

■ Expertise in Surface Treatment

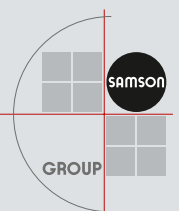
Surface preparation
Coating systems
Corrosion protection





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1 Scope

Surface treatment, especially to provide corrosion protection, is becoming increasingly important. This manual provides information on surface treatment at SAMSON and assists users in selecting a suitable coating system.

2 Validity of this manual

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

3 Intended use of this manual

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

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

4 General

4.1 Terms and standards

Control valves are used in various 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” is generally understood to mean a process that causes the deterioration of materials and often even the failure of a product.

Corrosion is defined as the reaction of a material with its environment, which effects measurable change in the material and can lead to impairment of the function of components or of an entire system.

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

Combined effects			
Mechanical			Chemical
Wear DIN 50320	Sliding abrasion Rolling wear Rolling/sliding wear Fretting wear Cavitation wear Erosive wear Solid particle erosion High velocity erosion	Wear Fretting corrosion Cavitation corrosion Erosion corrosion	Corrosion 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
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
ISO 2178	Non-magnetic coatings on magnetic substrates – Measurement of coating thickness – Magnetic method
ISO 2409 and ASTM D3359	Paints - Cross-cut test
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
ISO 6988	Metallic and other non-organic coatings – Sulfur dioxide test with general condensation of moisture
ISO 9227 and ASTM B117	Corrosion tests in artificial atmospheres – Salt spray tests

4.2 Durability and corrosion protection categories

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

The durability does not constitute a warranty period. It 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.



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 in selecting a suitable protective coating system for each application.

ISO 12944-2 Corrosivity category	Typical ambient conditions
C1 (very low)	Heated buildings with neutral 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: river installations, hydroelectric power plants
Im2	Sea or brackish water: harbor areas with structures like sluice gates, locks, jetties; offshore structures
Im3	Soil: buried tanks, steel pile walls, steel pipes

5 Surface treatment at SAMSON

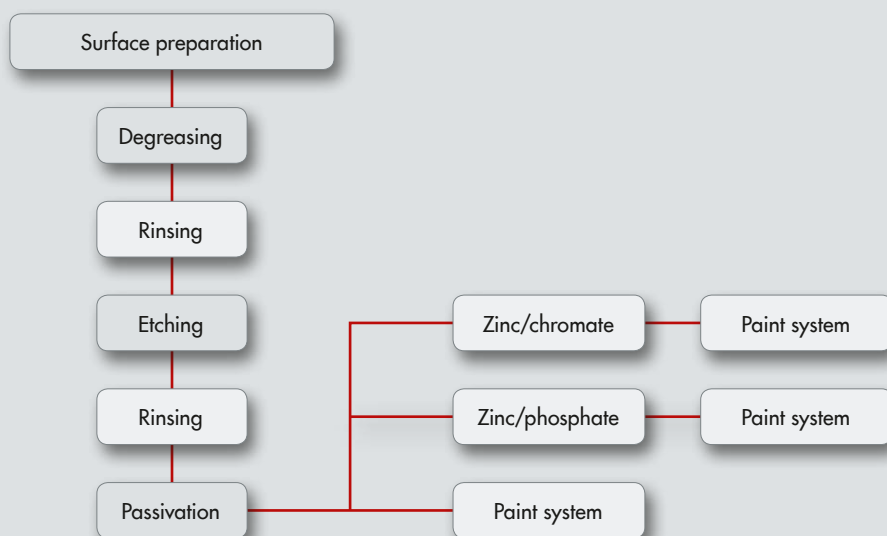
Corrosion can cause great economic loss. Damage to the environment cannot be ruled out either. To counteract corrosion damage caused by corrosion, the surface treatment at SAMSON is performed according to paint suppliers' specifications under controlled process and ambient conditions (e.g. constant temperature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

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



5.1 Surface preparation

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



6 Coating systems

6.1 General description of the painting process¹

Powder coating

Powder coating involves applying the paint or protective coating as dry powder. The powder is electrostatically charged, sprayed onto the component and 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-M



¹ The individual film thicknesses can be customized on request
Specifications subject to change without notice

Wet painting – Air gun spraying

Wet paint coatings are liquid mixtures of substances that form a firmly adhesive coat 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



6.2 Paint specifications

1. Powder coating for corrosivity categories C2 and C3 according to ISO 12944-5 (standard surface treatment)

Coating system no. 1		
Typical environment		Industry, chemical plants, coastal areas
Surface preparation		
Sa 2½ according to ISO 8501-1		
System description		
First layer	Film thickness Method of application	Min. 70 µm Powder coating (epoxy-polyester)
Total film thickness		Min. 70 µm
RAL code or standard color		RAL 1019 (gray beige)

2. Wet paint coating system for corrosivity categories C2 and C3 according to ISO 12944-5 (standard surface treatment)

Coating system no. 2		
Typical environment		Industry, chemical plants, coastal areas
Surface preparation		
Sa 2½ according to ISO 8501-1		
System description		
First layer	Film thickness Method of application	Min. 50 µm Spray painting (epoxy)
Second layer	Film thickness Method of application	Min. 50 µm Spray painting (polyurethane)
Total film thickness		Min. 100 µm
RAL code or standard color		RAL 1019 (gray beige)

3. Powder coating system with final sealant for corrosivity categories C4, C5-I and C5-M according to ISO 12944-5

Coating system no. 3		
Typical environment	Industrial areas with high humidity and aggressive atmosphere, river deltas, maritime and coastal areas with a high salinity C5-M, very high, marine (long)	
Surface preparation		
Sa 2½ according to ISO 8501-1		
System description		
First layer	Film thickness Method of application	Min. 100 µm Powder coating (epoxy-polyester)
Second layer	Film thickness Method of application	Min. 100 µm Powder coating (epoxy-polyester)
Third layer	Film thickness Method of application	Min. 50 µm Spray painting (polyurethane)
Total film thickness		Min. 250 µm
RAL code or standard color		RAL 1019 (gray beige)

4. Wet paint coating system for corrosivity categories C4, C5-I and C5-M according to ISO 12944-5

Coating system no. 4		
Typical environment	Industrial areas with high humidity and aggressive atmosphere, river deltas, maritime and coastal areas with a high salinity C5-M, very high, marine (long)	
Surface preparation		
Sa 2½ according to ISO 8501-1		
System description		
First layer	Film thickness Method of application	Min. 75 µm Spray painting (two-component zinc phosphate primer)
Second layer	Film thickness Method of application	Min. 100 µm Spray painting (two-component epoxy micaceous iron oxide coating)
Third layer	Film thickness Method of application	Min. 55 µm Spray painting (polyurethane)
Total film thickness		Min. 230 µm
RAL code or standard color		RAL 1019 (gray beige)

5. Wet paint coating system for high-temperature applications

Coating system no. 5		
Typical environment	Industry, chemical plants, coastal areas	
Surface preparation		
Sa 2½ according to ISO 8501-1		
System description		
First layer	Film thickness Method of application	Min. 75 µm Spray painting (zinc-rich ethyl silicate primer)
Second layer	Film thickness Method of application	Min. 25 µm, max. 35 µm Spray painting (high-temperature silicone coating)
Third layer	Film thickness Method of application	Min. 25 µm, max. 35 µm Spray painting (high-temperature silicone coating)
Total film thickness		Min. 125 µm, max. 145 µm
RAL code or standard color		RAL 9006 (white aluminum)

6. Wet paint coating system for high-temperature applications

Coating system no. 6		
Typical environment	Industry, chemical plants, coastal areas	
Surface preparation		
Sa 2½ according to ISO 8501-1		
System description		
First layer	Film thickness Method of application	Min. 25 µm, max. 35 µm Spray painting (high-temperature silicone coating)
Second layer	Film thickness Method of application	Min. 25 µm, max. 35 µm Spray painting (high-temperature silicone coating)
Total film thickness		Min. 50 µm, max. 70 µm
RAL code or standard color		RAL 9006 (white aluminum)

7. Wet paint coating system for stainless steel for corrosivity categories C5-I and C5-M according to ISO 12944-5

Coating system no. 7		
Typical environment	Industrial areas with high humidity and aggressive atmosphere, river deltas, maritime and coastal areas with a high salinity C5-M, very high, marine (long)	
Surface preparation		
Sa 2½ according to ISO 8501-1		
System description		
First layer	Film thickness Method of application	Min. 80 µm Spray painting (epoxy)
Second layer	Film thickness Method of application	Min. 80 µm Spray painting (two-component epoxy micaceous iron oxide coating)
Third layer	Film thickness Method of application	Min. 80 µm Spray painting (polyurethane)
Total film thickness		Min. 240 µm
RAL code or standard color		RAL 1019 (gray beige)

8. Coating system for stainless steel for corrosivity categories C5-I and C5-M according to ISO 12944-5

Coating system no. 8		
Typical environment	Industry, chemical plants, coastal areas	
Surface treatment		
Sa 2½ according to ISO 8501-1		
System description		
First layer	Film thickness Method of application	Min. 100 µm Spray painting (epoxy phenolic coating)
Second layer	Film thickness Method of application	Min. 100 µm Spray painting (epoxy phenolic coating)
Total film thickness		Min. 200 µm
RAL code or standard color		RAL 1019 (gray beige)

6.3 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. Specify the exact color code for customized solutions.



Special requirements for protective coating systems

The following customized solutions are available:

- Coating systems according to NORSOK M-501
- Customized coatings for applications at high or low temperatures
- Coatings according to customer specifications (after thorough examination)
- The individual film thicknesses of all coating systems can be customized on request (within the manufacturer's specifications)

7 Quality assurance

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

- Standardized film thickness measurement in accordance with
ISO 2178 = Film thickness measurement - Magnetic method and
ISO 2360 = Film thickness measurement - 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.

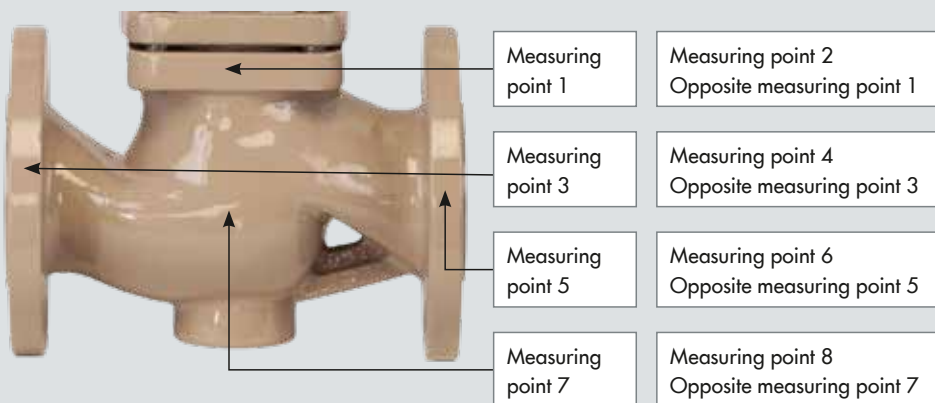
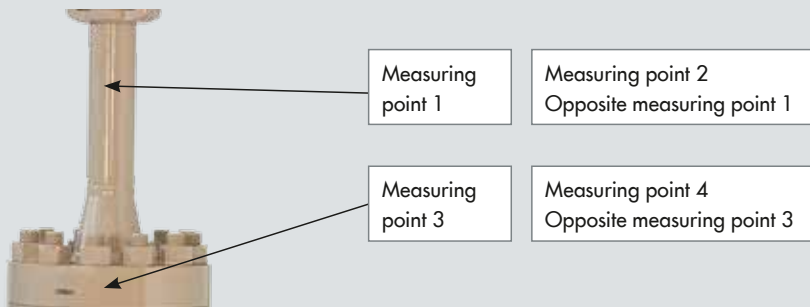
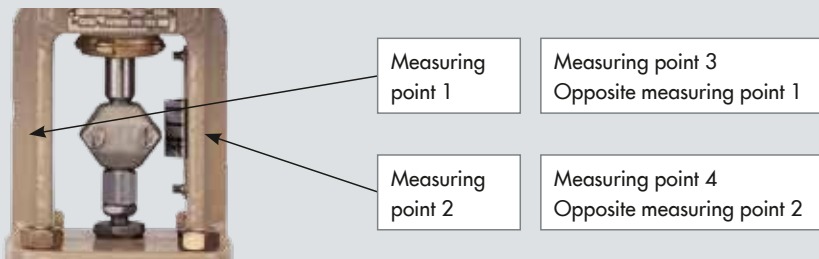
Further tests, such as corrosion and adhesion tests, are performed either by our paint suppliers or external inspectors. These results can be made available, if required.

7.1 Film thickness measurement according to

ISO 2178 = Film thickness measurement - Magnetic method and



ISO 2360 = Film thickness measurement - Non-destructive eddy current method

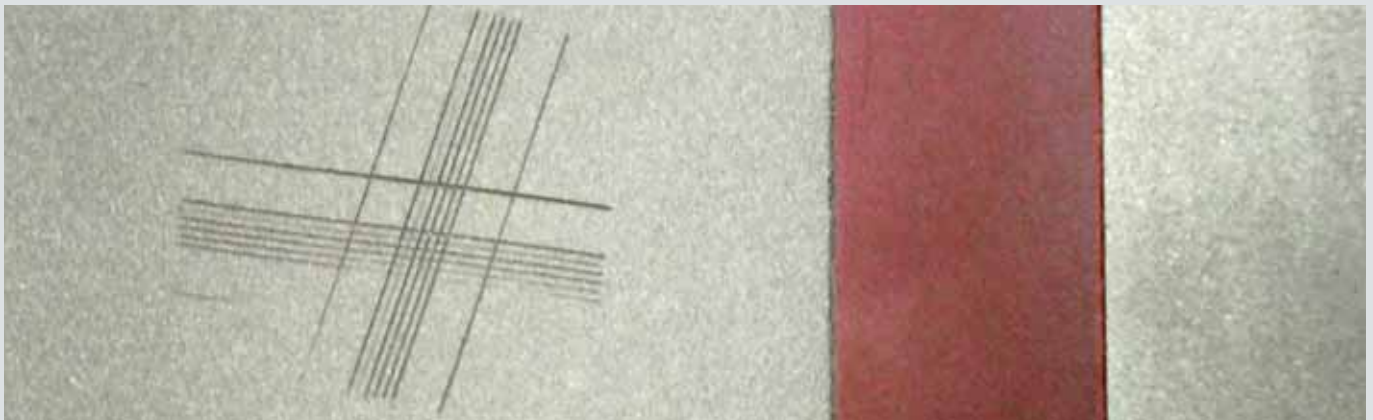
The film thickness is measured according to ISO 12944 or ISO 19840 using the non-destructive eddy current method. To provide comparable test results, the film thickness is measured at critical defined measuring points.



7.2 Cross-cut test according to ISO 2409 or ASTM D3359

The destructive cross-cut test is performed using a test plate representative of the substrate treated in the same process in accordance with ISO 2409 or ASTM D3359. All test data are saved 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 area of the cross cut where the coating has flaked (example for six parallel cuts)
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.	



7.3 Pull-off test according to ISO 4624 or ASTM D4541

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



8 Environmental protection

Environmentally safe powder coating

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

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

Waste water cleaning

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



9 FAQs (Frequently Asked Questions)

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.

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

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

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

Electrical instruments for use under tropical conditions are painted according to coating system no. 3 or have a polyurethane top coat.

5. What is the difference between polyurethane and DD coatings?

DD coatings are composed of polyols (Desmophen®) as the base paint and polyisocyanates (Desmodur®) as the hardener. The DD coating is a two-component polyurethane-based coating with the base paint containing the pigments.

■ Local customer assistance across the world



Specifications subject to change without notice.



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