Add value.
Inspire trust.

Singapore, 2018-08-01

Our reference: EDG-TUVSUD-0520

TÜV SÜD Industrial Additive Manufacturing Quality Program

Version 1.3

This document describes a program designed to support additive manufacturing companies to achieve quality and consistency in industrial additive manufacturing by adopting standards and certification. This program is technologically neutral and applicable to all additive manufacturing. It is also applicable to all industry verticals. It is designed to accelerate AM manufacturer's go-to-market capabilities through a rigorous examination of the quality and process framework. Where gaps are identified, generic training will be provided for the AM manufacturer to determine the right methods.
This program is designed to support National Additive Innovation Manufacturing Clusters

(NAMIC) and aligned to capability development objectives of Enterprise Singapore (ESG) programs.The TÜV SÜD Industrial Additive Manufacturing Quality Program consists of 3 parts that are designed as a single work package.

Part A: Guidance to creation of a test plan for AM part to comply to meet product requirements

Part B: Competency trainings of personnel

Part C: Industrial AM production quality & consistency certification

Part A is optional and applicable for companies with product design or product validation functions.

Telephone: +65 6778 7777
Fax No.: +65 6779 7088
www.tuv-sud-psb.sg

TÜV SÜD PSB Pte Ltd

1 Science Park Drive
Singapore 118221
Reg. No. : 199002667R

Part A: Guidance to creation of a test plan for AM part to comply to meet product requirements

1.1. Technical scan of applicable international and industry standards applicable to one specific AM product selected for review

1.2. Product risk assessment

1.3. AM materials, design & process selection

1.4. Part specific post-processing methods selection

2. Part B: Competency trainings of personnel

2.1 Up to 2 key personnel of the company will be trained on AM Quality and Production Management based on DIN SPEC 17071. Topics will also cover legal requirements of AM facility Health & Safety legal requirements; and an overview of AM industrial standards.

3. Part C: Industrial AM production quality & consistency certification

3.1 The Industrial AM manufacturer quality management system indicates that the AM manufacturer has achieved minimum requirements to be able to provide a serial AM part production in a consistent and quality manner. It is not product specific, but technology specific.

3.2 A dual-stage audit is conducted based on DIN SPEC 17071, ISO/ASTM PWI 52920-2 and TÜV SÜD internal quality requirements to acheive Industrial AM manufacturer quality management system. Upon meeting the requirements, the AM manufacturer is awarded a TÜV SÜD certification mark (figure 1). An annual surveillance audit is required to maintain this certification.

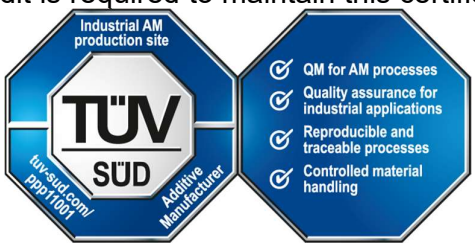

Figure 1

3.3 The audit is applicable to 6 major workflows (figure 2) with each workflow audited in details.

Figure 2

3.4 A stage 1 audit consists of the following steps

3.4.1 Kick-off meeting & Project co-ordination

3.4.2 Pre-audit of the additive production

3.4.3 Detailed Stage 1 non-conformance report

3.5 A stage 1 audit consists of the following steps

3.5.1 Documents checks

3.5.2 Certification audit and final report

3.6 A surveillance audit begins 1 year after the issuance of the certification

4. At the end of the program, the following deliverables are to be achieved:

4.1 Part A: Technical report for one specific product with recommendations

4.2 Part B: Attain training certificate

4.3 Part C: Meet requirements of TÜV SÜD Industrial AM production site and obtain Certification

5. Price schedule and lead time

5.1 The price schedule and lead time serves as a guidance. Actual costs may differ depending on product complexity, maturity of quality management system, personnel qualification, number of AM technology, number of staffs, and size of capacity.

5.2 Price schedule reference is shown in table 1

TÜV SÜD Industrial Additive Manufacturing Quality Program				
Parts	Description	Price	Leadtime	Remarks
A	Guidance to creation of a test plan for AM part to comply to meet product requirements	SGD 8,000	1 month	Does not include laboratory testing. See note1
B	Competency trainings of personnel	SGD 7,000	1 to 3 months	For 2 personnel
		SGD 3,500		For 1 personnel
C	Industrial AM production quality & consistency certification	SGD 25,000	3 to 6 months	For 1 production site
	Surveillance audit	SGD 5,000	Per year, starting second year onwards	For 1 production site
Note1 (Optional)	Laboratory testing	SGD 10,000 to SGD 50,000	1 to 2 months	This is an estimation of testing expenses and differs greatly depending on outcome of risk analysis. Price indicated is not to be taken as upper limit.

Table 1

Appendix I	
Motivation	*Systematically bring your production to a high quality level*
Title	**Quality and production management in additive manufacturing**
Content	Quality management as an umbrella term for organizational measures to improve process quality plays a major role in additive manufacturing. In addition to the measures generally known from existing quality management standards, such as a clear definition of roles and processes or the creation of clear communication structures, process specific aspects must also be taken into account in additive manufacturing. High complexity, a partial lack of general standards and little staff experience are just some of the aspects to be mentioned here. The aim of this training is to enable the participating quality manager or production manager to implement a high-quality level in AM production in a targeted manner. The training is very practice-oriented and includes the typical hurdles for an implementation as well as suitable measures to avoid them. Reproducibility of the process is ensured by implementing the corresponding processes and clearly defining the roles involved. Along the entire value chain, there are advantages such as compliance with health and safety regulations, the implementation of a continuous improvement culture or the identification of optimization potential. The training enables you to implement an AM-specific quality management approach in your company. This achieves a high level of quality for your customers and creates the basis for reproducible AM series production.
Summary	▪ Typical problems and solutions in the implementation of 3D printing technology as an additive manufacturing solution, e.g. • Missing standards • Lack of transparent personnel qualification programs • Lacking awareness of AM ▪ The communication of the most important measures for the quality adjustment and monitoring ▪ Understanding of the factors determining AM quality-decisive material properties, consisting of: Machine, feedstock, process and part ▪ Understanding of the workflow and the entire production chain, including typical error patterns and sensible remedial measures. ▪ AM Health & Safety Management Contents • Sources of danger in manufacturing • Legal requirements for Occupational health & Safety in Singapore ▪ The current state of AM standardization • Roadmaps and trends • Standard projects and approaches • Overview of the most relevant AM standards

Duration	3 days
Circle of participants	Target group of the workshop/training are quality managers and production managers who are or want to become active in AM series production.
Prerequisites	Ideally initial experience in the AM area or basic knowledge of additive manufacturing at TÜV SÜD
Graduation	Certificate of participation issued by TÜV SÜD Academy
Speaker	TÜV SÜD experts for quality management and additive manufacturing
Your benefit	▪ You will learn comprehensive, product-specific compact knowledge on the subject of quality management in additive manufacturing. ▪ You will receive practical examples of how quality management can be implemented. ▪ You can assess related areas such as standardization and health and safety for the AM area, with an overview of the most relevant AM standards