Protection upgraded

SurTec 650

Properties

- chromium(VI)-free passivation for aluminium
- suitable as post-treatment of anodic coatings[1)]
- suitable as conversion coating of magnesium[1)]
- liquid concentrate, based on trivalent chromium
- excellent bare corrosion protection comparable to hexavalent passivations
- also works on alloyed and casted aluminium
- easy to handle in immersion, spray and wipe application
- produces visible, faintly blue to tan iridescent layers
- suitable as pre-treatment before lacquering, powder coating and gluing
- approved by QUALICOAT
- fulfils all requirements of ELV, RoHS and WEEE, if following the recommended process sequence (see “application”)
- complies with LN 9368-3 ID-number 1108
- complies with DIN 50935-2, coating type A
- meets or exceeds MIL-DTL-81706B and MIL-DTL-5541F for bare corrosion (336 h in NSS per ASTM B-117, respectively, DIN EN ISO 9227)
- low contact resistance: < 5000 µOhm per square inch as per MIL-DTL-81706B
- heat resistant inorganic passivation layer (see “hints”)
- applied for US-patent: 6,375,726; 6,511,532; 6,521,029; 6,527,841
- IMDS-number: 30429267

[1)] for detailed information please ask for the respective information sheets

Application

The chromium(III)-containing passivation SurTec 650 can be used in immersion, spray and wipe application. For the make-up, dilute SurTec 650 concentrate in deionised (DI-)water.

	pre-treatment before coating	***as corrosion protection***
Layer weight:	50-120 mg/m²	> 110 mg/m²
Make-up value:		
spray:	5 %vol (3-25 %vol)	25 %vol (10-50 %vol)
immersion:	5 %vol (3-20 %vol)	20 %vol (10-50 %vol)
Temperature:	25°C (20-35°C)	40°C (30-40°C)
pH-value:	3.5 (2.5-3.95)	3.9 (3.7-3.95)
	adjust with 5 % sulfuric acid or with 1 % sodium hydroxide	

	pre-treatment before coating	*as corrosion protection*
Application time:	(for temperature dependency see “Hints”)	
spray:	1 min (0.5-3 min)	2 min (1-6 min)
immersion:	1 min (0.5-3 min)	2 min (1-6 min)
Spray pressure:	1 bar (0.5-2.5 bar)	1 bar (0.5-1.5 bar)
Agitation:	not necessary	not necessary

Make-up: Steps for make-up:

1. Fill SurTec 650 concentrate into the tank and dilute it with DI-water under vigorous stirring.
2. Control the pH-value and adjust it cautiously with 5 % sulfuric acid or with 1 % sodium hydroxide solution if necessary.

Tank material: stainless steel, or steel with acid- and fluoride-resistant coating

Rack material: titanium, stainless steel (V4A), aluminium, plastic

Filtration: necessary; 0.1-0.5 times the total bath volume per hour;
before coating: with pore size ≤ 25 µm

Heating: necessary; made of acid- and fluoride-resistant material

Exhaust: according to local requirements

Exemplary process sequences:

For immersion application:

<u>For aluminium alloys with < 1 % silicon:</u>

1. Mild alkaline degreasing	e.g. SurTec 061
2. Alkaline etching	e.g. SurTec 181
3. Deoxidising	e.g. SurTec 495 L
4. Passivation	with SurTec 650

<u>For aluminium alloys with > 1 % silicon:</u>

1. Mild alkaline degreasing	e.g. SurTec 061
2. Deoxidising	e.g. SurTec 495 L
3. Passivation	with SurTec 650

For spray application:

1. Acid degreasing	e.g. SurTec 478
2. Passivation	with SurTec 650

Between each step, the surface has to be rinsed. The rinsing methods need to be adapted to the plating line.

These process sequences are general recommendations. The actual process sequence may be different and must be customised to the respective requirements of the customer.

General hints: Metallic tank material and goods to be passivated must be electrically isolated from each other.

Storage: During storage, a slight precipitation may occur inside SurTec 650 concentrate, which will not impair quality or function of the product.

Process sequence: Prior to the passivation with SurTec 650, the aluminium surface must be cleaned and deoxidised thoroughly. The surface must be water-break free.

If using a silicate-containing degreasing, the surface needs to be treated with a fluoride-containing deoxidising subsequently.

Rinsing technique: It is recommendable to adjust the last rinse before the SurTec 650 bath to pH 3.5-4 (with 5 % sulfuric acid), in order to avoid strong pH variations in the SurTec 650 bath. Alternatively, the conductivity of the rinse can be controlled and kept below 350 µS/cm. A good rinsing water quality prevents the drag-in of impurities and prolongs the lifetime of the SurTec 650 bath. Additionally, it ensures a stable corrosion protection of the passivated surfaces. In general, the lower the conductivity of the rinse, the better the achievable process performance.

After passivation with SurTec 650, rinse the parts, for best corrosion resistance with deionised water. For subsequent lacquering, the last rinse should have a conductivity of less than 30 µS/cm.

Further treatment and tests: For the qualitative proof of the formed passivation layer, a spot test is available. The test kit and its instructions can be ordered separately.

Before testing the corrosion resistance in the salt spray test, the treated surfaces need to be stored for 24 hours.

Hints for corrosion resistance:

Process parameter: There is an inverse influence of temperature and immersion time on the formation of the passivation layer. At higher bath temperatures a shorter immersion time is sufficient; at lower temperatures longer immersion times are required.

Recommended combination for best corrosion protection:

at 30°C:	4 min	(2-6 min)
at 40°C:	2 min	(1-3 min)

Colourless layer – to replace a colourless chromate process:

at 30°C:	60 s	(45-90 s)

Layer weight: The weight of the passivation layer strongly depends on the roughness of the aluminium surface. Passivation layers with best corrosion resistance have a weight of approx. 0.25 g/m^2 (0.11-0.5 g/m^2). Colourless layers have a weight of approx. 0.08 g/m^2 (0.05-0.20 g/m^2).

Temper resistance: During drying, the surface temperature should not exceed 65°C. The freshly formed passivation layer contains integrated water. At drying temperatures of > 65°C, the layer may dry too fast and get micro-cracked. The result is a small loss of corrosion resistance. This loss is only slight, but slowly increases as the drying temperature rises.

Already dried passivation layers only show marginal loss of corrosion resistance after further heat treatment.

The influence of the temper process on the corrosion resistance depends on the type of aluminium alloy and has to be tested individually. For example, copper-free aluminium alloys can be tempered at > 100°C almost without loss of corrosion resistance.

pH-value: Applying SurTec 650 as bare corrosion protection, the required pH-range is narrow: pH 3.9 (3.7-3.95), outside the range of pH 3.7-3.95 the corrosion resistance deteriorates. This loss is minimal but increases with rising deviation. In exceptions, a pH range of 3.65-4.05 can be tolerated but must be re-adjusted most promptly.

Hints for coating:

Storage: Treated surfaces can be coated immediately after drying, or stored, when protected from contamination and temperature extremes.

To be compliant with QUALICOAT, apply the coating within 16 hours.

Layer weight: For pre-treatment of extruded profiles before powder coating, a layer weight of 0.05-0.12 g/m^2 must be observed. The formation of the passivation layer should be tested directly after the pre-treatment process by a spot test.

Drying temperature: The drying temperature should be 65°C (room temperature up to 100°C).

Maintenance and Analysis

Check the pH-value regularly. Analyse and adjust the concentration of SurTec 650 regularly. (Analysing methods of SurTec 650 by photometry are less exact; an analysing method for zirconium (HACH Cuvette Test) can be requested separately).

Sample Preparation

Take a bath sample at a homogeneously mixed position and let it cool down to room temperature. If the sample is turbid let the turbidity settle down and filter through a blue-ribbon filter.

SurTec 650 – Analysis by Titration

Reagents:

sulfuric acid (conc.)
ammonium peroxodisufate p. a.
0.1 mol/l silver nitrate solution
potassium fluoride p. a.
potassium iodide solution (10 %)
0.1 mol/l sodium thiosulfate solution (= $Na_2S_2O_3$ solution)
starch solution (2 %)

Procedure:

1. Pipette 100 ml bath sample into a 250 ml Erlenmeyer flask.
2. Acidify with 3 ml sulfuric acid.
3. Add 3 g ammonium peroxodisufate.
4. Add 10 ml silver nitrate solution.
5. Cover the Erlenmeyer flask with a watch glass. Then heat up the solution and boil it slightly for 20 min *(the solution must **not** evaporate completely!)*.
6. Let it cool down to room temperature.
7. Add a spatula tip of potassium fluoride.
8. Add 15 ml potassium iodide solution and let react for 5 min.
9. Titrate with 0.1 mol/l sodium thiosulfate solution until the solution is weakly yellow.
10. Add 5 ml starch solution *(sample turns blue-black)*.
11. Continue to titrate until the colour changes to milky light green.

Calculation: consumption $Na_2S_2O_3$ solution in ml · 1.613 = %vol SurTec 650

SurTec 650 – Analysis by AAS

Measuring device:	atomic absorption spectrometer (AAS): wavelength: 357.9 nm slit: 0.7 nm
Reagents:	nitric acid (½ conc.) p. a. chromium standard solutions: 1 mg/l, 2 mg/l, 5 mg/l
Procedure:	Prepare an exact dilution of 1:50: 1. Fill 2 ml nitric acid into a 100 ml volumetric flask. 2. Pipette 2 ml bath sample into the flask and mix well. 3. Wait 5 min, then fill up with deionised water and mix well. 4. Calibrate the AAS with the chromium standards solutions. 5. Measure the prepared dilution of the sample in the AAS and note the measured value (in mg/l). 6. According to the dilution, calculate the chromium concentration in the bath (for dilution 1:50: measured value x 50).
Calculation:	$\text{chromium}_{\text{in bath}}$ in mg/l · 0.0974 = %vol SurTec 650
Hint:	Choose the dilution in that way that the measurement is within the calibration range.

Layer Weight – Gravimetric Determination

Measuring device:	analytical balance (+/- 0.1 mg)
Reagents:	50 %vol nitric acid (65 %)
Procedure:	1. Passivate a test part with a known surface area in m^2 (preferably > 2 dm^2) with SurTec 650. 2. Rinse the passivated part with deionised water and dry it with compressed air at room temperature. 3. Weigh the dry part within 3 hours after the passivation on the analytical balance (= $\mathbf{M_1}$). 4. Remove the passivation layer in nitric acid for 4 min at 20-25°C. 5. Rinse the part with deionised water and dry it with compressed air at room temperature. 6. Weigh the dry part again on the analytical balance (= $\mathbf{M_2}$). 7. Repeat the analysis with a cleaned and deoxidised but <u>not</u>-passivated test part (= $\mathbf{M_3}$ and $\mathbf{M_4}$)
Calculation:	($\mathbf{M_1}$ - $\mathbf{M_2}$) / surface area = **A** ($\mathbf{M_3}$ - $\mathbf{M_4}$) / surface area = **B** **A** - **B** = layer weight in g/m^2
Hints:	For the determination of the layer weight, use always a freshly prepared solution. After 1 m^2/l at the latest, the solution must be renewed. The determination is suitable for extruded and sheet material. For aluminium cast, which contains high amounts of silicon and sometimes could be porous, the method is not applicable.

Layer Weight - Determination via X-ray Fluorescence Analysis (XRF)

Measuring device:	X-ray fluorescence analyser (= XRF analyser) (for example: Niton XL3t XRF Analyser from SurTec Deutschland GmbH, with stored calibration curve; for the calibration of the device, please contact the Technical Centre of SurTec).
Procedure:	1. Treat a test part with SurTec 650 and let it dry. 2. First measure an untreated part at several even areas with the XRF analyser. 3. Then measure the treated test part accordingly at the same areas. 4. Form the average of the measured values of the treated test part and the untreated part respectively and calculate the difference.
Calculation:	measured $value_{test\ part}$ – measured $value_{untreated\ part}$ = g/m² layer weight
Desired value:	The recommended layer weight is 0.05–0.5 g/m².
Hints:	In case of using an own XRF analyser, a calibration curve needs to be created (with the help of SurTec calibration standards) before starting the actual measurement. The weight of the passivation layer strongly depends on the roughness of the aluminium surface. For cast aluminium parts, it is recommended to define a specific area for the determination of the layer weight.

Technical Specification

(at 20°C)	Appearance	Density (g/ml)	pH-value *(conc.)*
SurTec 650	liquid, green, clear-turbid, precipitate possible	1.005 (1.00-1.01)	2.9-4.0
Note:	During the first days of storage, the pH-value of the product increases slightly.		

Ingredients

- trivalent chromium salts

Consumption and Stock Keeping

The consumption depends heavily on the drag-out. To determine the exact amounts of drag-out, see **SurTec Technical Letter 11**.

The following values can be taken as estimated average consumption:

45-55 ml SurTec 650 concentrate are sufficient for treating 1 m² surface (including a supposed drag-out of 200 ml/m² at a make-up concentration of 20 %vol).

The consumption is strongly dependent on further factors:

- the drag-out may be significantly higher for rough surfaces and scooping parts (up to 300 ml/m²)
- at rough surfaces, the effective surface is higher than the part's dimension, so the chemical consumption is higher
- drag-in of alkalinity into the SurTec 650 bath can lead to precipitations which means additional consumption

In order to prevent delays in the production process, per 1,000 l bath the following amount should be kept in stock:

SurTec 650 500 kg

Product Safety and Ecology

Classification and designation are noted in the **Material Safety Data Sheets** (according to the European legislation). The safety instructions and the instructions for environmental protection have to be followed in order to avoid hazards for people and environment. Please pay attention to the explicit details in our Material Safety Data Sheets.

Warranty

We are responsible for our products in the context of the valid legal regulations. The warranty exclusively accesses for the delivered state of a product. Warranties and claims for damages after further processing of our products do not exist. For details, please find our country-specific **General Terms and Conditions** for downloading on our homepage or ask your regional SurTec representative.