and with other key stakeholders, the conception of TR 87 will better guide businesses in this area. TR 87 will enable AM companies and new entrants to have quicker access to key information and regulations which will in turn allow for the setting up of their AM facilities in a safe and efficient manner.”

Mr Cheang Tick Kei, Director, Precision Engineering and Advanced Manufacturing Cluster, JTC, said, “The additive manufacturing players in Jurong Innovation District⁴ (JID) will be amongst the first to implement the standards. We are working with Siemens and TÜV SÜD to adopt best practices for operations and storage of flammable materials for Siemens AMTC facility. In addition, both Siemens and TÜV SÜD will collaborate to provide training for qualified persons, as well as industry standards and practices. This is an example of how JTC fosters a collaborative ecosystem in our estates, enabling and supporting additive manufacturing activities locally and in the region.”

⁴ Master-planned and developed by JTC, Jurong Innovation District is a 600-hectare next-generation district located along Singapore’s western manufacturing belt at the heart of Southeast Asia. The District houses a one-stop advanced manufacturing hub that is home to a vibrant ecosystem of R&D institutions, industry enablers, and advanced manufacturers and their factories of the future. The community has ready access to Nanyang Technological University, Singapore, an academic institution that offers world-class undergraduate and graduate programmes to 32,000 students. As Singapore’s largest living lab, the District is also a place where ideas and technologies are developed, prototyped, test-bedded and commercialised. Startups and incubators are housed in close proximity to businesses and academia, fostering strong collaborations and accelerating the commercialisation of new technologies. To be developed over the next 20 years, the District is estimated to bring about 95,000 new jobs in research, innovation and advanced manufacturing.

ANNEX B – Information on standards that support Singapore’s advance manufacturing sector

Enterprise Singapore (ESG) and the Singapore Standards Council (SSC) have published more than 70 standards to support advanced manufacturing and engineering in areas such as additive manufacturing or 3D-printing, robotics, autonomous vehicles, drones, smart manufacturing and cybersecurity.

These standards play an important role in addressing key issues of interoperability, cybersecurity, safety, reliability and sustainability in the adoption of advanced manufacturing technologies. It also helps in efforts to translate R&D knowledge in both the public and private sectors into innovative processes, products and services for use by industry.

To help companies use these manufacturing standards, ESG and SSC worked with TÜV SÜD Asia Pacific and Singapore Manufacturing Federation (SMF) to develop an online standards toolkit (www.standardsi40.sg). More than 2,500 unique users have accessed the toolkit.

In the field of 3D printing, ESG and SSC are working closely with the A*STAR, National Additive Manufacturing Innovation Cluster (NAMIC) and the industry to develop standards in design guidelines, parts qualifications and test methods. These standards will help Singapore enterprises shorten the timeline needed for development of innovative products using AM technologies.

Annex C: Distinctions between standards and technical references

Singapore Standards (SSs) and Technical References (TRs) are in the form of specifications for materials, products, services and systems, codes of practice, requirements for interoperability, methods of test, management systems, guidelines, nomenclatures, etc.

TRs are pre-SSs developed to address urgent industry demand and are issued for industry trials over a period of time. Comments received during this trial period are considered when a TR is reviewed. TRs can become SSs after the trial period, continue as TRs for further industry trials or be withdrawn.

To ensure adequate viewpoints are considered in the development and review of SSs and TRs, committees and working groups set up by the Singapore Standards Council consist of representatives from various key stakeholders which include industry associations, professional bodies, academia, government agencies and companies. SSs are also put up for public comment before publication.

