

## Protection upgraded

# SurTec® 650 chromitAL TCP

### Properties

- hexavalent chromium-free passivation for aluminium
- suitable as post-treatment of anodic coatings<sup>1)</sup>
- suitable as conversion coating of magnesium<sup>1)</sup>
- 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 and approved by GSB and 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 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

<sup>1)</sup> for detailed information please refer to the explicit information sheets

### Application

SurTec 650 chromitAL can be used in immersion, spray and wipe application.

For the make-up, dilute SurTec 650 chromitAL concentrate in deionised (DI-)water.

	<i>pre-treatment before coating</i>	<i>as corrosion protection</i>
layer weight:	50-120 mg/m <sup>2</sup>	> 110 mg/m <sup>2</sup>
make-up values:		
<i>spray:</i>	5 %vol           (3-25 %vol)	25 %vol       (10-50 %vol)
<i>immersion:</i>	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) adjust with 5 % sulfuric acid or 1 % caustic soda	3.9              (3.7-3.95) adjust with 5 % sulfuric acid or 1 % caustic soda



	<i>pre-treatment before coating</i>	<i>as corrosion protection</i>
application time:	(for temperature dependency see "hints")	(for temperature dependency see "hints")
<i>spray:</i>	1 min           (0.5-3 min)	2 min           (1-6 min)
<i>immersion:</i>	1 min           (0.5-3 min)	2 min           (1-6 min)
spraying 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. Pour SurTec 650 chromitAL 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 resp. 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: pore size ≤ 25 µm

heating: necessary; out of acid- and fluoride-resistant material

exhaust: according to local requirements

recommended process sequence:

***Standard process sequences for immersion application:***

For aluminium alloys with < 1 % silicon:

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 chromitAL

For aluminium alloys with > 1 % silicon:

1. mild alkaline degreasing   e.g. SurTec 061
2. deoxidising                e.g. SurTec 495 L
3. passivation                 with SurTec 650 chromitAL

***Standard process sequence for spray application:***

1. acid degreasing            e.g. SurTec 478
2. passivation                 with SurTec 650 chromitAL

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

These process sequences above are general recommendations. To customise the process, modifications may be necessary.

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.

Using a silicate containing degreasing, the surface has to be treated with a fluoride containing deoxidising subsequently.

It is recommendable to adjust the last rinse before the chromitAL bath to pH 3.5-4, in order to avoid strong pH variations in the SurTec 650 bath.

After passivation with SurTec 650, the parts have to be rinsed; for best corrosion resistance deionised water should be used. For subsequent lacquering, the last rinse must have a conductivity of less than 30  $\mu\text{S}/\text{cm}$ .

**Further treatment and tests:** As a qualitative determination to proof the deposited chromitAL-layer, a spot test is available. The test kit and its instructions can be ordered separately.

Before testing the corrosion resistance of parts in the salt spray test, the surface has to be stored for 24 hours.

hints for corrosion resistance:

**Process parameter:** There is an inverse influence of temperature and immersion time on the deposited chromitAL layer. With higher bath temperature, a shorter immersion time is sufficient; with lower temperature a longer immersion time will be necessary.

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 chromitAL layer strongly depends on the roughness of the aluminium surface. Passivation layers with best corrosion resistance have a weight of approx. 0.25  $\text{g}/\text{m}^2$  (0.11-0.5  $\text{g}/\text{m}^2$ ). Colourless layers weigh approx. 0.08  $\text{g}/\text{m}^2$  (0.05-0.20  $\text{g}/\text{m}^2$ ).

**Temper resistance:** During drying, the surface temperature should not exceed 65 °C. The freshly deposited chromitAL 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 minor, but increasing with rising drying temperature.

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 in special case. 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 desired pH-range is narrow: pH 3,9 (3.7-3.95). Applying the process outside the range of 3.7-3.95 results in a small loss of corrosion resistance. This loss is minor, but increases with rising deviation. In exceptions, a range from 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 as long as they are protected from contamination and temperature extremes.

To be compliant with QUALICOAT, the coating should be applied within 16 h, for GSB within 24 h, respectively as Premium Coater within 12 h.

**Layer weight:** For pre-treatment of extruded profiles before powder coating, a layer weight of 0.05-0.12 g/m<sup>2</sup> 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 the 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 with a blue band filter paper.

### SurTec 650 - Analysis by Titration

reagents: sulfuric acid (conc.)  
 ammonium peroxodisulfate p. a.  
 silver nitrate solution (0.1 mol/l)  
 potassium fluoride p. a.  
 potassium iodide solution (10 %)  
 0.1 mol/l sodium thiosulfate solution (= 0.1 N)  
 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 peroxodisulfate.
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.
9. Leave 5 min for reaction.
10. Titrate with 0.1 mol/l sodium thiosulfate solution until the solution becomes weakly yellow.
11. Add 5 ml starch solution (solution colour turns to blue-black).
12. Continue to titrate to the colour change to milky light green.

calculation: consumption in ml · 1.613 = %vol SurTec 650



### SurTec 650 - Analysis by AAS

equipment:	atomic absorption spectrometer (AAS): wave length: 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: <ol style="list-style-type: none"> <li>1. Pour 2 ml nitric acid into a 100 ml volumetric flask.</li> <li>2. Pipette 2 ml bath sample into the flask and mix well.</li> <li>3. Wait 5 min, then fill up with deionised water and mix well.</li> <li>4. Calibrate the AAS with the chromium standards solutions.</li> <li>5. Measure the prepared dilution of the sample in the AAS and note the measured value (in mg/l).</li> <li>6. According to the dilution calculate the chrome concentration in the bath (for dilution 1:50: measured value x 50).</li> </ol>
calculation:	$\text{chrome}_{\text{in bath}} \text{ in mg/l} \cdot 0.0974 = \% \text{vol SurTec 650}$
hint:	Choose the dilution in that way that the measurement is within the calibration range.

### SurTec 650 - Determination of the Layer Weight

equipment:	analytical balance (+/- 0.1 mg)
reagents:	50 %vol nitric acid (65 %)
procedure:	<ol style="list-style-type: none"> <li>1. Passivate a test part with a known surface area in <math>\text{m}^2</math> (preferably <math>&gt; 2 \text{ dm}^2</math>) in SurTec 650.</li> <li>2. Rinse it with deionised water and dry it with compressed air at room temperature.</li> <li>3. Weigh the dry part within 3 h after passivation on the analytical balance (= <math>M_1</math>).</li> <li>4. Remove the passivation layer in nitric acid (4 min at 20-25° C).</li> <li>5. Rinse the part with deionised water and dry it with compressed air at room temperature.</li> <li>6. Weigh the dry part again on the analytical balance (= <math>M_2</math>).</li> <li>7. Repeat the analysis with a cleaned and deoxidised but <u>not</u>-passivated test part (= <math>M_3</math> and <math>M_4</math>)</li> </ol>
calculation:	$(M_1 - M_2) / \text{surface area} = A$ $(M_3 - M_4) / \text{surface area} = B$ $A - B = \text{layer weight in g/m}^2$
hint:	To determine the layer weight always a fresh solution should be used. At the latest after 1 $\text{m}^2/\text{l}$ the solution has to be renewed. The determination is suitable for extruded and sheet material. In case of aluminium cast, containing high amounts of silicon and sometimes being porous, the method is not applicable.



## Technical Specification

(at 20°C)	Appearance	Density (g/ml)	pH-value (conc.)
SurTec 650	liquid, green, clear-turbid, contingency precipitate	1.005 (1.00-1.01)	2.9-4.0
hint:	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 m<sup>2</sup> surface (including a supposed drag-out of 200 ml/m<sup>2</sup> 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/m<sup>2</sup>)
- 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 the subsequent treatment of our products do not exist. For details please consider our [general terms and conditions](#).

## Further Information and Contact

If you have any questions concerning the process, please contact your local technical department.

For further information and contact details please visit our homepage:

<http://www.SurTec.com>

24 July 2017/DK, WT

## Trouble Shooting

problem	possible cause	remedy
removable white residue on the surface	a) pH-value is too high	adjust the pH
	b) temperature is too high	cool down the bath
	c) immersion time is too long	shorten the immersion time
heavy turbidity of the chromitAL bath	a) pH-value is too high	adjust the pH
	b) local overheating	possibly use indirect heater
	c) drag-in of alkalinity, phosphates or hard water	improve the rinsing quality prior to the chromitAL bath
cloudy layer	a) insufficient activation	check pre-treatment and activation
	b) insufficient agitation in the bath	possibly slight bath agitation