SAMSON

SAMSON

MANUAL

Surface Treatment

Expertise in Surface Treatment

Surface preparation

Coating systems

Corrosion protection

Contents

1 Manual

Scope

Surface treatment especially to provide corrosion protection is becoming increasingly important. This manual provides information on surface treatment of SAMSON products and assists users to select a suitable protective coating system.

Validity

This manual applies to control valves and valve accessories manufactured by SAMSON AG.
Further information to products can be found in the corresponding data sheets.

Intended use

This manual is intended to assist planners and operators to select a suitable protective coating system for a control valve or instrument.

Valves and instruments are to be commissioned and maintained by qualified personnel only. For further details refer to the mounting and operating instructions, protective coating specifications, and repair procedures.

2 General

2.1 Terms and standards

Control valves are used in diverse applications and locations. The ambient conditions at the site of installation vary significantly and place different demands on the surface finish. Corrosion can arise and damage valve components. SAMSON has the right protective coating system to suit all types of environmental conditions (e.g. abrasive wear or corrosive environment).

What is corrosion?

The term „corrosion" can be applied generally to mean a process involving the deterioration of materials and often even the failure of a product.
Corrosion is the reaction of a metallic material to its environment, which effects measurable change in the material and can lead to impairment of the function of a metal construction part or of an entire system.

The reaction can be affected by environmental effects as well as by mechanical or dynamic stress.

Combined effects			
Mechanical			Chemical
Wear	Sliding abrasion Rolling wear Rolling/sliding wear Fretting wear Cavitation wear Erosive wear Solid particle erosion High velocity erosion	Wear corrosion Fretting corrosion Cavitation corrosion Erosion corrosion	**Corrosion** DIN EN ISO 8044

There are different kinds of corrosion, such as crevice corrosion, pitting corrosion, shallow pitting or surface corrosion, as well as various causes of corrosion.
Corrosion damage occurs when a component's function is impaired or it fails completely.

Relevant standards

Standard	**Designation**
DIN EN ISO 12944-1 to -8	Paints and varnishes – Corrosion protection of steel structures by protective paint systems
DIN 55633	Paints and varnishes - Corrosion protection of steel structures by powder coating systems
ISO 8501-1	Preparation of steel substrates before application of paints and related products
DIN EN ISO 2178	Non-magnetic coatings on magnetic substrates – Measurement of coating thickness – Magnetic method
DIN EN ISO 2409 · ASTM D3359	Paints - Cross-cut test
DIN EN ISO 4624 and ASTM D4541	Paints and varnishes – Pull-off test for adhesion
DIN 50018	Testing in a saturated atmosphere in the presence of sulfur dioxide
DIN EN ISO 6988	Metallic and other non-organic coatings – Sulfur dioxide test with general condensation of moisture
DIN EN ISO 9227 and ASTM B117	Corrosion tests in artificial atmospheres – Salt spray tests

2.2 Durability and corrosion protection categories

DIN EN ISO 12944-5 determines the various coating durability ranges and DIN EN ISO 12944-2 classifies the corrosivity categories for protective coating systems.

The durability does not constitute a warranty period. Durability is a technical term to help users establish a maintenance scheme. The durability describes the time period within which a painted component is protected against corrosion.

DIN EN ISO 12944-5 Durability	Time span
Low (L)	2 to 5 years
Medium (M)	5 to 15 years
High (H)	More than 15 years

The corrosivity categories provide a uniform classification to clearly assign corrosion stress and environmental conditions. This helps the selection of a suitable protective coating system for each application.

DIN EN ISO 12944-2 Corrosivity category	Typical ambient conditions
C1 (very low)	Heated buildings with clean atmospheres
C2 (low)	Atmospheres with low level of pollution, unheated buildings where condensation may occur
C3 (medium)	Urban and industrial atmospheres, medium level of pollution (sulfur dioxide), coastal areas with low salinity, production rooms with high humidity and some air pollution
C4 (high)	Industrial areas and coastal areas with moderate salinity, chemical plants, swimming pools etc.
C5 – I (very high, industrial)	Industrial areas with high humidity, aggressive atmosphere, buildings or areas with almost permanent condensation and with high pollution
C5 – M (very high, marine)	Coastal and offshore areas with high salinity, buildings or areas with almost permanent condensation and with high pollution
Im1	Fresh water: hydroelectric power plants
Im2	Sea or brackish water: harbor areas with structures like sluice gates, locks, jetties, offshore structures
Im3	Soil: buried tanks, steel piles, steel pipes

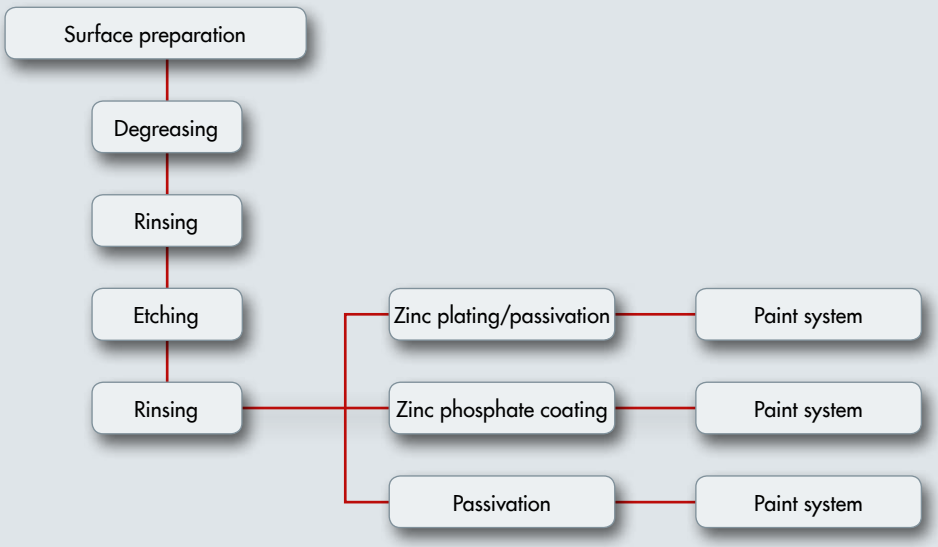
3 Surface Treatment at SAMSON

Corrosion can cause great economic loss. Damage to the environment cannot be ruled out either.
To counteract damage caused by corrosion, the surface treatment at SAMSON is performed according to paint suppliers' specifications under controlled process and ambient conditions (constant temperature and air humidity monitoring) in a heated building.

Ongoing testing during the coating procedure additionally ensure that the surface treatment remains at a constant high quality.

3.1 Surface preparation

Optimal surface preparation is necessary to achieve durable, long-lasting corrosion protection by subjecting parts to chemical or electrochemical surface treatment.



4 Coating systems[1]

4.1 General description of the painting process

4.1.1 Powder coating

Powder coating involves applying the paint or protective coating as dry powder. The powder is electrostatically charged and sprayed onto the component and then cured in an oven.

Advantages:

- Free from volatile organic compounds
- No solvent emissions
- Less toxic waste
- Minimized waste and high powder yield (up to 98 %) thanks to recovery
- Excellent coating quality
- Excellent adhesion to the substrate
- High film thickness can be achieved
- High level of automation possible
- Suitable for ambient conditions classified in C1 to C5 (see page 5 for definition of ambient conditions)

[1] The individual film thickness can be customized on request.
Specifications subject to change without notice

4.1.2 Wet painting – Air gun spraying

Wet paint coatings are liquid mixtures of substances which form a firmly adhering coating after they have dried on the surface of the component. Depending on the intended application, the paint contains dyes, pigments, fillers, softeners, resins, and binders. In addition to giving the component the desired appearance, the paint coating protects against damage and corrosion.

Advantages:

- Well-suited for one-off or small series production
- Multilayer coatings with variable layer structures possible
- Easy change of paint and component
- Coating of heat-sensitive components possible
- Customizable color

4.2 Paint specifications

4.2.1 Coating systems for C2 to C3 corrosivity categories according to DIN EN ISO 12944-5 following standard surface treatment procedures

Coating system no. 1a		
Typical environment		Atmospheres with low or moderate pollution, high humidity; Coastal areas with low salinity
Surface preparation		
Sa 2½ according to DIN EN ISO 8501-1 (very thorough blasting), etched, zinc phosphate coated according to DIN EN ISO 9717 or zinc coated and passivated according to DIN 50961		
System description		
First layer	Film thickness Method of application	NDFT: 70 µm Powder coating (epoxy-polyester hybrid powder, macrostructure)
Total film thickness		NDFT: 70 µm
RAL code or standard color		RAL 1019 (gray beige) No additional paint layer

Coating system no. 1b		
Typical environment		Atmospheres with low or moderate pollution, high humidity; Coastal areas with low salinity
Surface preparation		
Sa 2½ according to DIN EN ISO 8501-1 (very thorough blasting), etched, zinc phosphate coated according to DIN EN ISO 9717 or zinc coated and passivated according to DIN 50961		
System description		
First layer	Film thickness Method of application	NDFT: 70 µm Powder coating (epoxy-polyester hybrid powder, macrostructure)
Second layer	Film thickness Method of application	NDFT: 60 µm Spray painting (two-component polyurethane top coat)
Total film thickness		NDFT: 130 µm
RAL code or standard color		RAL 1019 (gray beige) (Recoating with special paint color on request; exception: paints with pearl or shining effect)

Coating system no. 2a		
Typical environment		Atmospheres with low or moderate pollution, high humidity; Coastal areas with low salinity
Surface preparation		
Sa 2½ according to DIN EN ISO 8501-1 (very thorough blasting), etched, zinc phosphate coated according to DIN EN ISO 9717 or cleaned with dry ice		
System description		
First layer	Film thickness Method of application	NDFT: 40 µm Spray painting (two-component epoxy primer)
Second layer	Film thickness Method of application	NDFT: 60 µm Spray painting (two-component polyurethane top coat)
Total film thickness		NDFT: 100 µm
RAL code or standard color		RAL 1019 Gray-beige (Recoating with special paint color on request; exception: paints with pearl or shining effect)

4.2.2 Coating systems for corrosivity categories C4, C5-I, and C5-M according to ISO 12944-5

Coating system no. 3a		
Typical environment		Industrial areas with high humidity and corrosive atmosphere; Coastal and offshore areas with moderate to high salinity; Buildings or areas with permanent condensation and with high pollution
Surface preparation		
Sa 2½ according to DIN EN ISO 8501-1 (very thorough blasting), etched, zinc phosphate coated according to DIN EN ISO 9717 or zinc coated and passivated according to DIN 50961		
System description		
First layer	Film thickness Method of application	NDFT: 70 µm/40 µm Powder coating (epoxy-polyester hybrid powder, macrostructure or two-component epoxy primer)
Second layer	Film thickness Method of application	NDFT: 150 µm/180 µm Spray painting (two-component epoxy micaceous iron oxide coating)
Third layer	Film thickness Method of application	NDFT: 60 µm Spray painting (two-component polyurethane top coat, isocyanate-free two-component top coat on request)
Total film thickness		NDFT: 280 µm
RAL code or standard color		RAL 1019 Gray-beige (Special paint color on request; exception: paints with pearl or shining effect)

Coating system no. 3b		
Typical environment		Industrial areas with high humidity and corrosive atmosphere; Coastal and offshore areas with moderate to high salinity; Buildings or areas with permanent condensation and with high pollution
Surface preparation		
Sa 2½ according to DIN EN ISO 8501-1 (very thorough blasting), etched, zinc phosphate coated according to DIN EN ISO 9717 or zinc coated and passivated according to DIN 50961		
System description		
First layer	Film thickness Method of application	NDFT: 60 µm Powder coating (zinc-rich two-component primer)
Second layer	Film thickness Method of application	NDFT: 160 µm Spray painting (two-component epoxy micaceous iron oxide coating)
Third layer	Film thickness Method of application	NDFT: 60 µm Spray painting (two-component polyurethane top coat, isocyanate-free two-component top coat on request)
Total film thickness		NDFT: 280 µm
RAL code or standard color		RAL 1019 Gray-beige (Special paint color on request; exception: paints with pearl or shining effect)

Coating system no. 4		
Typical environment		Industrial areas with high humidity and corrosive atmosphere; Coastal and offshore areas with moderate to high salinity; Buildings or areas with permanent condensation and with high pollution
Surface preparation		
Blast cleaning, cleanliness grade: Sa 2½ according to DIN EN ISO 8501-1, roughness grade: medium (G)		
System description		
First layer	Film thickness Method of application	NDFT: 60 µm Spray painting (zinc-rich two-component primer)
Second layer	Film thickness Method of application	NDFT: 160 µm Spray painting (two-component epoxy micaceous iron oxide coating)
Third layer	Film thickness Method of application	NDFT: 60 µm Spray painting (two-component polyurethane top coat or isocyanate-free two-component top coat on request)
Total film thickness		NDFT: 280 µm
RAL code or standard color		RAL 1019 Gray-beige (Special paint color on request; exception: paints with pearl or shining effect)

4.2.3 High-temperature-resistant coating systems

Coating system no. 5		
Typical environment		Ambient conditions (indoor and outdoor) with additional influence due to high temperatures (120 to 540 °C)
Surface preparation		
Sa 2½ according to DIN EN ISO 8501-1 (very thorough blasting), etched, zinc phosphate coated according to DIN EN ISO 9717 or blast cleaned on request		
System description		
First layer	Film thickness Method of application	NDFT: 75 µm Spray painting (ethyl silicate zinc dust primer)
Second layer	Film thickness Method of application	NDFT: 25 µm Spray painting (high-temperature silicone coating)
Third layer	Film thickness Method of application	NDFT: 25 µm Spray painting (high-temperature silicone coating)
Total film thickness		NDFT: 125 µm
RAL code (free selection of color not possible)		Approx. RAL 9006 (white aluminum)

Coating system no. 6		
Typical environment		Ambient conditions (indoor and outdoor) with additional influence due to high temperatures (400 to 600 °C)
Surface preparation		
Sa 2½ according to DIN EN ISO 8501-1 (very thorough blasting), etched, passivated or blast cleaned on request		
System description		
First layer	Film thickness Method of application	NDFT: 25 µm Spray painting (high-temperature silicone coating)
Second layer	Film thickness Method of application	NDFT: 25 µm Spray painting (high-temperature silicone coating)
Total film thickness		NDFT: 50 µm
RAL code (free selection of color not possible)		Approx. RAL 9006 (white aluminum)

4.2.4 Paint coatings for stainless steel surfaces

Coating system no. 7		
Typical environment		Industrial areas with high humidity and corrosive atmosphere; Coastal and offshore areas with moderate to high salinity; Buildings or areas with permanent condensation and with high pollution
Surface preparation		
Sa 2½ according to DIN EN ISO 8501-1 (very thorough blasting), etched and passivated or blast cleaned on request		
System description		
First layer	Film thickness Method of application	NDFT: 50 µm Spray painting (two-component epoxy primer)
Second layer	Film thickness Method of application	NDFT: 110 µm Spray painting (two-component epoxy micaceous iron oxide coating)
Third layer	Film thickness Method of application	NDFT: 80 µm Spray painting (two-component polyurethane top coat or isocyanate-free two-component top coat on request)
Total film thickness		NDFT: 240 µm
RAL code or standard color		RAL 1019 Gray-beige (Special paint color on request; exception: paints with pearl or shining effect)

Coating system no. 2b		
Typical environment		Atmospheres with low or moderate pollution, high humidity; Coastal areas with low salinity
Surface preparation		
Sa 2½ according to DIN EN ISO 8501-1 (very thorough blasting), etched, zinc phosphate coated according to DIN EN ISO 9717 or cleaned with dry ice		
System description		
First layer	Film thickness Method of application	NDFT: 40 µm Spray painting (two-component epoxy primer)
Second layer	Film thickness Method of application	NDFT: 60 µm Spray painting (two-component polyurethane top coat)
Total film thickness		NDFT: 100 µm
RAL code or standard color		RAL 1019 Gray-beige (Recoating with special paint color on request; exception: paints with pearl or shining effect)

4.2.5 Paint coatings for insulated or uninsulated steel or stainless steel in highly corrosive ambient conditions

Coating system no. 8		
Typical environment		Ambient conditions (indoor and outdoor) with additional influence due to increased or high temperatures (≤230 °C)
Surface preparation		
Sa 2½ according to DIN EN ISO 8501-1 (very thorough blasting), etched, passivated or blast cleaned on request		
System description		
First layer	Film thickness Method of application	NDFT: 125 µm Spray painting (epoxy phenolic coating)
Second layer	Film thickness Method of application	NDFT: 125 µm Spray painting (epoxy phenolic coating)
Total film thickness		NDFT: 250 µm
RAL code or standard color		Gray, white, red (top coat according to RAL, Munsell, etc. not possible)

4.3 Customized solutions

Contact SAMSON if you require a protective coating system not included in this brochure or simply want a different color.

Color

RAL 1019 is the standard color for SAMSON products. Other colors are possible on request to meet all international standards. The exact color code must be specified for customized solutions.

Protective coating systems

The following customized solutions are available:

- Coating systems according to NORSOK M-501
- Customized coatings for high and low-temperature applications
- Coatings according to customer specifications (after examination and consultation)
- Adaptation of the coating thickness according to customer specifications on request (with manufacturer specifications)

5 Quality assurance

Ongoing tests of coating systems are performed to ensure a constant high quality:

- Standardized film thickness measurement in accordance with:
  – DIN EN ISO 2178: Measurement of coating thickness (magnetic method)
  DIN EN ISO 2360: Measurement of coating thickness (non-destructive eddy current method)
- Cross-cut test according to ISO 2409 and ASTM D3359
- Pull-off test according to ISO 4624 and ASTM D4541

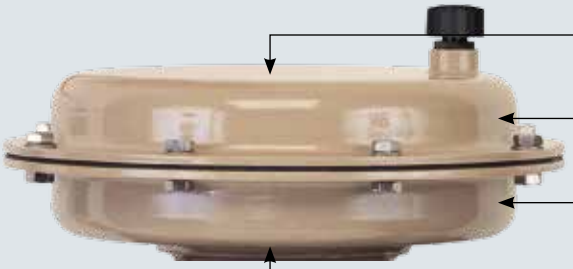
Test results can be supplied in a test protocol on request.

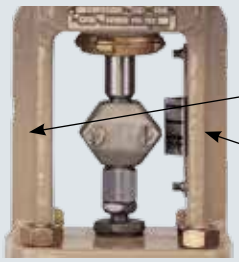
Further tests can be performed on request by SAMSON. Such tests include:

- Holiday testing to test for discontinuities in the coating
  a. NACE SP0188: discontinuity (holiday) testing of new protective coatings on conductive substrates
  b. DIN 55670: Paints and varnishes – Method for testing paint coatings for pores and cracks using high voltage
- Salt test to determine the salt concentration on the surface
  a. DIN EN ISO 8502-6 – Extraction of soluble contaminants for analysis (Bresle method)
  b. DIN EN ISO 8502-9 – Field method for the conductometric determination of water-soluble salts
- Dust assessment test
  a. DIN EN ISO 8502-3 – Assessment of dust on steel surfaces prepared for painting (pressure-sensitive tape method)
  b. DIN Test Report 28 – Testing of surfaces before application of coating materials for containments [sic] that cannot be detected visually
- Bend test (cylindrical mandrel) for assessing the resistance of coatings to cracking and/or detachment from a metal or plastic substrate according to DIN EN ISO 1519

5.1 Film thickness measurement

The non-destructive measurement of the film thickness is performed according to DIN EN ISO 21 78 using the magnetic method or according to DIN EN ISO 2360 using the eddy current method. Tests are performed to check whether the film thickness is kept according to DIN EN ISO 12944 or ISO 19840. To provide comparable test results, the film thickness is measured at critical defined measuring points.


Measuring point 1
Measuring point 2
Measuring point 3
Measuring point 4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Opposite measuring point 1
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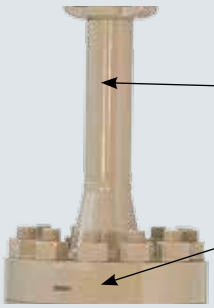
Measuring point 4
Opposite measuring point 2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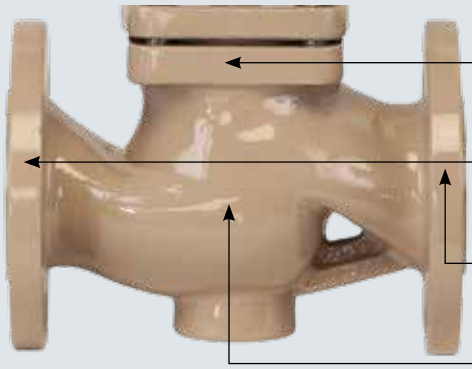
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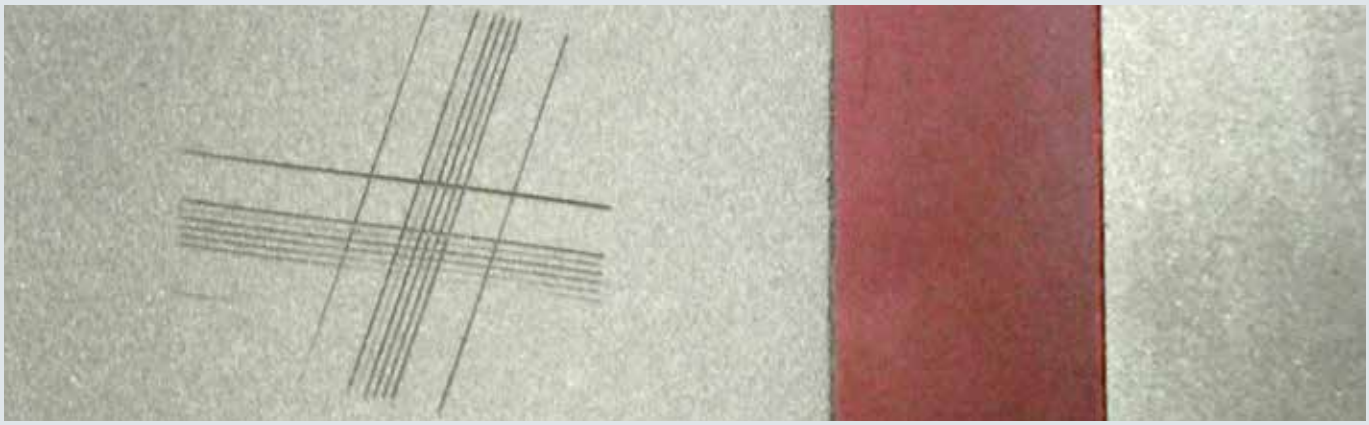
Measuring point 7
Measuring point 8
Opposite measuring point 7

5.2 Cross-cut test according to ISO 2409 and ASTM D3359

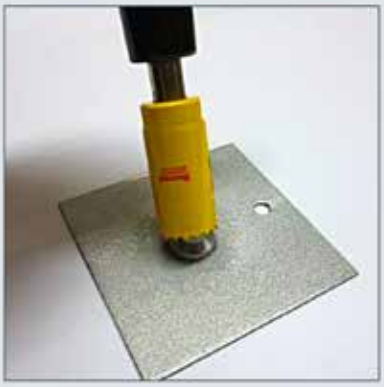
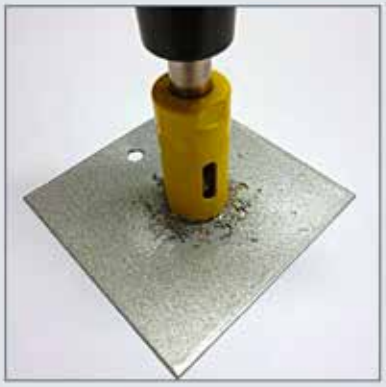
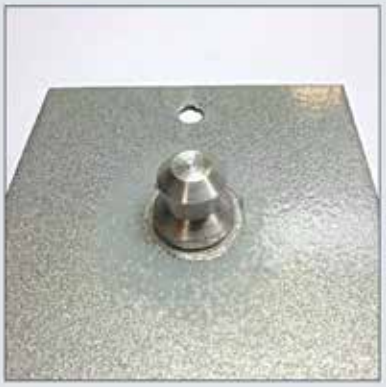
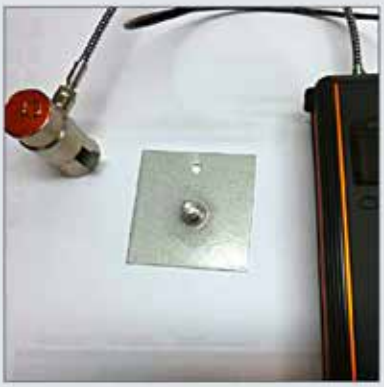
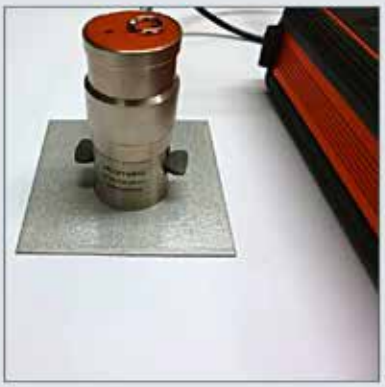
The destructive cross-cut test is performed using a test plate representative of the substrate in accordance with ISO 2409 or ASTM D3359. All test data are stored in a database to continuously document the process.

Description of cross-cut test		
To assess the resistance of a paint coating to separation from the substrate (adhesion). The procedure is performed on test plates (100 x 100 mm) according to ISO 2409. Permissible cross-cut classes: 0 and 1		
Classification	Description	Surface appearance in the cross-cut areas in which flaking occurred (example for six parallel cross-cut sections)
0	The edges of the cuts are completely smooth; none of the squares of the lattice is detached.	–
1	Detachment of small flakes of the coating at the intersections of the cuts. A cross-cut area not significantly greater than 5 % is affected.	
2	The coating has flaked along the edges and/or at the intersections of the cuts. A cross-cut area significantly greater than 5 %, but not significantly greater than 15 %, is affected.	



5.3 Pull-off test according to ISO 4624 and ASTM D4541

The destructive pull-off test is used to determine the adhesion performance of the paint product on the substrate. Similar to the cross-cut test, it is performed using a test plate representative of the substrate in accordance with ISO 4624 or ASTM D4541.


6 Environmental protection

Environmentally safe powder coating

- Free from volatile organic compounds (e.g. solvents)
- Up to 98 % efficiency is achieved by recovering overspray

Voluntary self-declaration: chromium (VI)-free passivation

Wastewater cleaning

- Precipitation of heavy metals and other suspended matter
- pH neutralization
- Professional waste disposal

7 FAQs

1. What needs to be observed when selecting a high-temperature paint coating?

For high-temperature or low-temperature applications, all the coats of the paint system must be suitable for the selected temperature range.

2. Why are zinc primers not used?

Components already have a sealed protective zinc coating after passivation by applying the zinc phosphate coating. For better adhesion of subsequent paint layers, a primer is used, making a zinc primer superfluous. For better adhesion of subsequent paint layers, a primer is used, making a zinc primer superfluous.

3. Can the film thickness of the paint coatings be varied?

Depending on the requirements and after consulting with SAMSON, individual coats can be thicker within the range specified by the paint manufacturer.

4. What paint coating is used for use under tropical conditions?

Electrical instruments for use under tropical conditions are painted according to coating system no. 3.

SAMSON

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Surface Treatment

● Production sites ● Subsidiaries

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