

# SurTec® 728

## Cyanide Bright Zinc Process

### Properties

- liquid brightener
- produces brilliant deposits at low, medium, and high current densities
- for both barrel and rack operations
- excellent throwing and covering power
- plated parts can easily be chromated
- due to the variable metal and cyanide content of the solution, it may be used over a wide range of operating conditions
- contains no aldehydes - a fact which allows to use operating temperatures higher than normal (up to 45 °C)
- its brilliant deposits and its economic use make it the outstanding cyanide zinc brightener system

### Application

make-up values:	<i>low cyanide</i>	<i>medium cyanide</i>
zinc oxide	12.5 g/l	25 g/l
sodium cyanide	18 g/l	50 g/l
sodium hydroxide	85 g/l	70 g/l
SurTec 728 Brightener	3 ml/l	4 ml/l
SurTec 720 Purifier	0-1 ml/l	0-1 ml/l

analytical values:		
zinc	10 g/l (7-15 g/l)	20 g/l (15-25 g/l)
sodium cyanide	18 g/l (11-30 g/l)	50 g/l (30-65 g/l)
sodium hydroxide	85 g/l (80-90 g/l)	70 g/l (60-80 g/l)
sodium carbonate	max. 90 g/l	max. 80 g/l
ratio NaCN : Zn	1.8 (1.5-2.2)	2.5 (2.0-3.0)

- make-up:                      Steps for make-up:
1. Fill 1/3 of the required amount of water into the tank.
  2. Add sodium hydroxide and sodium cyanide and dissolve.  
**Caution:** Solution becomes hot!
  3. Add zinc oxide and stir until it is dissolved.
  4. Cool down to room temperature.
  5. According to the amount of contaminants (out of the salts) add SurTec 720 Purifier (pre-diluted 1:10).
  6. Fill up the tank to its final volume with water and filtrate continuously overnight.
  7. Add the required amount of SurTec 728 and stir the electrolyte.

temperature:                      25 °C                                      (20-45 °C)  
at lower temperatures current densities should be lower, at higher temperatures brightness and throwing power is reduced

cathodic current density:	0.2-2.0 A/dm <sup>2</sup> ( <i>barrel</i> )	0.2-4.0 A/dm <sup>2</sup> ( <i>rack</i> )
current efficiency:	60-80 %	
deposition rate:	10-14 μm per Ah/dm <sup>2</sup>	
anodes:	pure zinc 99,99 % according to DIN 1706 or steel anodes, to control the zinc concentration	
agitation:	cathode agitation (rack or barrel movement) recommended, no air agitation (to avoid cyanide mist and carbonate increase)	
tank material:	plastic or steel with plastic coating	
filtration:	recommended	
heating:	not necessary	
cooling:	necessary for lines with high load on small volumes and/or recommended to freeze out sodium carbonate	
exhaust:	required for worker's protection	

## Technical Specification

(at 20 °C)	Appearance	Density (g/ml)	pH-value (conc.)
SurTec 728	liquid, yellowish-red	1.022 (1.01-1.04)	10.7
SurTec 720	liquid, red-brown	1.072 (1.03-1.12)	10.3

## Maintenance and Analysis

Analyse the concentration of zinc, sodium cyanide, sodium hydroxide and sodium carbonate regularly. Zinc is controlled by changing the anodic current density or by using steel anodes. Add sodium cyanide and sodium hydroxide according analysis. Add 0.1 l SurTec 720 Purifier for each added kg NaOH. Freeze out excess sodium carbonate. Adjust SurTec 728 with the aid of Hull cell tests.

### Effects of the Electrolyte Components

Increase of **zinc** increases the burning limit, but reduces the throwing power. A lack of zinc produces burnings.

Excess of **sodium cyanide** reduces brightness, thus more SurTec 728 is needed. Lack of cyanide produces a more brittle zinc layer. High cyanide bath types are less sensitive against impurities.

Excess of **sodium hydroxide** speeds up zinc dissolution too much. Lack of hydroxide reduces the burning limit.

Excess **sodium carbonate** reduces brightness, thus more SurTec 728 is needed. Further, it is responsible for passive anodes leading to a bad current distribution in the electrolyte and a too low zinc dissolution rate.

**Contaminating metals** like Cu, Pb, Cd, Sn, Ni, ... deteriorate brightness and appearance of the zinc layer and should be removed with SurTec 720 Purifier. Chromium(VI) reduces current efficiency and coverage in the low current density area. It affects the chromatability and appearance and has to be reduced to Cr(III) with sodium dithionite.

Excess of Additive **SurTec 728 Brightener** causes a spotted dull zinc deposition in the low to medium current density area, current efficiency is reduced and in extreme cases, blistering may occur. Lack of additive effect a lack of brightness and throwing power.

### 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.

### Zinc – Analysis by Titration

reagents: 0.1 mol/l EDTA (Titrplex III)  
buffering solution (100 g/l NaOH + 240 ml/l 98 % acetic acid)  
indicator: xylenol orange (1 %, blended with KNO<sub>3</sub>)

procedure: 1. Pipette 5 ml bath sample into a 250 ml Erlenmeyer flask.  
2. Dilute with 100 ml deionised water.  
3. Add 30 ml buffering solution.  
4. Add a spatula tip of indicator.  
5. Titrate with 0.1 M EDTA from red to yellow.

calculation: consumption in ml · 1.3074 = g/l zinc

### Sodium Cyanide – Analysis by Titration

reagents: 0.1 N silver nitrate solution  
NaOH solution (10 %)  
potassium iodide solution (2 %)

procedure: 1. Pipette 5 ml bath sample into a 250 ml Erlenmeyer flask.  
2. Dilute with 100 ml deionised water.  
3. Add 10 ml 10 % NaOH solution.  
4. Add 6 drops potassium iodide solution.  
5. Titrate with 0.1 N silver nitrate solution until lasting turbidity.

calculation: consumption in ml · 1.96 = g/l sodium cyanide

### Sodium Hydroxide – Analysis by Titration

reagents: 1 N sulfuric acid or hydrochloric acid  
indicator: Tropaeolin O (0.1 g in 100 ml deionised water)

procedure: 1. Pipette 5 ml bath sample into a 250 ml Erlenmeyer flask.  
2. Dilute to approx. 100 ml with deionised water.  
3. Add 5 drops of indicator.  
4. Titrate with 1 N acid from orange to light yellow.

calculation: consumption in ml · 7.98 = g/l sodium hydroxide

### Sodium Carbonate – Analysis by Titration

- reagents:           barium nitrate solution (5 %)  
                      1 N hydrochloric acid  
                      1 N sodium hydroxide solution  
                      indicator methyl orange solution (0.04 %)
- procedure:           1. Pipette 10 ml bath sample into a 250 ml Erlenmeyer flask.  
                      2. Dilute with 50 ml deionised water and boil the solution.  
                      3. Add 75 ml barium nitrate solution.  
                      4. After settle down of the precipitate, filtrate with a fine-grained filter paper and wash with hot deionised water.  
                      5. Put the filter into a 250 ml Erlenmeyer flask.  
                      6. Add 100 ml deionised water.  
                      7. Add 30 ml 1 N hydrochloric acid and boil the solution shortly.  
                      8. After cooling down, add 3 drops indicator.  
                      9. Titrate excess hydrochloric acid with 1 N sodium hydroxide from red to orange-yellow.
- calculation:       (30 - consumption in ml) · 5.3 = g/l sodium carbonate

### Hull Cell Test

- equipment:       rectifier with 10-30 V and 0-3 A and cables  
                      250 ml Hull cell  
                      zinc anode  
                      steel Hull cell panels
- procedure:       1. Put the anode into the Hull cell and connect with the cable to the (+) pole of the rectifier; fill the cell with the original zinc bath up to the Hull cell's mark.  
                      2. Remove the zinc coating of the Hull cell panel in 1:1 hydrochloric acid, rinse, electroclean the panel, rinse well and put into the cell. Move slightly to and fro in order to wet the panel properly. Then connect with the cable to the (-) pole of the rectifier.  
                      3. Plate for 15 min with 1 A (full voltage, current adjusted to the desired value) without agitation. Take the panel out, rinse well and brighten in a 0.5 %vol nitric acid.  
                      4. If the analysis of the bath values indicated that some inorganic ingredient should be adjusted, plate a second panel with these corrections.
- evaluation:       A correct SurTec 728 panel should be completely bright and uniform; a slight haziness in the hcd area is normal, vertical hydrogen marks (stripes) also. There should be no dullness in mcd and lcd area and the panel should be coated completely.
- Correct according the information under "Effect of the Electrolyte Compounds". If the organic additives have no positive effect but the panel is still dull, it might be a strong overdose. In this case, dilute the original electrolyte 1:1 with a fresh electrolyte prepared in the laboratory and having no additives. Plate a Hull cell panel in this 50 % electrolyte and try again if the correction was now possible.

## Conversion of a Cyanide Electrolyte to SurTec 728

For a complete conversion test, at least 3 litres original electrolyte are necessary.

### First Indication Test:

1. Plate a SurTec 728 panel in a fresh laboratory electrolyte according the instructions of the chapter "Hull Cell Test".
2. Plate an original panel in the actual electrolyte without any additions. If the original panel was already bright, you can only try the overdosage effect, if it was less bright than panel 1, you can already get an indication on the receptivity of the old system for SurTec 728.
3. Add 0.5 ml/l SurTec 728 to the 250 ml Hull cell 2 and plate again.

If there was a positive effect (panel 3 is the same as or better than panel 2), a conversion is possible without an immediate problem.

### Mid Term Compatibility:

1. Fill 1.8 litre of the actual bath into a 2 l beaker, hang in a small Hull cell anode and a pre-treated jiggle cell panel (or, if not available, a 15 cm long and about 4 cm wide steel sheet) as a cathode, put it on a magnetic stirrer and stir slowly, connect anode and cathode to the rectifier and plate with 1 A for 5 h.
2. Fill 250 ml of this treated electrolyte into a Hull cell and plate a Hull cell panel according the instructions of the chapter "Hull Cell Test".
3. Add 0.5 ml SurTec 728 to the Hull cell and repeat the test.
4. Repeat (3) until a good result was obtained.

### Long Term Compatibility:

1. Prepare 1 litre of a fresh SurTec 728 electrolyte with the desired values (low or medium cyanide electrolyte, see front page) with 4 ml/l SurTec 728.
2. Prepare 5 dilutions with a total volume of 250 ml each of the actual (untreated) electrolyte with the fresh electrolyte
  - a) 225 ml original bath + 25 ml fresh electrolyte
  - b) 175 ml original bath + 75 ml fresh electrolyte
  - c) 125 ml original bath + 125 ml fresh electrolyte
  - d) 75 ml original bath + 175 ml fresh electrolyte
  - e) 25 ml original bath + 225 ml fresh electrolyte

and plate a Hull cell panel in each electrolyte.

If the first indication test (see above) had shown a lack of brightness in the original bath, add 0.05 ml SurTec 728 additive for every 25 ml strange electrolyte.

There should not be any negative effect in any dilution. If e.g. the panel plated in bath c) had an unexpected appearance, e.g. uncorrectable spottiness, possible problems must be expected after about 5 weeks of conversion (barrel application) resp. 15-20 weeks (rack application).

If every dilution can be adjusted to a good panel, no problems are expected by the conversion itself.

