

SurTec® 693

Concentrated Black Chromate

Properties

- liquid
- 3-component process with make-up and maintenance concentrates
- very long service life due to tailor-made maintenance additives
- forms brilliant, uniform black chromate layers
- exceeds the corrosion norm according to DIN 50 021 SS
- for cyanide, alkaline cyanide free and acid zinc

Application

SurTec 693 can be applied in rack or barrel application.

The process includes the following products:

- SurTec 693 A Make-Up Concentrate
- SurTec 693 I Maintenance Concentrate
- SurTec 693 II Silver Solution

make-up values:

| | | |
|--------------------|--------|----------------|
| SurTec 693 A | 6 %vol | (5-8 %vol) |
| SurTec 693 II | 2 %vol | (1.8-2.2 %vol) |
| acetic acid (98 %) | 4 %vol | (1-5 %vol) |

analytical values:

| | | |
|---------------|--------|----------------|
| SurTec 693 I | 7 %vol | (6-9 %vol) |
| SurTec 693 II | 2 %vol | (1.8-2.2 %vol) |

make-up:

Steps for make-up:

1. Fill 3/4 of the final volume with deionised water (**chloride free!**).
2. Add the calculated amount of SurTec 693 A and the acetic acid.
3. Add the adequate amount of SurTec 693 II slowly while stirring.
4. Fill up to the final volume with deionised water. (A slight turbidity has no negative effect.)

We recommend to retain approx. 10 % of the old solution for preparing a new black chromate make-up.

temperature: 20°C (15-35°C)

application time: 30 s to 5 min
depending on concentration, temperature, pH-value and bath age

pH-value: 0.8-3.0

1.7 optimum for rack
2.2-2.6 optimum for barrel

adjust with diluted sulfuric acid or diluted sodium hydroxide

tank material: steel with acid resistant plastic coating

recommended process sequence:

1. zinc plating (minimum layer thickness 5 µm)
2. cold rinse
3. activation (0.5-1 % nitric acid in deionised water)
4. cold rinse (deionised water)
5. **black chromate SurTec 693**
6. cold rinse (3 g/l chromic acid + 5 ml/l acetic acid or 5 % black chromate solution in deionised water)
7. cold rinse (deionised water)
8. drying

Technical Specification

| (at 20°C) | Appearance | Density (g/ml) | pH-value (conc.) |
|---------------|---------------------------|-------------------|------------------|
| SurTec 693 A | liquid, orange, clear | 1.440 (1.41-1.46) | < 1 |
| SurTec 693 I | liquid, orange, clear | 1.261 (1.25-1.28) | < 1 |
| SurTec 693 II | liquid, colourless, clear | 1.080 (1.06-1.10) | < 2.5 |

Maintenance and Analysis

Analyse and adjust the concentration of SurTec 693 I regularly.

Add SurTec 693 II in a ratio of 1:3 to SurTec 693 I.

Use SurTec 693 A for make-up only.

Partly new make-up: At zinc concentrations of 20 g/l, 20 % of the bath volume can be thrown away. Calculated for the new make-up, for 20 % of the bath volume add 7.5 %vol SurTec 693 I, 2.1 %vol SurTec 693 II and approx. 3 %vol acetic acid (98 %), as well as the missing deionised water. If necessary, adjust the pH-value to pH 1.7 with 50 % sodium hydroxide solution.

Sample Preparation

Take a sample at a homogeneously mixed position. Let it cool down to room temperature. If the sample is turbid, let the turbidity settle down and decant or filter the solution.

SurTec 693 I (by analysis of Chromium(VI) content) – Analysis by Titration

reagents: hydrochloric acid (conc.)
potassium iodide
0.1 N sodium thiosulfate solution
starch solution (1 %)

procedure: 1. Pipette 2 ml bath sample into a 250 ml Erlenmeyer flask.
2. Dilute to 150 ml with deionised water.
3. Acidify with 10 ml conc. hydrochloric acid.
4. Add 2 g potassium iodide.
5. Titrate with 0.1 N sodium thiosulfate solution from brown to light yellow.
6. Add 3 drops of starch solution.
7. Titrate again until discolouration.

calculation: consumption in ml (= consumption **A**) · 0.437 = %vol SurTec 693 I

Chromium(III) – Analysis by Titration

| | |
|--------------|---|
| reagents: | caustic soda (10 %) H ₂ O ₂ (30 %) hydrochloric acid (conc.) potassium iodide 0.1 M sodium thiosulfate solution starch solution (1 %) |
| procedure: | Due to the low content of Cr(III) a repeat determination of the analysis is recommended: <ol style="list-style-type: none">1. Pipette 2 ml bath sample into a 250 ml Erlenmeyer flask.2. Dilute with approx. 50 ml deionised water.3. Add 10 ml caustic soda solution.4. Add ca. 2 ml H₂O₂.5. Cover it with a watch glass and boil the solution for 30-40 min (max. evaporation loss: 40 ml). It is important to remove excessive H₂O₂ completely.6. Cool down the solution and add approx. 150 ml deionised water (rinse also the watch glass).7. Acidify with 25 ml hydrochloric acid (colour should be orange)8. Add approx. 2 g potassium iodide.9. Titrate with 0.1 N sodium thiosulfate until it is slightly yellowish.10. Add some drops of starch solution.11. Titrate to complete discolouration. |
| calculation: | consumption in ml = consumption B $(B - A) \cdot 0.867 = \text{g/l Cr(III)}$ |

Zinc – Analysis by Titration

| | |
|--------------|---|
| reagents: | 0.1 mol/l EDTA solution (Titriplex III, Merck) buffer solution (100 g/l NaOH and 240 ml/l 98 % acetic acid in deionised water) indicator: xylenol orange tetra sodium salt (mixture of 1 % in KNO ₃) |
| procedure: | <ol style="list-style-type: none">1. Pipette 5 ml bath sample into a 250 ml Erlenmeyer flask.2. Dilute with approx. 100 ml deionised water.3. Add 20 ml buffer solution.4. Add a spatula tip of indicator.5. Titrate with 0.1 M EDTA from red-brown to yellow or to light green (depending on the Cr-III content), resp. to brown-orange (depending on the Fe content). |
| calculation: | consumption in ml · 1.3074 = g/l zinc |
| hint: | The presence of iron influences the colour change at the endpoint. At Fe concentrations above 0.5 g/l, the colour changes from red-violet no longer to yellow, but more and more to orange or brown-orange. So the endpoint is seen worse. |

Product Safety and Ecology

The safety instructions and the instructions for environmental protection have to be followed in order to avoid hazards for people and environment. The Material Safety Data Sheets (according to European legislation) contain explicit details for this.

The following hazard designations and classifications into water hazard classes (WHC) have to be taken into account:

| <u>product</u> | <u>hazard designation</u> | <u>water hazard class</u> |
|----------------|---|---------------------------|
| SurTec 693 A | T+- Very toxic N - Dangerous for the environment | WHC 3 |
| SurTec 693 I | T - Toxic N - Dangerous for the environment | WHC 3 |
| SurTec 693 II | C - Corrosive | WHC 2 |

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

In our forum, you can discuss topics of the surface technology:
<http://forum.SurTec.com/>

If you have any questions concerning the process, please contact your local technical department: <http://SurTec.com/International.html>

2 February 2012/DK, AB

Trouble Shooting

| problem | possible cause | remedy |
|--|-----------------------------------|--|
| soft, bad adhesive chromate layer | a) concentration is too high | dilute the bath |
| | b) pH-value is too low | raise the pH-value |
| | c) temperature is too high | lower the temperature or chill |
| | d) dip time is too long | shorten the immersion time |
| surface not brilliant enough | a) temperature is too high | lower the temperature or chill |
| | b) rinsing water is too warm | use cold rinsing water |
| | c) calcium containing water | use deionised water for the first rinse |
| insufficient corrosion protection | a) chromate layer is too thick | shorten the dip time |
| | b) temperature is too high | lower the temperature or chill |
| | c) rinsing water is too warm | use cold rinsing water |
| colour not black enough (grey, dark brown or iridescent) | a) bath concentration is too low | add SurTec 693 I and II in the ratio 3:1 |
| | b) SurTec 693 I is too low | add SurTec 693 I |
| | c) pH-value is too high | lower the pH-value |
| | d) dip time is too short | extend the immersion time |
| | e) temperature is too low | raise the temperature |
| | f) chloride or cyanide impurities | add SurTec 693 II |