



## FUSION® V1100

### Epoxy Coating Quality Standard

#### SCOPE

This Standard specifies the quality requirements for the FUSION® V1100 process for epoxy coating by painting of panels intended for use in the construction of tanks used for the storage, processing and general containment of a range of liquids.

This Standard applies to the painting elements of the FUSION® V1100 process, however, the quality criteria in Section 3.2 should apply to the tank as built. The FUSION® V1100 epoxy coating has been developed with reference to International Standard specifications for epoxy coatings on bolted steel panels, including AWWA D103-19<sup>[1]</sup>.

#### DEFINITIONS

For the purposes of this Standard, the following definitions shall apply.

**Epoxy coating:** A Fusion Bonded Epoxy (FBE) material applied and cured onto the internal side of the steel substrate to form a coated steel panel.

**Polyester coating:** A polyester paint material applied and cured onto the external side of the steel substrate to form a coated steel panel.

**Supplier:** Any company supplying Permastore with any materials for use in the FUSION® V1100 process.

**Defect:** Any void, break, crack, discontinuity, blister, foreign inclusion or contamination of the epoxy or polyester coating.

**Discontinuity Free:** Any epoxy coating which does not allow an electric current to pass through to the steel substrate when testing using the specified instrument operated in accordance with Section 3.2.2 of this Standard.

#### 1. GENERAL

The inspection procedures specified in this Standard and the FUSION® V1100 coating process shall be carried out under Permastore's quality management system certified to EN ISO 9001:2015<sup>[2]</sup>.

#### 2. RAW MATERIALS

The steel used shall have a specification as agreed between Permastore and the steel supplier having due regard to the requirements of the epoxy coating process.

All other raw materials used in the production of the epoxy coated panels shall be inspected on receipt at Permastore's premises to ensure that they meet Permastore's specifications.

Where Permastore is not able to inspect raw material against any aspect of Permastore's specification or the specification according to Clause 3.1.1 (for example, chemical composition of steels), Permastore shall require the supplier to carry out such inspections at the supplier's premises and provide Permastore with authorised copies of certificates for such inspections and record conformity of the raw materials in accordance with the Quality Specification, and make certified copies of those records available.

#### 3. QUALITY

##### 3.1 Epoxy Coating

Epoxy coated test samples shall be regularly tested to ensure that the properties of the coating meet the requirements of this Standard and Permastore's specification.

##### 3.1.1 Quality Specification

Tests shall be carried out to ensure that the epoxy coating on the contact surface meets the chemical resistance and physical property specifications set out in Table 1. Testing shall also be carried out to ensure that the polyester coating on the external surface meets the physical property specification set out in Table 1.

**TABLE 1 – CHEMICAL RESISTANCE AND PHYSICAL PROPERTIES**

	TEST STANDARD	QUALITY SPECIFICATION	MINIMUM TEST FREQUENCY
<b>CHEMICAL RESISTANCE (Inside Surface)</b>			
Hot Sulphuric acid	EN ISO 2812-1:2017 <sup>[3]</sup> Clause 8.3.1	EN ISO 4628-2 <sup>[9]</sup> :2016 0 No Blistering	Annually
Hot Hydrochloric acid	EN ISO 2812-1:2017 Clause 8.3.1	ISO 4628-2:2016 0 No Blistering	Annually
Hot Sodium Hydroxide	EN ISO 2812-1:2017 Clause 8.3.1	ISO 4628-2:2016 0 No Blistering	Annually
<b>PHYSICAL PROPERTIES (Inside Surface)</b>			
Impact	ASTM G14 <sup>[4]</sup> 3.2mm (1/8 in) steel plate	>18 J	Annually
Adherence level	EN ISO 2409 <sup>[5]</sup>	Gt 0	Monthly
Resistance to abrasion	ASTM D4060 <sup>[6]</sup>	<40 mg: CS-17, 1000g, 1000 cycles	Annually
Hardness (Buchholz)	EN ISO 2815:2003 <sup>[7]</sup>	>95	Six Monthly
<b>PHYSICAL PROPERTIES (Outside Surface)</b>			
Impact	ISO 6272 <sup>[8]</sup>	No cracking or peeling at 2.5 joules	Monthly
Adherence level	EN ISO 2409	Gt 0	Monthly

**3.2 Finished Panels**

Finished panels shall be inspected following the coating process, prior to packing and despatch from Permastore’s premises. Permastore shall carry out inspections on both the inside and the outside surfaces. In cases where both the inside and the outside surfaces of the panel are in contact with the stored liquid both surfaces shall be treated as inside surfaces for the purposes of this Standard.

**3.2.1 Inspection of the Outside Surface**

The outside surface of all panels shall be inspected visually under good daylight or equivalent lighting for defects in the polyester coating. Any panel having visible defects larger than 1mm shall be rejected. Any panel having more than three visible defects per m<sup>2</sup> of the total panel area shall be rejected. All visible defects on the outside surface of accepted panels shall be repaired using a repair material approved by Permastore for this purpose and applied according to the repair material manufacturer's instructions.

**3.2.2 Inspection of the Inside Surface**

The inside panel surface shall be inspected using a high voltage tester approved by Permastore for this purpose and used in accordance with Test Method B of ASTM D5162-15<sup>[10]</sup> and Clause 5.2.2.1. Inspection shall be carried out on every panel and any panel that is not discontinuity free shall be rejected and subsequently repaired using an approved repair material and re-tested at the test voltage.

**3.2.2.1** The tester shall have an accuracy of ±1% and a test voltage of 1100 volts shall be used. The tester shall have a valid calibration record.

**3.2.3 Inspection of the Coating Thickness**

The thickness of the coatings shall be measured using an approved instrument suitable for a measurement range of 0-500µm and used in accordance with EN ISO 2178<sup>[11]</sup>. Inspection shall be carried out using a sampling procedure complying with ISO 2859-1:1999<sup>[12]</sup>.



The thickness of the epoxy coating on the inside surface of every panel shall be maintained in the range from 150µm to 250µm. The thickness of the combined epoxy and polyester coating on the outside surface of every panel shall be maintained in the range from 150µm to 230µm. Panels having a coating thickness outside these ranges shall be rejected.

#### 3.2.4 Inspection of External Coating Colour

The outside panel surface shall be inspected using a colour comparator instrument. Inspection shall be carried out using a sampling procedure complying with ISO 2859-1:1999. Panels of a colour outside of acceptable limits shall be rejected.

### 4. HANDLING AND PACKING

All panels shall be packed using a suitable membrane between the panels.

### 5. GUIDANCE NOTES FOR INSTALLATION AND USE

#### 5.1 Care in Handling

Recommendations for the correct methods of handling outside the coating premises are given in the Permastore Construction Guide latest revision.

#### 5.2 Inspection at the Construction Site

During tank installation, the use of an approved low voltage wet swab tester on the inside panel surface is recommended. Permastore can advise on the use of the low voltage wet swab test equipment. Guidance is also given in the Permastore Construction Guide latest revision.

#### 5.3 Change of Use

Owners and users of storage tanks should be aware that changes in the use or structure of a tank can result in dramatic changes to the operating environment and affect the coating and design limitations of the tank. Permastore will offer advice on request.

### REFERENCES

#### [1] AWWA D103-19

Factory-Coated Bolted Carbon Steel Tanks for Water Storage.

#### [2] EN ISO 9001:2015

Quality management systems. Requirements.

#### [3] EN ISO 2812-1:2017

Paints and varnishes –Determination of resistance to liquids – Part 1: Immersion in liquids other than water.

#### [4] ASTM G14–04 (2018)

Standard Test Method for Impact Resistance of Pipeline Coatings (Falling Weight Test).

#### [5] EN ISO 2409:2013

Paints and varnishes — Cross-cut test.

#### [6] ASTM D4060-19

Standard Test Method for Abrasion Resistance of Organic Coatings by the Taber Abraser.

#### [7] EN ISO 2815:2003

Paints and varnishes — Buchholz indentation test.

#### [8] ISO 6272:2011

Paints and varnishes — Rapid-deformation (impact resistance) tests — Part 2: Falling-weight test, small-area indenter.

#### [9] EN ISO 4628-2:2016

Paints and varnishes -- Evaluation of degradation of coatings — Designation of quantity and size of defects, and of intensity of uniform changes in appearance — Part 2: Assessment of degree of blistering.

#### [10] ASTM D5162-15

Standard Practice for Discontinuity (Holiday) Testing of Nonconductive Protective Coating on Metallic Substrates.

#### [11] EN ISO 2178:2016

Non-magnetic coatings on magnetic substrates – Measurement of coating thickness– Magnetic method.

#### [12] ISO 2859:1999

Sampling procedure for inspection by attributes — Part 1: Sampling schemes indexed by Acceptance quality limits (AQL) for lot-by-lot inspection.

