Protection upgraded

SurTec® 650 V
chromitAL TCP

Properties

- chromium(VI)-free passivation for aluminium
- suitable as post-treatment of anodic coatings[1)]
- liquid concentrate, based on trivalent chromium
- produces colourful and visible layers which are blue-grey to yellow iridescent
- excellent bare corrosion protection comparable to hexavalent chrome passivation
- also works on high-alloyed copper-containing aluminium alloys and cast aluminium
- easy to handle for immersion, spray and wipe application
- QPL qualified
- meets or exceeds MIL-DTL-81706B and MIL-DTL-5541F for bare corrosion (336 h in NSS per ASTM B-117, or DIN EN ISO 9227), meeting classes 1A and 3
- low contact resistance: < 5000 µOhm per square inch as per MIL-DTL-81706B
- heat resistant inorganic passivation layer (see “hints”)
- applied for US-patent: 6,669,764
- IMDS-number: 511025914

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

Application

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

The optimal process parameters may vary, and depend on alloys treated, plant layout, and required performance criteria. The optimal setting of the parameters is be done with the support of our experienced SurTec field staff.

	spray application	*immersion application*
Make-up value:	25 %vol (5-30 %vol)	8 %vol (5-30 %vol)
Make-up:	Steps for make-up: 1. Before preparing the make-up, clean the tank thoroughly. Treat new tanks or lines with 10 % sulfuric acid before use, then rinse. 2. Fill the calculated amount of SurTec 650 V concentrate into the tank and dilute it with DI-water with vigorous stirring. 3. Finally, control the pH-value and adjust it to pH 3.8 if necessary.	
Temperature:	38°C (30-40°C)	
pH-value:	3.8 (3.70-3.95) adjust slowly under constant mixing with 5 % sulfuric acid or with 1 % sodium hydroxide solution	

Application time:	*at 38°C:* 3 min (2-4 min) *at 30°C:* 4 min (2-6 min)
Spraying pressure:	1 bar (0.5-1.5 bar)
Agitation:	not necessary
Tank material:	stainless steel, or steel with acid- and fluoride-resistant coating
Filtration:	necessary; 0.1-0.5 times the total bath volume per hour
Heating:	necessary; made of acid- and fluoride-resistant material
Cooling:	not necessary
Exhaust:	according to local requirements

Exemplary process sequence:

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. Deoxidizing	e.g. SurTec 495 L
4. Passivation	with SurTec 650 V

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

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

For spray application:

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

After each step, rinsing is required. 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.

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 the SurTec 650 V concentrate, which will not impair quality or function of the product.

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

Using a silicate-containing degreasing, the surface must be treated with a fluoride-containing deoxidising subsequently.

Rinsing technique: It is recommendable to adjust the last rinse before the SurTec 650 V bath to pH 3.5-4 (with 5 % sulfuric acid), to avoid strong pH variations in the SurTec 650 V bath.

After passivation with SurTec 650 V, the parts have to be rinsed. For best corrosion resistance, rinsing with deionised water is recommended. At best, the conductivity of the last rinse should be less than 30 µS/cm.

The drying temperature should not exceed 65°C at the part's surface.

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

Before testing the corrosion resistance in the salt spray test, the treated part needs be stored for 24 hours.

Hints for corrosion resistance:

Process parameter: There is an inverse influence of temperature and immersion time on the passivation layer. At higher bath temperatures 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	(1-4 min)

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. 0.3 g/m^2 (0.11-0.7 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, 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 needs to be tested in individual cases. For example, copper-free aluminium alloys can be tempered at > 100°C almost without loss of corrosion resistance.

Maintenance and Analysis

Check the pH-value regularly. Analyse and adjust the concentration of SurTec 650 V regularly. (Analysing methods of SurTec 650 V 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 and filter through a blue-ribbon filter paper.

SurTec 650 V – Analysis by Titration

Reagents:
sulfuric acid (conc.)
ammonium peroxodisulfate p.a.
0.1 mol/l silver nitrate solution
potassium fluoride p. a.
potassium iodide solution (10 %)
0.1 mol/l sodium thiosulfate 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 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 is weakly yellow.
11. Add 5 ml starch solution *(sample turns blue-black)*.
12. Continue to titrate until the colour changes to milky light green.

Calculation: consumption in ml · 1.613 = %vol SurTec 650 V

SurTec 650 V - 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 half conc. nitric acid into a 100 ml volumetric flask.
2. Pipette 2 ml bath sample into the flask and mix thoroughly.
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 V

Hint: Choose a dilution ratio such that the measurement is within the calibration range.

SurTec 650 V – Determination of the Layer Weight

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) in SurTec 650 V. 2. Rinse the 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 (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 not-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
Hint:	For the determination of the layer weight, use always a freshly prepared solution. After processing 1 m^2/l, the solution must be replaced. The determination is suitable for extruded and sheet material. For aluminium cast, which contains high amounts of silicon and sometimes surface porosity, the method is not applicable.

Technical Specification

(at 20°C)	Appearance	Density (g/ml)	pH-value *(conc.)*
SurTec 650 V	liquid, green, clear-turbid contingency precipitate	1.011 (1.00-1.02)	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 V concentrate are sufficient for treating 1 m^2 surface (included a supposed drag-out of 200 ml/m^2 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^2)
- 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 V 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 V 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.

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

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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 bath	a) pH-value is too high	adjust the pH
	b) local overheating	possibly indirect heater
	c) drag-in of alkalinity, phosphates or hard water	improve the rinsing quality prior to the SurTec 650 V bath
cloudy layer	a) insufficient activation	check the pre-treatment and the activation
	b) insufficient agitation in the bath	possibly slight bath agitation